State tax elasticities of revenue bases

Tax and Transfer Policy Institute

Ralf Steinhauser, Mathias Sinning and Kristen Sobeck

Tax and Transfer Policy Institute, Crawford School of Public Policy

ralf.steinhauser@anu.edu.au, mathias.sinning@anu.edu.au and kristen.sobeck@anu.edu.au

The Australian National University

Canberra ACT 0200 Australia

www.anu.edu.au

CRICOS Provider No. 00120C

Table of Contents

List of Tables

List of Figures

Executive Summary

Determining the fiscal capacity of Australian States and Territories is challenging because variation in tax rates can affect the level of economic activity and the underlying revenue bases. The aim of this study is to estimate tax elasticities for a number of State taxes from a variety of existing data sources. In particular, we combine different data sources and econometric techniques to obtain reliable estimates of the effects of changes in tax rates on revenue bases ("tax elasticities").

As our main empirical strategy, we apply a difference-in-difference estimation approach by exploiting the variation in tax rates (and thresholds) across States and Territories and changes over time as 'natural experiments' to identify the effects of tax rate changes on revenue bases. We pay particular attention to potential endogeneity problems and employ instrumental variable appropriate to deal with possible specification problems.

Our analysis focuses on the following taxes and covers the revenue assessments undertaken by the Commonwealth Grants Commission as part of the horizontal fiscal equalisation process:

<u>Payroll tax</u>

We use data from the newly available Business Longitudinal Analysis Data Environment (BLADE) to obtain estimates for the effects of increases in State level payroll tax thresholds on wages and employment. We find no consistent evidence of an effect of payroll taxes on a firm's payroll. The effects of increases in payroll tax thresholds on the firm payroll range from -1% to +1%, with most effects being insignificant. Our findings are consistent with empirical findings generated in other developed economies. The evidence presented is limited as we only observe increases in payroll tax thresholds and are unable to say how firms would have reacted to payroll tax increases. However, our results suggest that payroll taxes are a more efficient way of collecting tax revenues than often recognised. We find no measurable behavioural effect of payroll taxes on labour market outcomes.

<u>Insurance Tax</u>

The demand for insurance in response to a change in taxes on insurance premiums is assessed using data from the Household Expenditure Survey, from the Australian

Prudential Regulation Authority and aggregated revenue data provided by States and Territories to the CGC in combination with private and public insurer premiums. Using aggregate CGC data across all insurance types, we find a one percentage point increase in the tax rate will reduce expenditure on total premiums by 0.6 percent. The elasticity, however, does vary by type of insurance, looking at the other two data sets we estimate a reduction of 0.3 percent in cases where insurance is compulsory to over 9 percent for expenditure on non-compulsory insurances. While these estimates are based on a number of different data sources, they are internally consistent and in line with results from the existing literature, where they are at the lower end of the range. The overall elasticity of insurance premiums in response to changes in the insurance tax of -0.06 represents a robust and conservative measure of the behavioural effect.

Motor Tax

We investigate the demand for motor vehicles in response to a change in licence fees (*taxes on vehicle ownership*) using panel data form the Household, Income and Labour Dynamics in Australia (HILDA) and aggregated ABS vehicle ownership data and revenue data provided by states and territories to the CGC. We find that the demand for motor vehicles is relatively inelastic in response to changes in licence fees. According to estimates based on HILDA, a 10 percent increase in licence fees will decrease car ownership by about 0.35 percent. Using data from the CGC, we obtain an elasticity estimate of similar magnitude implying a 0.6 percent reduction in light motor vehicles ownership as response to a 10 percent increase in licence fees. These finding are consistent with each other and the international literature, while being at the lower end of the range found within in the literature. This suggests that the estimate for the elasticity of car ownership in response to changes in the licence fees of -0.06 is a robust and conservative measure of the behavioural effect of motor tax.

Stamp Duty

We assess the change in the value of sold properties (tax base) in response to a change in stamp duty using sales data by Corelogic and aggregated revenue and tax base data provided by States and Territories to the CGC. Estimation results according to aggregate CGC data suggest a 10 percent increase in the tax rate will reduce the overall value of sold properties by 3-4 percent while the sales data suggest effects from very small up to 3 percent. The calculated behavioural response includes both changes in prices and quantity of properties sold, which explains the relatively large effect for a tax which is on average about 5 percent of the sales price of a property. The results are remarkably similar to findings in the existing international and domestic literature on price effects of taxation, which represent a lower bound with regard to tax base elasticities and suggest that an elasticity of -0.3 represents a plausible and, within the literature, conservative measure of the behavioural effect of stamp duty.

Land Tax

We assess the change in land tax base (total unimproved/site value of taxable properties) in response to a change in land tax rate. The analysis utilises aggregated revenue and tax base data provided by States and Territories to the CGC. Our analysis of the CGC data suggests a 10 percent increase in the tax rate will reduce the overall unimproved value of taxable properties by 0.6 percent. This behavioural effect is contemporaneous and therefore likely due to change in the quantity of properties that fall under land tax. We find no evidence of lagged effects. Our low elasticity estimate, of about -0.06, represents a plausible and conservative first estimate of the behavioural effect of the land tax.

Mining Tax

Due to data limitations and methodological problems, we conclude that elasticities of mining royalties cannot be reliably estimated. The high level of aggregation of available data sources at a State level and the lack of valid comparison of treatment and control States, due to the large heterogeneity in the stock of mineral resources across States, preclude the calculation of a robust estimate. Moreover, mining royalties of a State typically come from a single commodity, such as iron ore or coal, which impedes interstate comparisons. A further complication is the differences in the quality of minerals across States.

Summary of selected elasticities by state tax

Tax	Elasticity	Interpretation
Payroll	Largely statistically insignificant	Not applicable
Insurance	-0.057 (CGC)	A 1 **percentage point** increase in the tax rate reduces expenditure on total premiums by 0.6 percent (equivalent to about a 10 percent increase).
Motor	-0.056 (CGC) -0.035 (HILDA)	A **10 percent** increase in licence fees reduces vehicle ownership by 0.6 percent. A **10 percent** increase in licence fees reduces car ownership by 0.35 percent.
Stamp duty	-0.29 to -0.43 (CGC) -0.01 to -0.37 (Corelogic)	A **10 percent** percent increase in the tax rate reduces the overall value of sold properties by 3-4 percent. A **10 percent** increase in the tax rate reduces the value of sold properties by 0.1 to 3.7 percent, depending on the specification chosen.
Land	-0.054 to -0.062 (CGC)	A **10 percent** increase in the tax rate will reduce the overall unimproved value of taxable properties by about 0.6 percent.
Mining	Not applicable	

1. Introduction

In 2016, Australia's total tax burden amounted to about 28 percent of GDP, well below the OECD average of 34 percent (OECD 2018). The Commonwealth Government collects income taxes, the Goods and Services Tax (GST), and customs and excise duties. Tax revenues from these taxes make up about 80 percent of all tax revenues. State and Territory governments raise around 17 percent of total tax revenue from a broad spectrum of taxes, including payroll taxes, stamp duties, land taxes, insurance taxes, motor vehicle taxes, mining royalties and gambling taxes. Local governments levy property rates, which account for about four percent of total tax revenue.[1]

The GST is passed on to the States and Territories under a horizontal fiscal equalisation formula. GST revenues are distributed across States and Territories in a way that aims to equalise their revenue and spending capabilities. The Commonwealth Grants Commission (CGC) determines a GST distribution that achieves horizontal fiscal equalisation based on the fiscal capacity that would prevail if all States and Territories made the same effort to raise revenue from their own sources and operated at the same level of efficiency. Assessing fiscal capacities is complicated by variation in tax rates across States and Territories, which can affect the level of economic activity and the underlying revenue bases.

The aim of this study is to estimate tax elasticities for a number of State taxes from a variety of existing data sources. In particular, different data sources and econometric techniques are combined to obtain reliable estimates of the effects of changes in tax rates on revenue bases. Each of the subsequent chapters focuses on one of the following taxes: (1) payroll tax, (2) insurance tax, (3) motor tax, (4) stamp duty, (5) land tax, and (6) mining royalties. In each chapter, a brief overview of the theoretical underpinnings of the different taxes is provided and accompanied with a description of current practices across the various States and Territories and a general empirical strategy. Each data source and the specific empirical methodology used is described in detail. Particular attention is paid to potential endogeneity problems. Elasticity estimates for the different data are presented including a number of robustness checks. Finally, to the extent possible, the estimated elasticities are compared to those estimates calculated in the academic literature for Australia and internationally.

[1] ABS 5512.0 Government Finance Statistics, Australia, 2016-17

2. Payroll Tax

2.1 Introduction

Payroll tax is a State and Territory tax assessed on wages paid by employers to employees. From a legal perspective, employers bear the *statutory burden*[2] of payroll taxes because they have to pay the tax bill. From an economic perspective, it is possible that employers shift the *economic burden* of payroll taxes to employees through wages and employment.

This chapter presents empirical evidence on the effect of changes in payroll taxes on wages and employment in Australia. A newly available data source, the Business Longitudinal Analysis Data Environment (BLADE), is used to exploit variation in payroll tax thresholds across States and changes over time to estimate the parameters of interest. Difference-in-difference estimation is used to isolate the effect of increases in State-level payroll tax thresholds between 2006 and 2015 on wages and employment. Of particular interest is the extent to which firms and workers share the burden of payroll tax. Understanding the link between changes in payroll tax thresholds and labour market outcomes has important implications for the use and design of payroll taxes in Australia.

The empirical findings presented in this chapter are based on preliminary work of the Australian National University in collaboration with the Department of Industry, Innovation and Science.[3] First, a brief overview of the theoretical underpinnings of payroll taxes is provided and followed by a summary of the current rates and thresholds in place in different States and Territories in Australia. Then estimates of the elasticity of labour demand (measured by the wage bill/payroll, full-time equivalent employees and the headcount of employees in a firm) in response to changes in payroll taxes are discussed alongside a description of the data sources applied for the calculation. Finally, to provide a comparative benchmark, these results are compared to estimates calculated in studies from the academic literature in Australia and internationally.

2.2 Theoretical background

From a theoretical perspective, payroll taxes may reduce the after-tax income of workers, leaving them with less money to buy goods and services. Payroll taxes are often viewed as a tax on labour income or, equivalently, as a tax on the consumption of goods and services.

[2] Statutory and economic burden are used interchangeably with the legal and economic incidence of a tax.
[3] Majeed and Sinning (forthcoming) provide a more detailed description of the data and the empirical strategy, together with a detailed discussion of empirical findings, robustness checks and limitations.

In theory, a tax on goods and services and a payroll tax should therefore have similar effects on the incentive to work because both reduce the goods and services that can be purchased through working (Henry Tax Review 2009).

The overall impact of payroll taxes on the labour market is ambiguous from a theoretical standpoint. On one hand, when workers value the benefits paid for with payroll taxes as much as the amount they contribute, increases in payroll taxes are fully passed through from companies to employees in the form of lower salaries, without any effect on employment. Thus, companies do not experience any increase in their overall labour costs. On the other hand, if wages are not fully flexible or if payroll taxes do not directly benefit all employees, then wages do not fully absorb the payroll tax, leading to higher labour costs and lower employment (Kugler et al. 2017).

The debate about whether labour or capital bears the burden of payroll tax depends on the labour supply elasticity – the degree of responsiveness of labour to a change in the wage rate. If labour is fixed in supply (or if the labour supply elasticity is zero), then labour will bear the full burden of the payroll tax. Conversely, if labour supply is very responsive to a change in the wage rate, then the tax burden will be shifted elsewhere (Kugler and Kugler 2002, Alm and López-Castaño 2005).

However, with binding wage floors in place, payroll taxes paid by the employer cannot be passed on to minimum wage workers by lowering their pay. If minimum wages misalign labour costs and worker productivity, such taxes may result in lower employment for the groups concerned (Immervoll 2007).[4]

The incidence of payroll taxes may also depend on whether the tax is imposed on the employer or the employee. For example, Dahlby and Wilson (2003) investigate vertical fiscal externality in a federation in which the taxes or expenditures of one level of government affect the budget constraint of another level of government. They show that, if the demand for labour is inelastic, the vertical fiscal externality with ad valorem payroll taxes is always negative when taxes are levied on employers, while the effect is positive when taxes are levied on employees. The reason for the difference is that when the tax is levied on the

[4] Thus, it is not surprising that Melguizo and González-Páramo (2013), based on a meta-analysis of 52 empirical studies, find that economic institutions significantly affect the incidence of the tax burden. They also find that a significant part of the variability of findings remains unexplained even after controlling for a large number of factors in the model. The work of Nickell (1997) confirms that labour market rigidities can affect employment.

employee, the federal wage tax base includes the State's wage tax. The federal wage tax base excludes State's tax revenues if payroll taxes are levied on the employer.

In sum, payroll taxes can affect wages and employment. The effect of payroll taxes on labour market outcomes may have important implications for State revenues because changes in labour market outcomes will affect the tax base. Moreover, the payroll tax can generate a significant deadweight loss to society by deviating from a free-market equilibrium.

2.3 States' and Territories' tax policies

Payroll tax is the most important State tax in terms of revenue collection (leaving aside the GST). The total payroll tax revenue in 2016-17 amounted to $23.2bn, or 28.2 per cent of the total tax revenue of the States.[5] The payroll tax is assessed on wages paid by an employer to its employees, when the total wage bill of an employer exceeds a certain threshold.[6] Wages and salaries include most forms of employee benefits, including commissions, bonuses and fringe benefits, although there are differences in the definitions across the States.

The payroll tax is affected by interstate competition, which has led to increases in tax thresholds, lower rates and special exemptions (Stewart et al. 2015). The Commonwealth government, local governments, religious institutions and non-profit organisations in education, health and welfare are generally exempt from the payroll tax. Moreover, the tax thresholds exempt a significant proportion of businesses from the base. For instance, around 90 per cent of businesses in NSW were exempt from payroll tax in 2008-2009 (IPART 2008). With a flat marginal payroll tax rate above the exemption threshold, the ACT currently has the highest payroll tax rate and threshold in Australia ($2 million). Queensland has the lowest rate (4.75 percent), and the threshold is lowest in Victoria ($625,000). The payroll tax rates, exemption thresholds and tax scales are presented in Table 1.

[5] http://www.abs.gov.au/ausstats/abs@.nsf/mf/5506.0.
[6] https://www.payrolltax.gov.au/.

Table 1. Payroll tax exemption thresholds, rates, and tax scales across States, 2017-18

	Exemption Threshold ($)	**Max. Rate (%)**	**Tax scale**
NSW	750,000	5.45	Marginal rate of 5.45% of payroll in excess of $750,000
VIC	625,000	4.85	Marginal rate of 4.85% of payroll in excess of $625,000(a)
QLD	1,100,000	4.75	Effective rate slides from 0% at $1.1m to 4.75% at $5.5m
SA	600,000	4.95	Marginal rate of 4.95% of payroll in excess of $1.5m(b)
WA	850,000	5.50	Effective rate slides from 0% at $850,000 to 5.5% at $7.5m
TAS	1,250,000	6.10	Marginal rate of 6.10% of payroll in excess of $1.25m
NT	1,500,000	5.50	Effective rate slides from 0% at $1.5m to 5.5% at $7.5m
ACT	2,000,000	6.85	Marginal rate of 6.85% of payroll in excess of $2m

Note: (a) The rate of payroll tax for regional employers is 3.65%. The payroll tax exemption threshold is expected to increase to $650,000 from 1 July 2018. (b) A small business payroll tax concessional rate of 2.5% applies for Australia-wide payrolls between $600,000 and $1 million and increases incrementally to 4,95% for businesses with Australia-wide payrolls above $1.5 million.

Source: Government of Western Australia (2018).

Being able to set their own payroll tax rates and thresholds has given the States the opportunity to adjust the tax to their needs, taking into account factors such as their industrial structures and revenue needs. However, allowing the States to design their own tax has also led to more complexity, e.g., for businesses operating in more than one State. To address this issue, the States have worked on the harmonisation of tax arrangements (Henry Tax Review 2009) but these efforts did not lead to an alignment of payroll tax rates and exemption thresholds.

2.4 Data source

The data source for this chapter is the Australian Bureau of Statistics' (ABS) Business Longitudinal Analysis Data Environment (BLADE). BLADE is a series of integrated, linked longitudinal datasets over the period 2001 to 2015. It is based on retrospectively reconciling the different reporting structures used in Australian Taxation Office (ATO) and ABS data to facilitate the linking of survey and administrative data for businesses, using Australian

Business Numbers (ABNs) as a backbone. We restrict our analysis to data for the years 2006 to 2015.

The administrative data is sourced from the ATO and includes Business Activity Statement (BAS) and Pay-As-You-Go (PAYG) tax data. In addition, demographic information (such as firm age and industry classification) is derived by a combination of data from the ABS Business Register and historical ATO reporting patterns. To study wage and employment effects, we restrict our sample to employing firms with at least 1 full time equivalent (FTE) in the private sector.

Table 2 presents summary statistics of our outcome variables. After removing the government sector and all non-employing firms, we observe 3,785,655 firm-year observations of 829,280 firms over the study period.

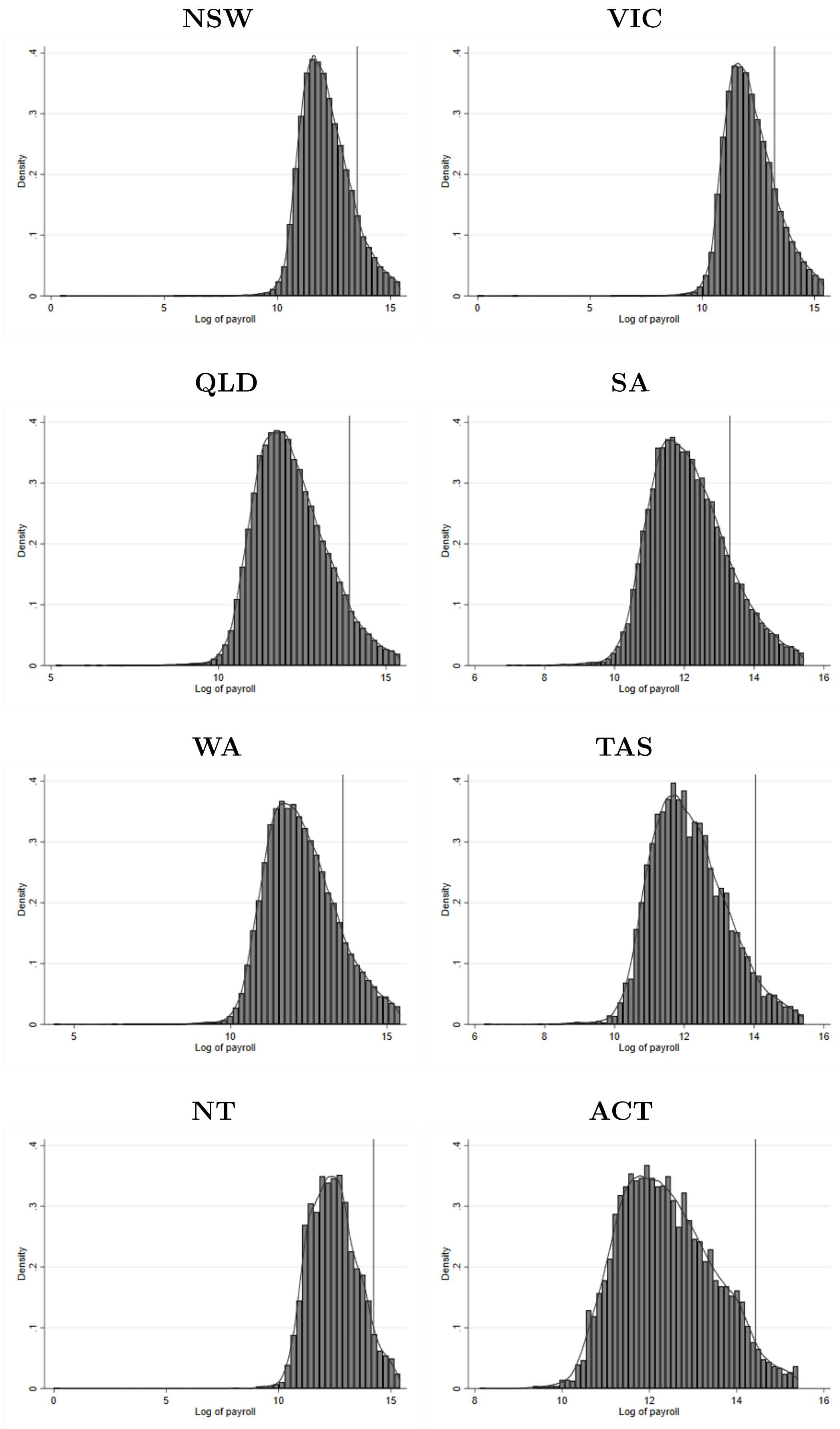
Table 2. Summary statistics - private sector firms

	N	Mean	SD	P1	P50	P99
Wages & salaries ($ m)	3,774,555	1.20	103.7	0.011	0.146	9.28
Real wages & salaries ($ m)	3,373,974	0.89	64.9	0.009	0.113	6.82
Employment (FTE)	3,785,655	18.6	375.6	1.00	3.22	181.0
Employment (Head Count)	3,785,635	31.6	555.6	1	6	315

Note: Firms with less than 1 FTE were dropped from the sample.

We find that the median firm is relatively small, with around 3.2 FTE. However, the data is skewed, with a small proportion of firms employing large number of employees. Hence the average number of employees in the data is around 18.6. For the same reason, the median wage bill of a firm is around $110,000, while the average wage bill is around $900.000, in real terms. Firms usually have around 40 to 50 percent more employees on their payroll than they employ full-time.

Figure 1. Payroll distributions and payroll tax thresholds, 2015



Before studying the effects of changes in payroll tax thresholds, it is important to know whether firms actively try to avoid the tax by *bunching* below these thresholds. This behavior would not only imply that payroll taxes have adverse effects on firms, but it would also make it more difficult to study the effects of changes in payroll tax thresholds on labour market outcomes. Figure 1 presents payroll distributions and payroll tax thresholds by State in 2015.

Bunching would imply that a considerable number of firms would stay just below the payroll tax threshold in order to avoid the tax. In the case of bunching, we would expect to see an unusually large fraction of firms immediately below the payroll tax threshold, and a correspondingly small fraction above the threshold.

Figure 1 provides no evidence of bunching below the payroll tax threshold in 2015 because there is no discontinuity in the observed fraction of firms around the payroll tax threshold. Instead, the fraction of firms around the threshold declines continuously along the payroll distribution in all States and Territories, indicating that our analysis is not affected by behavioural responses to the tax threshold.

This result is consistent with a more detailed analysis of Ralston (2018), which concludes that firms in Australia generally do not bunch below the payroll tax threshold. The result justifies the use of a difference-in-difference estimator, which is based on a comparison of changes in wages and employment of firms that experienced a threshold change and firms that did not.

2.5 Empirical strategy

Our empirical strategy exploits variation in payroll tax thresholds across States and over time. Table 3 presents the payroll tax rates and thresholds for the period 2006-2015. We focus on studying the effects of changes in payroll tax thresholds on labour market outcomes because they were associated with a relatively large change in payroll tax rates, from around 6 percent to 0 percent, for firms that were affected. The shaded areas in Panel B of Table 3 indicate changes in payroll tax thresholds compared to the previous year.

We also observe changes in payroll tax rates, which sometimes coincide with changes in payroll tax thresholds. To isolate the effect of changes in payroll tax thresholds, we will remove cases in which changes in payroll tax rates took place (indicated by the shaded values in Panel A of Table 3). We will use two samples in our analysis in which changes in payroll tax rates are either included (“unrestricted sample”) or excluded (“restricted sample”).

Table 3. Payroll tax rates and thresholds, 2006 - 2015

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Panel A. Payroll tax rates (%)								
2006/1	6.00	5.25	4.75	5.50	5.50	6.10	6.20	6.85
2006/2	6.00	5.25	4.75	5.50	5.50	6.10	6.20	6.85
2007/1	6.00	5.25	4.75	5.50	5.50	6.10	6.20	6.85
2007/2	6.00	5.15	4.75	5.50	5.50	6.10	6.20	6.85
2008/1	6.00	5.05	4.75	5.50	5.50	6.10	6.20	6.85
2008/2	6.00	5.05	4.75	5.25	5.50	6.10	6.20	6.85
2009/1	6.00	5.05	4.75	5.25	5.50	6.10	6.20	6.85
2009/2	6.00	4.95	4.75	5.00	5.50	6.10	5.90	6.85
2010/1	5.75	4.95	4.75	5.00	5.50	6.10	5.90	6.85
2010/2	5.75	4.95	4.75	4.95	5.50	6.10	5.90	6.85
2011/1	5.65	4.95	4.75	4.95	5.50	6.10	5.90	6.85
2011/2	5.50	4.90	4.75	4.95	5.50	6.10	5.90	6.85
2012/1	5.45	4.90	4.75	4.95	5.50	6.10	5.90	6.85
2012/2	5.45	4.90	4.75	4.95	5.50	6.10	5.50	6.85
2013/1	5.45	4.90	4.75	4.95	5.50	6.10	5.50	6.85
2013/2	5.45	4.90	4.75	4.95	5.50	6.10	5.50	6.85
2014/1	5.45	4.90	4.75	4.95	5.50	6.10	5.50	6.85
2014/2	5.45	4.90	4.75	4.95	5.50	6.10	5.50	6.85
2015/1	5.45	4.90	4.75	4.95	5.50	6.10	5.50	6.85
2015/2	5.45	4.85	4.75	4.95	5.50	6.10	5.50	6.85
Panel B. Payroll tax thresholds ('000 AUD)								
2006	600	550	850	504	750	1,010	1,000	1,250
2007	600	550	1,000	504	750	1,010	1,250	1,250
2008	600	550	1,000	504	750	1,010	1,250	1,250
2009	623	550	1,000	552	750	1,010	1,250	1,500
2010	638	550	1,000	600	750	1,010	1,250	1,500
2011	638	550	1,000	600	750	1,010	1,250	1,500
2012	678	550	1,000	600	750	1,010	1,500	1,500
2013	689	550	1,100	600	750	1,250	1,500	1,750
2014	750	550	1,100	600	750	1,250	1,500	1,750
2015	750	550	1,100	600	800	1,250	1,500	1,850

Note: Panel A: Shaded values indicate periods during which payroll tax rates changed. Panel B: Shaded values indicate changes in payroll tax thresholds compared to the previous year.

Source: https://www.payrolltax.gov.au/harmonisation/payroll-tax-rates-and-thresholds

The starting point of our analysis is a pooled linear regression model, which is used to study the link between labour market outcomes and changes in payroll tax thresholds. Specifically, we estimate a pooled regression model of the following form:

Equation 1

$$\log(y_{jst}) = \beta_0 + \beta_1 T_{st} + \theta_j + \lambda_s + \phi_t + u_{jst}, \quad j = 1, \dots, n, \quad s = 1,2,\dots,8, \quad t = 0,1,2,\dots,9,$$

where y_{jst} is the labour market outcome of firm *j* in State *s* at time *t*. Our analysis uses data from eight Australian States and Territories over a ten-year period (2006-2015). We consider three outcome measures: (1) the total amount of wages and salaries paid by a firm in a given year (in the following, we refer to this measure as "payroll", the tax base of payroll taxation),

(2) the number of full time equivalent (FTE) of workers employed by a firm in a given year, and (3) the head count of workers employed by a firm in a given year.

T_{st} is an indicator variable that takes on the value 1 if the payroll tax threshold in a given State has changed compared to the previous year (the shaded values in Panel B of Table 3), and 0 if the payroll tax threshold has stayed the same. θ_j includes industry fixed effects that account for time-invariant differences between industries, such as structural differences between service and manufacturing sectors that do not change over time. λ_s denotes State fixed effects that capture time-invariant State-specific characteristics, such as geographic location, natural resources, etc. ϕ_t includes year fixed effects, which capture changes that affect all firms simultaneously, such as inflation, changes in overall economic conditions, etc. β_0 and β_1 are model parameters and u_{jst} is the model error term. We are particularly interested in estimating β_1 because it measures the relationship between a change in the payroll tax threshold and the change in one of the outcome measures.

Several sample restrictions are imposed. Firms with a payroll between $500,000 and $2 million are focused on because many firms within that range are likely to be affected by changes in payroll tax thresholds, which range from $504,000 to 1,850,000 over the sample period. The impact of changing the upper and lower limits, within the range of $100,000 to $5 million, is also considered. Moreover, a sample that includes cases in which tax rate changes took place ("unrestricted sample") is compared to a sample that excludes these cases ("restricted sample"). The restricted sample is preferred because it allows us to isolate the effects of threshold changes from the effects of rate changes. The shaded values in Panel A of Table 3 indicate periods during which tax rate changes took place. These periods were removed from the restricted sample used in our analysis of threshold changes.[7]

In addition to the pooled regression model specified above, we also estimate a standard difference-in-difference model based on data from two consecutive years to study the effect of changes in payroll tax thresholds on labour market outcomes:

Equation 2

$$\log(y_{jst}) = \gamma_0 + \gamma_1 T_{jst} + \gamma_2 A_{jt} + \theta_j + \lambda_s + v_{jst}, \quad j = 1, \dots, n, \quad s = 1,2,\dots,8, \quad t = 0,1,$$

[7] We do not analyse the effects of changes in payroll tax rates because these changes were much smaller (below 0.5 percentage points) than the tax rate changes associated with threshold increases, which reduced payroll tax rates by about 6 percentage points.

where y_{jst} is the labour market outcome (see Equation 1 for details), T_{st} indicates a change in the payroll tax threshold in a given State compared to the previous year (the shaded values in Panel B of Table 3), and A_{jt} indicates the period after the threshold change. θ_j includes industry fixed effects that account for time-invariant differences between industries and λ_s denotes State fixed effects that capture time-invariant State-specific characteristics. γ_0, γ_1 and γ_2 are model parameters and v_{jst} is the model error term. The difference-in-differences approach relies on the assumption that there are no temporary changes that have differential effects on the States, such as temporary State-level economic fluctuations. If the assumption holds, then the parameter γ_1 measures the causal effect of a change in the payroll tax threshold on one of the outcome measures.

2.6 Results

Table 4 summarises the findings of our estimates of the pooled model specified by Equation 1. We consider two alternative analysis samples that either include or exclude cases in which payroll tax rate changes took place (unrestricted vs. restricted sample). We also focus on firms with a payroll of between $100,000 to $5 million and we study the impact of gradually narrowing the payroll range to between $500,000 and $2 million. Panel A of Table 4 indicates that the relationship between threshold changes and the payroll (the tax base) is not significant. There is also no significant link between threshold changes and employment measured in full-time equivalents (FTEs). However, we do observe a significantly positive association between threshold changes and the head count measure (the two stars indicate statistical significance at a 5% level), which suggests that increases in payroll tax thresholds are positively related to employment. We obtain similar results from the restricted and the unrestricted sample, suggesting that excluding cases in which tax rates changes take place does not affect our results qualitatively.

Panel B of Table 4 shows how our results change when we increase the lower payroll limit to $300,000. For this sample, the threshold changes are positively related to both FTE and head count measures. However, this picture changes when we further increase the lower limit to $500,000 (Panel C). In this case, the relation between threshold changes and labour market outcomes is not significant. Reducing the upper payroll limit from $5 million to $2 million produces similar results (Panels D-F). The estimated coefficients in Panels D-F are even somewhat less significant than the corresponding coefficients in Panels A-C. The estimates based on our preferred sample presented in Panel F, which is restricted to firms that are most likely to be affected by the threshold changes, indicate that the relation between threshold changes and labour market outcomes is not significant. Taken together, the results presented in Table 4 indicate that the link between changes in payroll tax thresholds and labour market outcomes is rather weak.

Table 4. Pooled model

	Sample including tax rate changes (Unrestricted sample)			Sample excluding tax rate changes (Restricted sample)		
	Payroll	FTE	Head Count	Payroll	FTE	Head Count
Panel A. Payroll > $100,000 <$5,000,000						
Coefficient	-0.00112	0.00297	0.00817**	-0.00165	0.00265	0.00769**
	(0.00299)	(0.00194)	(0.00312)	(0.00384)	(0.00170)	(0.00261)
R2	0.0306	0.0663	0.1329	0.0315	0.0667	0.1352
N	2,356,136	2,356,136	2,356,136	1,790,034	1,790,034	1,790,034
Panel B. Payroll > $300,000 <$5,000,000						
Coefficient	0.00071	0.00473**	0.01035**	0.00275	0.00663***	0.01207**
	(0.00124)	(0.00183)	(0.00425)	(0.00183)	(0.00160)	(0.00487)
R2	0.0249	0.0686	0.1445	0.0265	0.072	0.1488
N	1,001,966	1,001,966	1,001,966	762,647	762,647	762,647
Panel C. Payroll > $500,000 <$5,000,000						
Coefficient	-0.00009	0.00363	0.00876	0.00172	0.00500	0.01008
	(0.00245)	(0.00275)	(0.00506)	(0.00306)	(0.00274)	(0.00597)
R2	0.0217	0.0685	0.1615	0.0233	0.0725	0.1659
N	595,608	595,608	595,608	453,618	453,618	453,618
Panel D. Payroll > $100,000 <$2,000,000						
Coefficient	-0.00206	0.00225	0.00741**	-0.00335	0.00131	0.00629**
	(0.00268)	(0.00142)	(0.00274)	(0.00337)	(0.00092)	(0.00256)
R2	0.0229	0.0803	0.1532	0.0233	0.0804	0.1554
N	2,259,157	2,259,157	2,259,157	1,717,084	1,717,084	1,717,084
Panel E. Payroll > $300,000 <$2,000,000						
Coefficient	-0.00094	0.00353*	0.00908*	-0.00037	0.00424	0.00954
	(0.00102)	(0.00151)	(0.00404)	(0.00190)	(0.00234)	(0.00537)
R2	0.0144	0.1036	0.181	0.0151	0.1074	0.1854
N	904,987	904,987	904,987	689,697	689,697	689,697
Panel F. Payroll > $500,000 <$2,000,000						
Coefficient	-0.00257	0.00175	0.00666	-0.00222	0.00206	0.00676
	(0.00156)	(0.00160)	(0.00483)	(0.00219)	(0.00192)	(0.00637)
R2	0.0101	0.1159	0.2082	0.0109	0.1215	0.2129
N	498,629	498,629	498,629	380,668	380,668	380,668

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. All regressions include State, time and division fixed effects. Standard errors (reported in parentheses) were clustered at the State level.

The coefficients presented in Table 4 measure the link between variation in tax thresholds and variation in labour market outcomes over the sample period 2005-2016. The results may be interpreted as causal under the assumption that the threshold changes are uncorrelated with the unobserved variation in labour market conditions captured by the model error term.

Our difference-in-differences estimates are based on the assumption that there are no systematic differences in temporary fluctuations in labour market outcomes over time. Empirical studies usually examine whether outcome measures in different States follow a common trend during the period before a policy intervention. Unfortunately, we do not observe longer periods without changes in payroll tax thresholds that would allow us to verify whether treatment and control States are comparable because they follow a common trend. However, we can exploit the absence of changes in payroll tax thresholds in 2008 and 2011. We can use these two years to obtain 'Placebo' estimates to confirm whether our difference-in-differences models produce reliable results. For example, suppose we are interested in estimating a difference-in-differences model to examine the effect of threshold changes in treatment States on labour market outcomes for the years 2012/2013. Then our Placebo estimates are based on moving the 2012/2013 model back in time by estimating the same model using data for the years 2007/2008 and 2010/2011. Because there were no threshold changes in 2008 and 2011, we would expect that the Placebo estimates show no effects. Therefore, the Placebo estimates can be used to test the validity of our model.

We observe numerous threshold changes over the sample period 2006-2015, and therefore we can estimate a large number of difference-in-differences models. Table 5 only includes selected difference-in-differences estimates for cases in which we observe a statistically significant effect of threshold changes on labour market outcomes and where the underlying Placebo estimates (for both 2007/2008 and 2010/2011) indicate that our difference-in-differences estimates are valid. In other words, Table 5 does not include a large number of difference-in-differences estimates that were either statistically insignificant (zero) or invalid (according to the Placebo estimates). Majeed and Sinning (forthcoming) provide a detailed discussion of the complete difference-in-differences analysis and the Placebo testing.

The difference-in-differences estimates in Table 5 reveal that the effects of threshold changes on labour market outcomes are ambiguous. The observed effects on total wages (the payroll) range from -0.0092 in 2009-10 (for the sample of firms with a payroll between $100,000 - $2 million) to 0.0072 in 2006-07 (for the sample $500,000 - $2 million), indicating substantial heterogeneity in the effects of increases in payroll tax thresholds. The negative coefficient (-0.0092) implies that increases in payroll tax thresholds over the period 2009-10 reduced the average payroll of firms (in the sample $100,000 - $2 million) by 0.92%. In contrast, the positive coefficient (0.0072) indicates that increases in payroll tax thresholds over the period 2006-07 increased the average payroll of firms (in the sample $500,000 - $2 million) by 0.72%. These coefficients are the most extreme estimates obtained from our analysis.

Table 5. Selected difference-in-differences estimates

	Payroll		**FTE**	**Head Count**		
	2006-07		2006-07		2006-07	
Sample	$100k-$2m	$500k-$2m	$300k-$2m	$300k-$5m	$300k-$2m	$300k-$2m
Coefficient	0.0049**	0.0072***	-0.0117**	-0.0127**	-0.014***	-0.014***
	(0.00174)	(0.00174)	(0.00408)	(0.00491)	(0.00349)	(0.00366)
Restricted	No	No	No	No	No	Yes
R2	0.0244	0.0106	0.0912	0.1417	0.1717	0.1751
N	398,074	80,090	149,496	163,947	149,496	131,023
	2009-10	2011-12			2008-09	
Sample	$100k-$2m	$500k-$5m		$300k-$5m	$100k-$2m	$300k-$2m
Coefficient	-0.0092**	-0.0074***		0.0140**	0.0066**	0.0163***
	(0.00262)	(0.00202)		(0.00474)	(0.00197)	(0.00355)
Restricted	Yes	No		No	No	No
R2	0.0216	0.0218		0.1433	0.1542	0.1761
N	298,741	112,313		185,554	432,875	168,307
	2013-14			2012-13		
Sample	$300k-$2m	$500k-$2m		$300k-$2m		
Coefficient	0.0017**	0.0026***		-0.0053**		
	(0.00070)	(0.00051)		(0.00181)		
Restricted	Yes	Yes		Yes		
R2	0.0131	0.0104		0.1762		
N	203,139	114,194		161,715		
	2014-15					
Sample	$300k-$2m	$300k-$2m				
Coefficient	-0.006***	-0.006***				
	(0.00081)	(0.00084)				
Restricted	No	Yes				
R2	0.0125	0.0127				
N	214,345	187,847				

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All regressions include State, time and division fixed effects. Standard errors (reported in parentheses) were clustered at the State level.

Turning to the employment effects, we only observe a significant effect on FTE in 2006-07 (for the sample of firms with a payroll between $300,000 - $2 million) but this effect is negative. The coefficient of -0.0117 indicates that increases in payroll tax thresholds over the period 2006-07 reduced employment (measured in full-time equivalents) by 1.17%. We find significant effects on the head count measure in several cases, but these effects vary substantially from -0.014 in 2006-07 (for the sample $300,000 - $2 million) to 0.0163 in 2008-09 (for the sample $300,000 - $2 million).

Taken together, the estimates in Table 4 and Table 5 provide no evidence to support the hypothesis that workers and firms share the burden of payroll taxes in Australia.

2.7 Comparing the elasticity results to estimates from the literature

2.7.1 Domestic evidence

Empirical evidence on payroll taxes in Australia is limited. Gabbitas and Eldridge (1998) provide descriptive evidence and argue that greater harmonisation between States would lower compliance costs. Dixon et al. (2004) compute the deadweight loss of payroll tax thresholds under alternative model scenarios based on work by Murphy (1999). They find that the deadweight loss in Victoria is about 10 per cent of the size of the payroll tax collections and conclude that the payroll tax affects the number of employees. Freebairn (2002) provides static deadweight loss estimates of payroll tax exemptions for small businesses. He finds that the combination of high payroll tax rates with exemptions generates a large deadweight loss and concludes that important efficiency gains can come from broadening tax bases and reducing rates.

More recent work by KPMG Econtech (2010) uses a computational general equilibrium (CGE) model and finds that the narrowness of the payroll tax base leads to a high marginal excess burden. Murphy (2016) also employs a CGE model and concludes that the high marginal excess burden may be attributed to a disincentive for employment in large firms relative to small firms due to payroll tax exemptions.

While these studies highlight the potential distortions resulting from payroll taxation, they mainly derive their conclusions from theoretical considerations and suffer from severe data limitations. A recent exemption in the Australian context is the work of Ralston (2018) who uses BLADE data to examine bunching of firms below the payroll tax threshold and concludes that firms generally do not bunch (consistent with Figure 1 above).

Work in related areas includes the evaluation of the 2015 company tax cut for companies under $2 million turnover. The Australian Government cut the tax rates of these companies from 30% to 28.5% (the average company at the threshold received a $2,940 tax cut). AlphaBeta (2018) use a regression discontinuity approach in combination with a large-scale business database to study the effect of the tax cut on employment, wages and business investment. The authors conclude that the tax cut had a small effect on employment and investment and an insignificant effect on wages in the companies that received the tax relief.

2.7.2 International evidence

Much of the empirical work in developed countries concludes that labour supply is almost completely inelastic, so the usual assumption made is that labour bears the full burden of any payroll tax (Alm and López-Castaño 2005). However, if wages can increase flexibly but have downward rigidity, there could be full shifting in response to a reduction in payroll taxes but not in response to a large increase (Kugler and Kugler 2002). In some countries, minimum wages are relatively high and constitute a binding restriction on formal sector employment and increases in payroll taxes may reduce formal employment.

Empirical evidence on the effects of payroll taxes has produced mixed results. Bennmarker et al. (2009) evaluate the effects of a 10 percentage point reduction in the payroll tax introduced in 2002 in northern Sweden and find that the average wage increases by about 0.25 per cent in response to a one-percentage point reduction in the tax rate, while employment effects are insignificant. The effect on wages is also no longer significant when the entry and exit of firms are taken into account.

Egebark and Kaunitz (2013) examine the effect of a large-scale cut of Swedish employer-paid payroll tax for young workers in 2007 that substantially reduced labour costs. They find small effects on employment and wages and they conclude that the payroll tax cut is not an efficient way to boost youth employment because the estimated tax revenue loss could have been used to hire four times as many workers at an average wage than were actually hired in response to the reform. In a similar setting, Egebark and Kaunitz (2014) find no effect of the payroll tax reduction on hours worked. Egebark and Kaunitz (2017) show that the lower costs induced by the reduced taxes in Sweden have no impact on exit rates from formal employment or profitability. They also find negligible effects on gross investments, and negative, but not statistically significant, effects on labour productivity.

Korkeamäki (2011) evaluates the effects of a regional experiment that reduced payroll taxes by 3-6 percentage points in Northern and Eastern Finland. By comparing employment and wage changes before and after the experiment to a control region, they find that the reduction in payroll taxes has no effect on employment, payroll, profits, hourly pay and monthly hours worked.

Some empirical studies confirm that payroll taxes also affect employment and wages in developing countries. Kugler and Kugler (2009) find that manufacturing employment reduces by 5 per cent among the least skilled workers as a result of a 10 per cent increase in payroll tax rates in Colombia. (Kugler et al. 2017) find that a payroll tax reduction in Colombia led to an increase in formal employment and an increase in the likelihood of transitioning into registered employment. Gruber (1997) finds that a reduction in payroll taxes in Chile is completely passed through to employees in the form of higher wages, without an impact on employment.

2.8 Conclusion

This chapter provides evidence on the effect of changes in payroll tax thresholds on wages and employment in Australia. We use data from the newly available Business Longitudinal Analysis Data Environment (BLADE), the most comprehensive firm-level data source in Australia, in combination with differences-in-differences estimation, to obtain the effects of increases in State-level payroll tax thresholds between 2006 and 2015 on wages and employment.

We find no evidence in favour of the hypothesis that workers and firms share the burden of payroll taxes in Australia. The effects of increases in payroll tax thresholds on the firm payroll range from -1% to 1%, with most effects being insignificant. We observe a similar pattern for the effects of threshold increases on employment, which range from -1.4% to 1.6% and are mostly insignificant. Our difference-in-differences estimates are based on the assumption that there are no systematic differences in temporary fluctuations in labour market outcomes over time. We perform robustness checks to ensure that our estimates are robust with regards to a range of sample restrictions and Placebo tests. Our findings are consistent with empirical findings generated in other developed economies but inconsistent with the largely theory-driven work produced in the Australian context.

The evidence presented here is limited because we only observe increases in payroll tax thresholds, which are associated with reductions in payroll tax rates from about 6% to 0% for firms within certain payroll intervals.[8] Therefore, we are unable to say how firms would have reacted to payroll tax increases. However, our results suggest that payroll taxes are a more efficient way of collecting tax revenues than often recognised, as we find no measurable behavioural effect of payroll taxes on labour market outcomes.[9]

[8] We do not study the effect of changes in payroll tax rates because these changes were comparatively small (see Panel A of Table 3).
[9] The empirical findings presented in this chapter are based on the work of Majeed and Sinning (forthcoming) who discuss the empirical analysis and the results in greater detail.

3. Insurance Tax

3.1 Introduction

Insurance helps to spread risk more effectively across a population. By providing the option to mitigate risk, it helps to maximise individuals' and society's well-being by enabling individual to optimize their resource allocation given the implied risks. In order to access insurance, individuals pay a premium, to which insurance tax is subsequently applied. Insurance tax, also known as stamp duty on insurance, is a State tax that is payable mainly on general insurance premiums. General insurers are required to report details on the insurance premiums received by providing a monthly statement and paying stamp duty.[10] Taxes on insurance increase the cost of providing insurance. The degree of distortion imposed by the increased cost and therefore, its social cost, will depend on the degree to which the demand and supply of insurance respond to taxation.

This chapter presents an empirical assessment of the extent to which the demand for insurance in Australia is sensitive to changes in the insurance tax rate applied (also referred to as the elasticity of insurance demand in response to changes in State insurance taxes). First, a brief overview of the theoretical underpinnings of insurance taxes is given and followed by a summary of the current rates in place in different States and Territories in Australia. Then estimates of the elasticity of insurance demand in response to changes in insurance taxes are discussed alongside a description of the data sources applied for the calculation. Finally, to provide a comparative benchmark, these results are compared to estimates calculated in studies from the academic literature in Australia and internationally.

3.2 Theoretical background and empirical strategy

The degree of distortion and subsequent social cost of insurance taxes, like for all taxes, depends on the responsiveness of demand and supply. Although empirical research is limited, evidence indicates that the demand for insurance seems relatively price elastic (see literature review in this chapter), though this can vary by type of insurance and context. This suggests that the deadweight loss associated with taxes on insurance, like any tax on transactions, is likely to be large. Since insurance premiums are also subject to the Goods and Services Tax (GST), the compounded effect of multiple taxes significantly increases the

[10] https://www.revenuesa.sa.gov.au/taxes-and-duties/stamp-duties/insurance

relative costs of premiums. This is likely to amplify the reduction in the potential number of people who buy insurance and/or their level of cover (Henry Tax Review 2008).

By helping to redistribute risk, insurance markets play an important role in society. The amount Australians spend on insurance is influenced by various factors, many of which are within their control. We are interested in the types of behavioural responses that are induced by changes in the tax on insurance premiums. First, increasing insurance premiums may discourage people from buying insurance (referred to as the extensive margin). Second, people may insure less than what would be considered optimal (referred to as the intensive margin). Third, people may search for ways to avoid the tax, including by purchasing offshore foreign insurance (Tooth and Barker 2007, Tooth 2015). Insurance premiums are also influenced by factors beyond individuals' control, such as business cycles, changes in interest rates, demographic changes, and the growth or decline in different industries, occupations, and regions.

Our empirical model assumes that insurance premiums are explained by four factors that attempt to capture these different behavioural and exogenously driven influences: an individual-specific effect, a_i, capturing all time-invariant individual (locational) characteristics of relevance for insurance purchases; a time-specific effect, b_t, controlling for common shocks to the tax base across individual (jurisdictions) due to the business cycle or common changes to federal regulation. Aside from individual effects, the estimation employs time-varying individual (locational) characteristics X_{it}, such as for example population and/or income, which are entered in logs. The tax rate Tax_{ti}, which varies across both individuals (locations) and over time, enters in logs in order to estimate the elasticity of insurance premiums in response to changes in insurance taxes. ε_{it} is an error term. Premiums for the *i*-th individual in time period *t* are thus given by:

Equation 3

$$\log(prem)_{i,t} = \beta \log(Tax)_{i,t} + a_i + b_t + X_{i,t}\delta + \gamma \log(prem)_{i,t-1} + \varepsilon_{i,t}$$

As the derived effective tax rates may be correlated with shocks in the tax base, the analysis makes use of instrumental variables. These instruments vary depending on the data used and are described in more detail in the individual data sections below. The varying individual data sources mean we will adjust the above general empirical specification according to the data in each respective section. For example, in some cases we only have aggregate data at the State level. In these cases, individual effects become State effects. The controls that go into vector X_{it} also depends on the data set and we will discuss the details in each data section.

Lastly, note the lagged right-hand side term, $log(prem)_{it-1}$, included among the explanatory variables. It adds a time-series dimension and permits accounting for a simple pattern of dynamic adjustment of the tax base to changing local conditions. In this way, following Buettner (2003), we impose our specification as a partial adjustment model.

3.3 States' and Territories' tax policies

While insurance tax applies in all States and Territories, its application varies across jurisdictions, impacting potential tax bases. First, the tax rate which applies to insurance premiums varies by State and Territory. Current duty rates on general insurance are summarised in Table 6 and vary between 9 and 11 per cent. States and Territories' stamp duties on insurance premiums have varied in all States over the last 20 years with the exception of Victoria, where rates have remained constant at 10 percent over the entire sample period. Figure 2 shows the variation of State tax rates on insurance premiums over time.[11] These range from as high as 11 percent in SA to a low of 0 percent in the ACT and go up or down over time and even up and down as in the case of New South Wales and Queensland.

Table 6. General insurance tax/duty rates across States and Territories

State	
1. NSW	9% (on the premiums) of Type A*, 5% on Type B# and 2.5% on Type C† items
2. VIC	10% of the premiums
3. QLD	9% of the premiums
4. SA	11% of the premiums
5. WA	10% of the premiums
6. TAS	10% of the premiums
7. NT	10% of the premium

Note: * *Type A includes general insurances other than insurances on Type B, Type C, life or exempt items.*

\# *Type B includes insurances on motor vehicle, aviation, disability income, occupational indemnity and hospital and ancillary health benefits.*

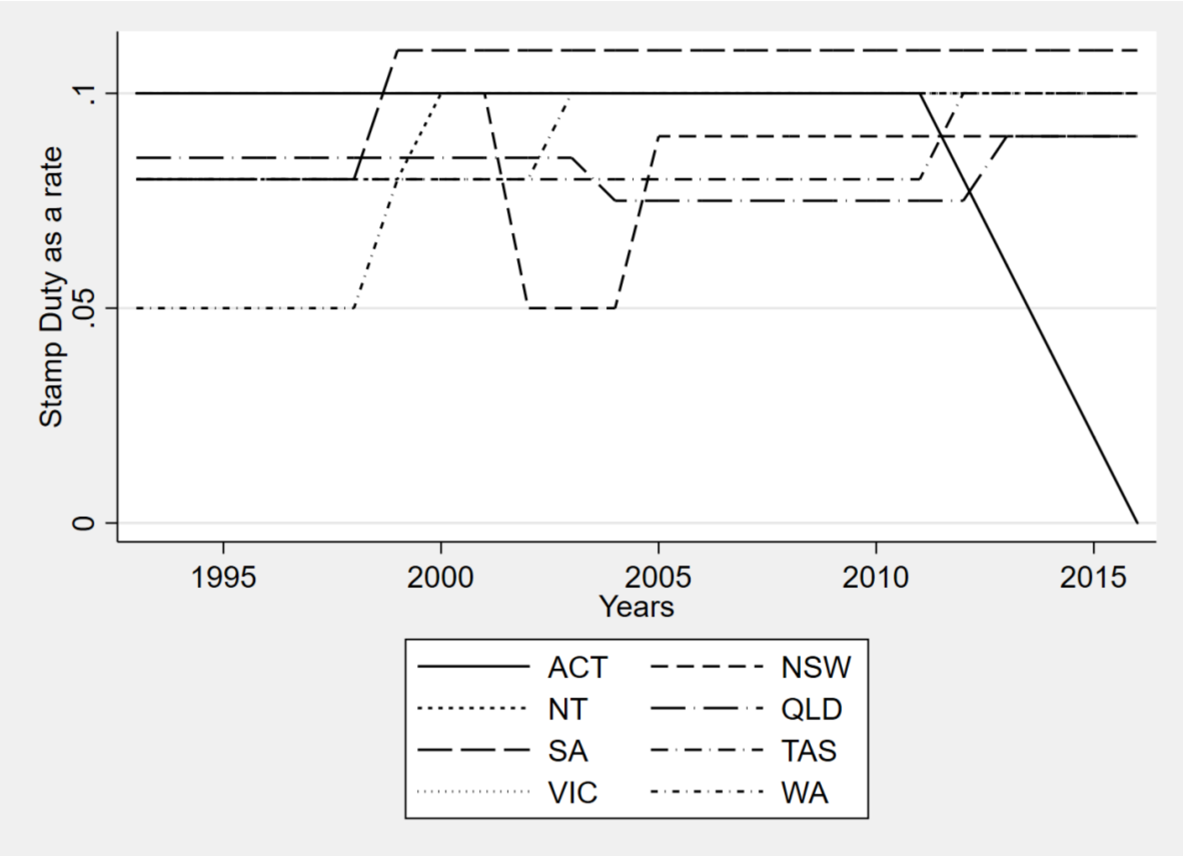
† *Type C includes insurances on crops and livestock. Insurance duties on these items will be exempt for all policies taken out on or after 1 January 2018.*

Sources: http://www.revenue.nsw.gov.au/taxes/insurance, http://www.sro.vic.gov.au/insurance, https://www.business.qld.gov.au/industries/service-industries-professionals/professional-financial-services/insurance-duty/calculating/rates, http://www.revenuesa.sa.gov.au/taxes-and-duties/stamp-duties/insurance,

[11] Data taken from Tooth (2015) Table 2.

https://www.finance.wa.gov.au/cms/State_Revenue/Duties/Insurance_Duty.aspx, http://www.sro.tas.gov.au/motor-vehicle-and-insurance-duty/insurance-duty/insurance-duty-calculator, http://www.treasury.nt.gov.au/TaxesRoyaltiesAndGrants/StampDuty/Pages/Duty-Types-and-Rates.aspx, https://www.revenue.act.gov.au/tax-reform

Figure 2. Insurance tax or stamp duty by State and Territory, 1993 - 2016



Second, while there are various types of insurance (i.e. health insurance, building insurance, life insurance, etc.), not all forms are taxed equally across States and Territories. For example, a levy applicable to health insurance only applies in NSW and the ACT. Tax exemptions explain the relatively low insurance tax revenues of about $5.7bn in 2015-16.[12] The contribution of insurance taxes to State revenues has also gradually declined since 2011-12. Estimated revenues from insurance taxes currently made up about 7.2 per cent of State tax revenues in 2016-17, compared to 9.0 per cent in 2011-12.[13]

Finally, insurance uptake depends on the institutional framework in place in the public and/or private sector of a specific jurisdiction. For example, compulsory third-party insurance is, by definition, legally binding. Similarly, mortgage financing, provided by a private lender, can

[12] For a detailed list of exemptions, see https://www.treasury.nsw.gov.au/sites/default/files/pdf/TRP16-01_Interstate_Comparison_of_Taxes_2015-16_-_pdf.pdf.
[13] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5506.02016-17?OpenDocument

be made conditional on the borrower taking out mortgage insurance. Differences across jurisdictions in the laws, contractual obligations, exemptions, and tax rates interact to influence consumer demand for insurance and consumers' sensitivity to changes in the prices of the premiums they pay (directly through price increases and taxes).

3.4 Data sources

This section gives an overview of the data sources we employ to estimate Australia's States and Territories' tax base elasticity (the elasticity of expenditure on insurance premiums) in response to changes in State insurance taxes.

3.4.1 Household Expenditure Survey (HES)

The Household Expenditure Survey (HES) collects information about income, wealth, housing and expenditure from residents in private dwellings in Australia (excluding very remote areas). It runs every five to six years. 2015-16 is the latest cycle of the surveys. We use data from the Confidentialised Unit Record Files of the HES. There are four waves of the survey that are relevant for us to analyse State taxes and insurance spending: 1998-99, 2003-04, 2009-10 and 2015-16. Generally, the more recent survey years have more detailed information on some other minor forms of expenditure on insurance, especially the latest survey 2015-16.

As the time dimension is crucial for identification of an effect independent of other contemporaneous variation, we only look at the main insurance categories that have been covered in the surveys starting in the 1990s. Since 1998-99, the HES survey collects details on insurance expenditure in the same format for the following insurances: household contents, computer and audiovisual equipment repair, household appliance repair and car insurance beyond the compulsory third party insurance.[14] Pooling over these four HES waves gives us a sample of 33,238 household-year observations.[15] Summary statistics for the insurance variables including the number of responses in the sample are listed in Table 7.

Across the different types of insurance, comprehensive car insurance[16] is most frequently purchased by 70 percent of the sample of households that spend, on average, $18 per week for it. Contents insurance is taken out by 25 percent of households in the sample. This

[14] Other typically non-voluntary insurance spending items collected in the HES are compulsory third party car and house insurance.
[15] Unlike the HILDA survey, the HES is not a household panel.
[16] As opposed to the compulsory third party insurance.

includes households who report expenditure on contents insurance separately from house insurance. Since they are reported separately, we can identify households that have purchased this voluntary insurance. The HES also allows for expenditure on house and contents insurance to be reported as one spending item, in which case we cannot observe whether contents insurance was purchased. 48 percent of the sample report spending on house and contents insurance.[17] As a robustness check, we run a regression where we assume that everyone who answers the combined question has taken out contents insurance. The two remaining insurances on computer and household appliances are less common; only 5 and 2.5 percent, respectively, report spending on these items. The smaller variation in the sample will make it harder to find significant results for these items.

Table 7. Summary statistics insurance spending (dependent variables), HES 1998-2015

Insurance	Observations	Mean weekly spending (AUD)	Std. Dev.	Min	Max
Contents	8,090	8.06	6.51	0.08	348.1
House and contents	15,875	18.19	16.10	0.02	621.4
Computer	1,552	2.52	2.71	0.02	57.53
Appliances	784	2.31	1.77	0.02	18.99
Comprehensive Car	23,185	17.73	13.86	0	265.02

In modelling the decision to purchase the different types of insurance, and how much to spend, we use the State-specific statutory tax on insurance and a number of household level variables including: disposable income, value of the dwelling, type of dwelling, the tenure of the place of residence, number of persons in the household, born in Australia or overseas and age.[18] Table 8 reports the summary statistics for these variables.

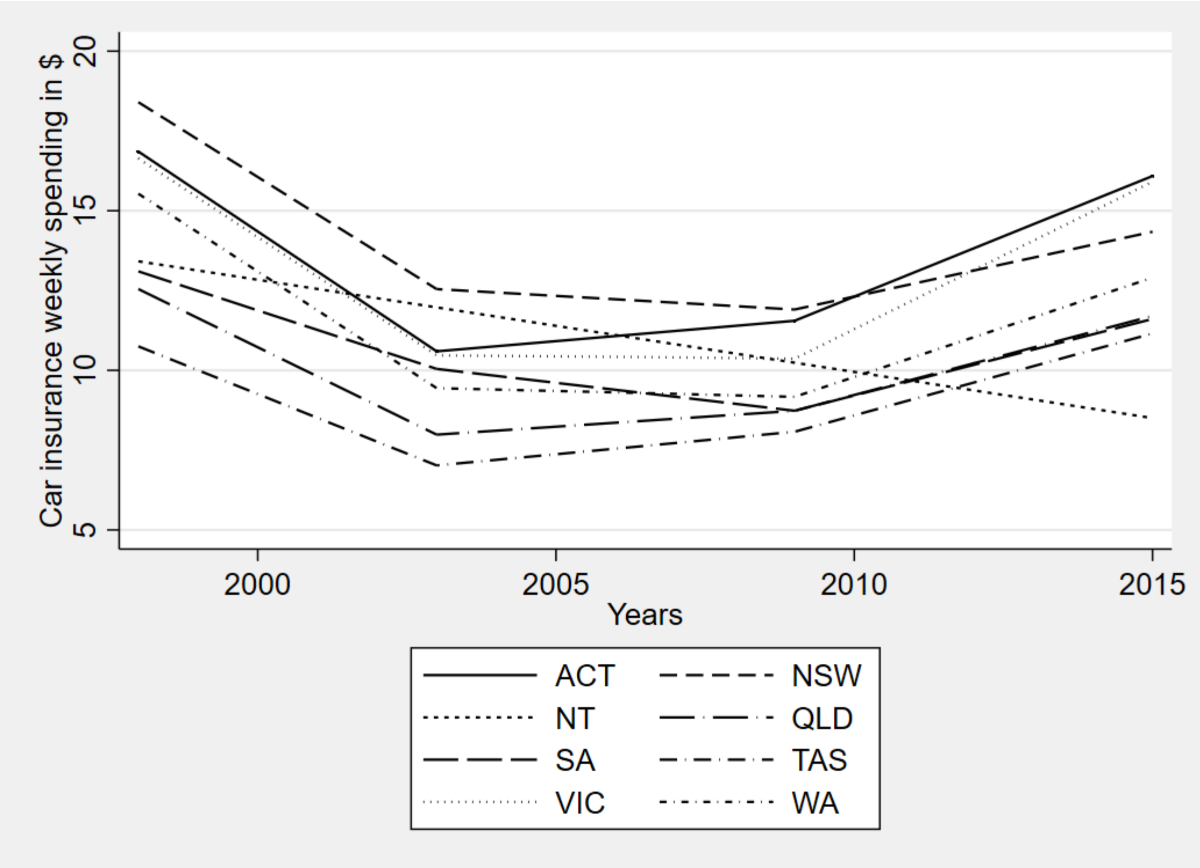
[17] For more details on this HES data issue, see Tooth (2015).
[18] We selected these main controls following Tooth's (2015) in depth analysis of the 2003-04 and 2009-10 HES sample waves.

Table 8. Summary statistics household characteristics (explanatory variables), HES 1998-2015

Variable	Mean	Std. Dev.	Min	Max
Statutory tax rate	0.092	0.02	0.02	0.11
Disposable weekly income	1115.89	1099.33	-4678	59262.34
Dwelling value in $000	306.17	390.49	0	12400
Number of persons in HH	2.42	1.31	1	10
Born overseas	0.306		0	1
Owning	0.367		0	1
Owning with mortgage	0.319		0	1
Renting	0.278		0	1
Other tenure	0.024		0	1
age24m	0.039		0	1
Age is 25 to 34	0.151		0	1
Age is 35 to 44	0.195		0	1
Age is 45 to 54	0.185		0	1
Age is 55 plus	0.430		0	1
House	0.793		0	1
Semi	0.103		0	1
Flat	0.098		0	1
Non-standard dwelling	0.006		0	1

To present some of the variation of our dependent variables over time by State and Territory, Figure 3 provides a visual impression of the extra expenditure on car insurance. Weekly averages are shown for the years 1998-2015. Even though similar patterns emerge over time for most States, the remaining variation is what we exploit in the regression analysis in the next section. We will run two types of regression models. A first model estimates changes in the probability of buying home or contents insurance as a function of insurance taxes and other controls using a binary Probit model. As not all households purchase insurance, a second model takes into account no insurance as a 'corner solution' for non-insurers and estimates insurance expenditure, as a function of the tax rate and various controls, in the form of a Tobit model. With both these estimation approaches we exploit changes in statutory insurance taxes in the States and Territories over time employing a difference-in-difference identification strategy. Our estimation will be equivalent to Equation 3 with the exception of: including State dummies, excluding household level dummies, and excluding the lagged dependent variable (since data on a panel of households is not available in the HES). Results are reported in Section 3.5.1 below.

Figure 3. Non-compulsory car insurance weekly spending by State and Territory, 1998 - 2015



3.4.2 Australian Prudential Regulation Authority (APRA)

APRA is an independent statutory authority that supervises institutions across banking, insurance and superannuation and promotes financial system stability in Australia.[19] APRA only collects data from private insurance providers. We use quarterly data available from APRA.[20] The data on premiums by Class of Business (type of insurance) is available from 2002 but only disaggregated on a State level basis from the 2nd Quarter of 2013. Currently data up until the 1st quarter of 2018 is available, but more data is being added on a continually quarterly basis. This leaves us with 152 State-quarter observations.

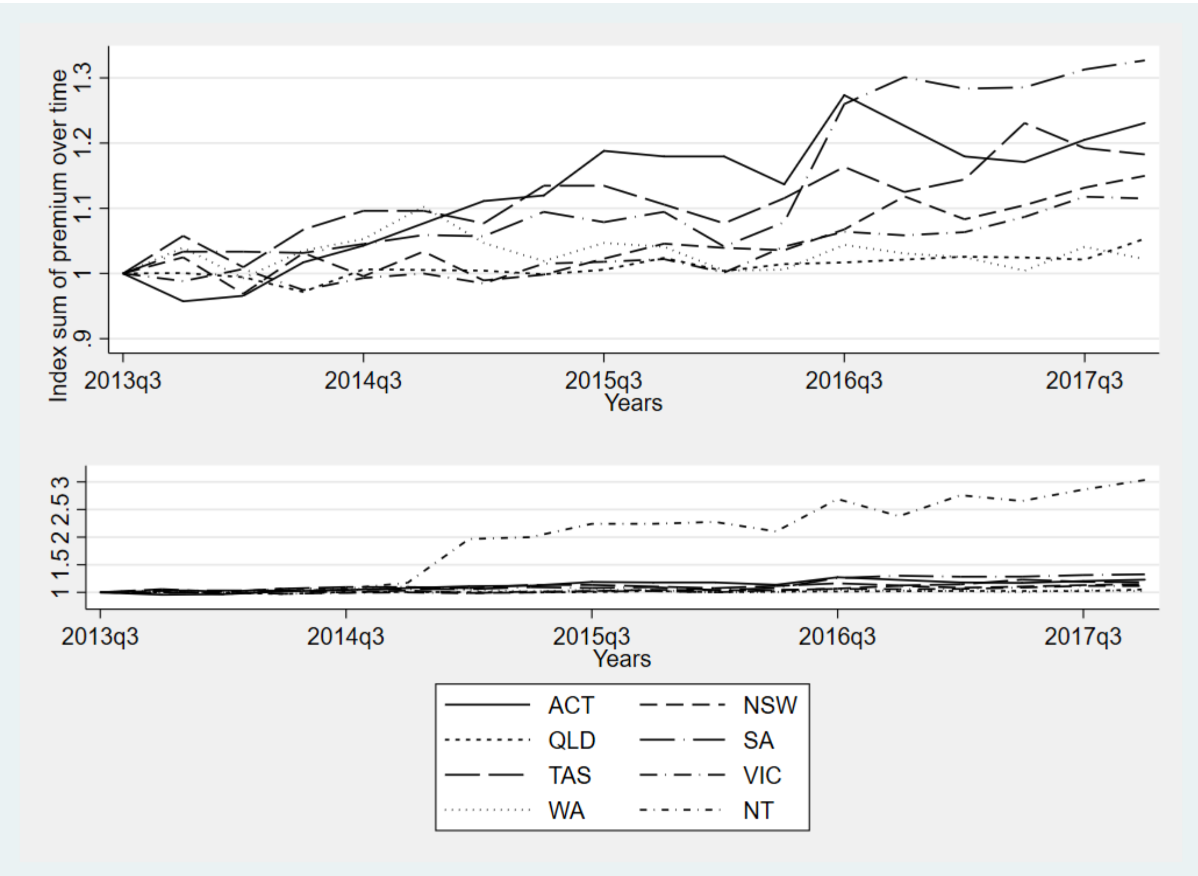
APRA lists 16 different types of insurance by class of business. We study 14 types of these where there is enough data[21] but only nine of which are subject to insurance taxes in a

[19] https://www.apra.gov.au/
[20] Data is freely available from the APRA website https://www.apra.gov.au/publications/quarterly-general-insurance-institution-level-statistics
[21] Insurance classes Other B and Other C only include data for a few quarters over the relevant period.

majority of States and are therefore included in the sum of taxable premiums that we derive for the analysis.

Figure 4 gives an overview over of the normalised sum of insurance premiums over the six years of our sample (starting from 2nd Quarter of 2013). In the lower panel, the Northern Territory is an outlier since insurance premiums more than doubled over the short sample period. This is due to stark increases in the reported domestic motor vehicle, fire and industrial special risks, and homeowners' and householders' insurances. These changes are a result of reforms that led to previously considered public insurances being classified as private insurance and therewith appearing in the APRA data set. Panel 1 excludes the Northern Territory in order to better illustrate the development of premiums in all other States and Territories. As observed, there is considerable variation and Queensland is the only State where insurance premiums grew by more than 30 percent.

Figure 4. First period indexed sum of taxable premiums trend by State



As the APRA data is available on a quarterly by State basis, we reinterpret our baseline model from Equation 3. The time variable *t* is now measured in quarters, rather than years and more importantly the individual level is replaced with a State index. We use quarterly population data from the ABS[22] as time-varying controls in X_{st}. This gives us the following specification:

Equation 4

$$\log(prem)_{s,t} = \beta \log(Tax)_{s,t} + a_s + b_t + X_{s,t}\delta + \gamma \log(prem)_{s,t-1} + \varepsilon_{s,t}$$

The variable $log(prem)_{s,t}$ is the logarithm of the overall insurance premium expenditure on the subset of insurance types[23] which fall under the insurance tax in State *s* during quarter *t*. Taxes are statutory tax rates in logs, $log(tax)_{s,t}$, b_t includes quarter fixed effects. The time fixed effect captures any quarter-specific effects on insurance expenditure that are common across all States. For example, it captures the effects of a general increase in insurance expenditure due to an Australia-wide growing population, the overall economy, and factors due to international economic conditions. Including a State fixed effects, a_i, will control for the fact that Australian States and Territories differ in many ways that are relevant to expenditure on insurance. This specification allows use to draw difference-in-difference type inferences where we try to identify the effects of changes to statutory taxes at the state-level over time. Apart from only including private insurances, the biggest limitation of the APRA data is the short time series available (only six years). Moreover, in those six years, changes to the tax rate have only occurred in the ACT, while the tax rate on insurance in all other States remained constant over this period. Therefore, the identification of the effects of tax rate changes is solely driven by variation in the ACT. The regression results are presented in Section 3.5.2.

3.4.3 CGC assessment data

The CGC data for insurance tax is based on data from APRA to calculate the tax base[24], data from public insurers, and data from the States and Territories on total tax revenue on an annual basis starting with the financial year 1993-94 through 2016-17. This leaves us with a panel dataset containing 192 State-year observations.

The data collection changed with the 2004 Review, when compulsory third-party (CTP) insurance premiums were collected and included in the tax base. First, they were collected separately, in addition to general and life insurance, and from 2010 onward they were all

[22] The population data comes from the ABS Table 3101 and represents quarterly population estimates by States.
[23] We follow the CGC’s categorisation of insurance types that are subject to insurance tax. The following categories are included in the sum of taxable premium: Commercial motor vehicle, Compulsory third party, Domestic motor vehicle, Fire and industrial special risks, Houseowners and householders, Mortgage, Other - Category A, Professional indemnity & Public and product liability. Not included are Consumer credit, Employers' liability, Marine and aviation, Other accident and Travel.
[24] We will also refer to the tax base as ‘revenue’ or ‘premiums’ that are GST inclusive.

reported together as one tax base. This results in a structural break in the data due to a change in the definition of the insurances included in the tax base. We chose the longer time series and more recent definition which includes CTP premiums. As the CGC employs a rolling window of data collection five years into the past, we observe a tax base consistently including the CTP premiums back to 1997-98 and only lose the first four years of the data set. This leaves us with a final panel data set of 160 State-year observations.

Figure 5. Insurance premiums (tax base) in millions of dollars, 2016-17

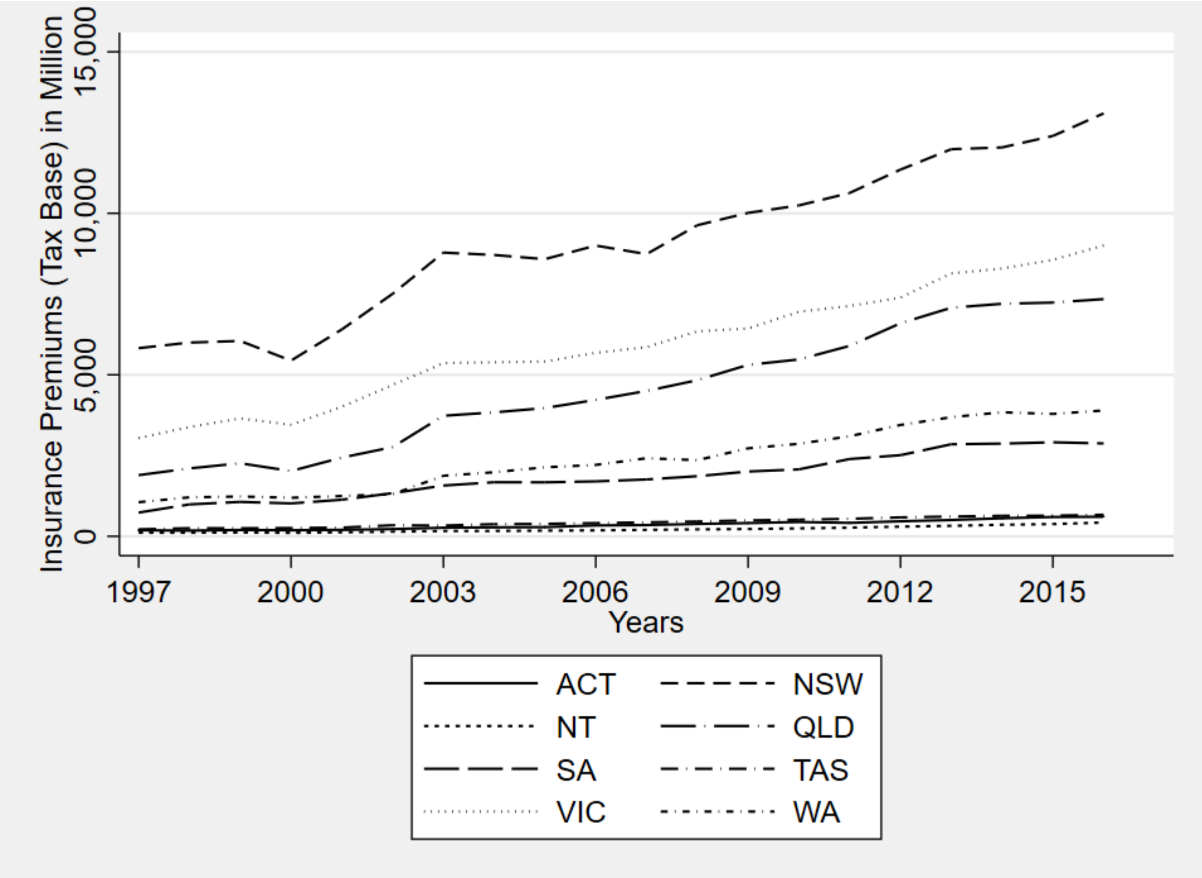
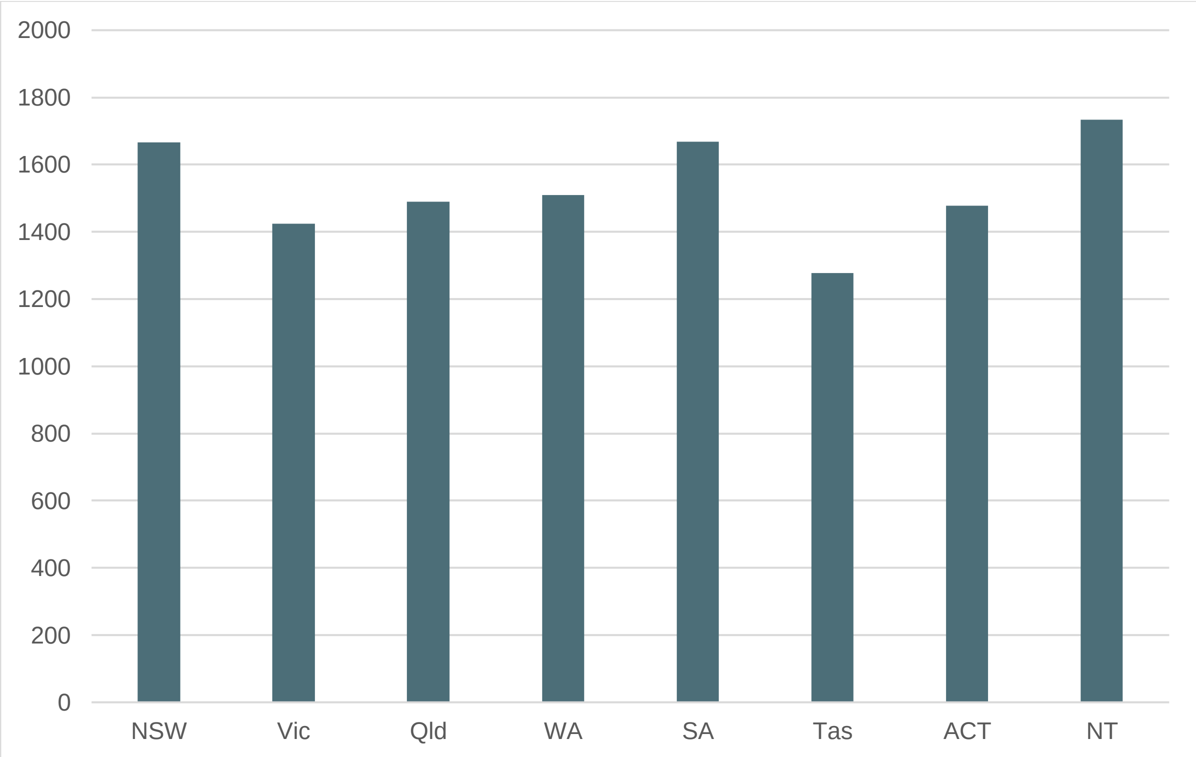


Figure 5 shows the insurance premiums by State and Territory for the sample period 1997-2016. We observe a strong increase in insurance premiums in nominal terms since 1997. For example, in New South Wales insurance premiums went from 5.8 billion in 1997-98 to 13 billion in 2016-17. Figure 6 looks at the per capita consumption of insurance by State for the 2016-17 Financial Year. We find sizeable differences in per capita consumption across States and Territories. In the Northern Territory, the State with the highest per capita consumption, expenditure is 35 percent higher than in Tasmania. People living in the ACT also spend, on average, 16 percent more per capita on insurance compared to Tasmanians.

The lower expenditure in Tasmania may be due to many factors. For example, Tasmanians might have less need for insurance, they may drive fewer cars or have lower home insurance. It is also possible that insurance premiums are cheaper in Tasmania. Alternatively, there might be fewer droughts, floods, and burglaries in Tasmania or Tasmanians may just have less of a taste for insurance.

Figure 6. Insurance premiums by State and Territories, per capita spending on insurance, 2016-17



Since we are interested in the effect of taxes on the demand for insurance, we might wonder if the zero percent tax rate in the ACT, compared to the 10 percent tax rate in Tasmania, might explain the difference in expenditure. However, the Northern Territory also has a 10 percent tax rate on insurance premiums, complicating this potential interpretation. To shed light on the behavioural effect of the tax itself we have to move from graphical representations of the data to regression analysis. We have adopted the specification outlined in Equation 3 to the annual State level data context analogous to Section 3.4.2, Equation 4. We use disposable income and population data from the ABS[25] as time-varying controls in X_{st}.

One advantage of the CGC data is that we observe annual tax revenue as well as the tax base of insurance premiums for each State. These give us the opportunity to calculate an effective tax rate that includes all exemptions, other rules, and special cases in the State's

[25] The disposable income and population data comes from the ABS Tables 65230 and 3101, respectively, and represents annual income and population estimates by States.

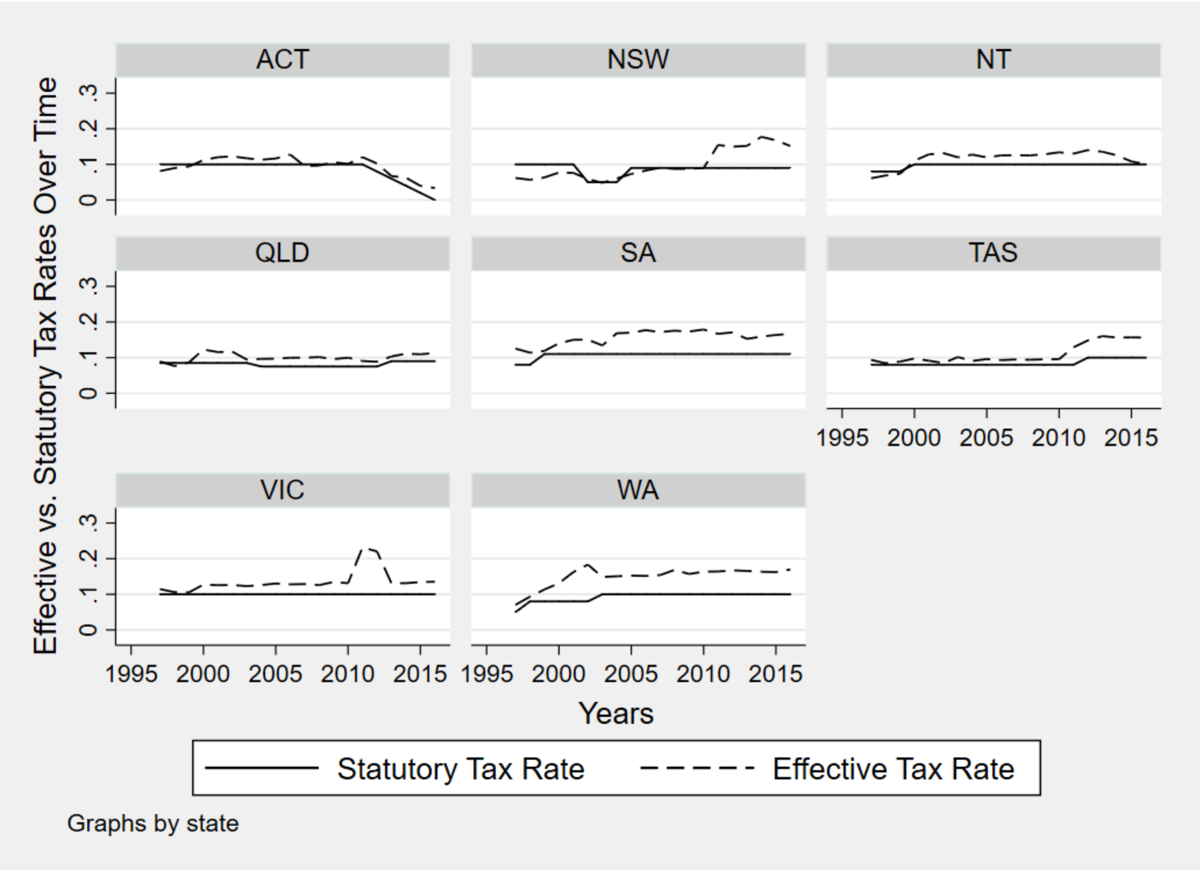
tax regulation. It also captures additional taxes like the emergency services levy (ESL). For this reason, it is a much richer source of information compared to the statutory tax rates that can be found on the States' websites. But it also introduces potential endogeneity, since we derive the effective tax rate by dividing State revenues by total State premiums.

For example, suppose we have a category of insurance that is taxed in some States but exempt in others. If enough States tax this type of insurance, it will, according to the formula employed by the CGC, form part of the tax base for all States. For argument's sake, suppose that insurance is on natural disasters and in State X, this type of insurance is exempt. Now suppose there is an exogenous shock on demand for this type of insurance in State S, like a salient natural disaster that drives people to buy more of this type of insurance. In this case total premiums will go up in State X, while total revenue stays the same, which lowers the implied effective tax rate we have calculated. In the data, this will appear as a negative correlation between the tax base and tax rate, even though there has been no real change in the tax rate.

We instrument the effective tax rate with the statutory tax rate in a two stage least squares regression in order to prevent this type of endogeneity bias. Figure 7 shows the effective and statutory tax rates for each State over time. The effective tax rate roughly follows the variation in the statutory rate, but the effective rate picks up other fluctuations in revenue or the tax base that are not due to tax rate changes.

The Cragg-Donald Wald F-Statistics of the first stage regression measures the strength of the instrument. Throughout the different specifications presented in Table 13, the value of the test statistic is very high, suggesting that this a strong instrument. The regression results with all relevant statistics are presented in Section 3.5.3.

Figure 7. Comparison of effective and statutory tax rates over the sample period



3.4.4 Other data sources

We have also considered other data sources, such as the HILDA survey. Unfortunately, however, most of the insurance categories that are included in the HILDA survey are excluded from the insurance tax in all or most States and Territories. The two prominent categories of insurance in the HILDA survey are private health insurance and life insurance. A third category of insurance is "Other Insurance", which attempts to capture all remaining insurances. However, "other insurance" is limited since, aside from contents insurance, it is principally comprised of expenditure on house insurance and CTP, categories that are typically compulsory. Therefore, it is not possible to observe a household's decisions on insurance premium expenditure for a relevant insurance in the HILDA dataset.

3.5 Elasticity results

3.5.1 Household Expenditure Survey (HES)

As discussed above, we use data from the Confidentialised Unit Record Files of the HES to estimate the effect of insurance taxes on the demand for insurance and insurance coverage, following the approach of Tooth (2015), but analysing additional types of insurance. First, we estimate changes in the probability of buying different types of non-compulsory insurances as a function of insurance taxes and a number of controls using a binary Probit model. Results of these regression models are reported in Table 9 below. Each column of Table 9 includes the estimates for a different insurance type. The dependent variable in each case is equal to one if the household has taken out such insurance, and zero otherwise. In other words, this first set of results considers the extensive margin (i.e. the decision to purchase insurance).

Columns 1 and 2 of Table 9 report results for the contents insurance. We find an implied elasticity of -0.11 for the tax rate. This implies that an increase in the tax rate by 10 percent, or about 1 percentage point, reduces the likelihood of purchasing contents insurance in the average State or Territory by 1 percent. The control variables in the regression have the expected signs. Higher income leads to a higher probability of insurance with an elasticity of about 0.23. People born overseas, younger people and people residing in large households are less likely to take out insurance. The results for the value of dwelling or tenure type are less intuitive and are explained by the omission of households having to answer the combined contents and/or house insurance type spending question.

As discussed in the data section, we consider the alternative approach as a robustness check. Column 2 represents a dependent variable that takes on the value of one for a positive response to the combined or the single spending question, and zero otherwise. We find that the tax elasticity increases slightly to -0.14. Including people who take out house and contents insurance together results in a positive correlation with the house value. Having a mortgage also makes people more likely to take out the single or combined insurance (which might be driven by house insurance being compulsory for those with a mortgage). Perhaps not surprisingly, we find that renters are less likely to take out such insurance. Other controls behave as before. As a further robustness check, we include the value of contents in the house as a control. This reduces the sample to 26,681 observations as this variable is not available in the 1998-99 survey and the elasticity reduces slightly to -0.12 but remains highly significant. These results are of a similar magnitude as what Tooth (2015) finds for content insurance in his Probit analysis.

Columns 3 and 4 present results on (the less frequently purchased) computer and audiovisual equipment and appliances insurances. As expected, the lack in variation makes it harder to find results. In both cases, the coefficient on the tax rate variable is insignificant. The remaining coefficients imply that younger people are more likely to take out these types of insurance. Income is also positively correlated with this type of spending and the number of people who purchase this type of insurance increases in the later survey waves.

Column 5 presents results for the extra, non-compulsory car insurance. The tax rate coefficient implies a tax elasticity of -0.072. With an average tax rate of 10 percent, a 1 percentage point change in the tax rate leads to a decline in the likelihood of purchasing extra car insurance by 0.7 percent. The coefficients of the controls are sensible: more income makes the purchase of such an insurance much more likely (people might also have a newer car to insure). Renters, younger people and people born overseas or not living in a house are less likely to purchase such extra insurance (they might be driving an older car or might not have a car at all). As a further robustness check, we include the value of the car(s) as a control. This reduces the sample to 26,681 observations as this variable is not available in the 1998-99 survey and the elasticity increases slightly to -0.10 and becomes more significant with a similar standard error of 0.047.

Table 9. Probability of taking out different insurances depending on the tax rate - Probit estimation

VARIABLES	(1) Contents Insurance	(2) Contents plus house Insurance	(3) Computer Insurance	(4) Appliances Insurance	(5) Comprehensive Car Insurance
Log(statutory tax rate)	-0.110***	-0.136***	0.027	0.014	-0.072*
	[0.041]	[0.051]	[0.061]	[0.082]	[0.043]
Log(disposable income)	0.235***	0.367***	0.240***	0.120***	0.398***
	[0.016]	[0.016]	[0.027]	[0.031]	[0.015]
Dwelling value in $000	-0.000***	0.001***	-0.000***	-0.000*	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Persons in HH	-0.057***	-0.047***	0.017	0.038**	0.036***
	[0.008]	[0.009]	[0.012]	[0.015]	[0.008]
Born overseas	-0.191***	-0.335***	-0.033	-0.038	-0.044***
	[0.018]	[0.019]	[0.028]	[0.035]	[0.017]
Owning with mortgage	-0.073***	0.155***	0.005	0.104**	0.012
	[0.022]	[0.027]	[0.035]	[0.044]	[0.022]
Renting	0.349***	-1.094***	-0.111**	-0.081	-0.551***
	[0.028]	[0.032]	[0.043]	[0.054]	[0.026]
Other tenure	0.235***	-0.928***	0.037	-0.288**	-0.395***
	[0.053]	[0.053]	[0.083]	[0.135]	[0.049]
Age is 25 to 34	0.414***	0.408***	-0.130**	-0.021	0.240***
	[0.048]	[0.046]	[0.063]	[0.086]	[0.041]
Age is 35 to 44	0.536***	0.549***	-0.171***	-0.070	0.186***
	[0.048]	[0.046]	[0.063]	[0.086]	[0.041]
Age is 45 to 54	0.577***	0.575***	-0.237***	-0.112	0.235***
	[0.048]	[0.047]	[0.064]	[0.087]	[0.041]
Age is 55 plus	0.709***	0.837***	-0.351***	-0.186**	0.327***
	[0.048]	[0.047]	[0.065]	[0.087]	[0.041]
Semi	0.403***	-0.279***	-0.002	-0.022	-0.074***
	[0.026]	[0.028]	[0.043]	[0.055]	[0.025]
Flat	0.175***	-0.507***	0.035	-0.078	-0.263***
	[0.029]	[0.030]	[0.046]	[0.063]	[0.027]
Non-standard dwelling	-0.400***	-0.802***	-0.157	0.104	-0.280***
	[0.120]	[0.102]	[0.202]	[0.214]	[0.098]

year==2003	-0.200***	0.003	0.242***	0.150**	-0.096***
	[0.026]	[0.030]	[0.048]	[0.061]	[0.026]
year==2009	-0.407***	-0.171***	0.616***	0.505***	-0.369***
	[0.025]	[0.028]	[0.045]	[0.055]	[0.025]
year==2015	-0.612***	-0.317***	0.186***	0.318***	-0.360***
	[0.028]	[0.031]	[0.050]	[0.058]	[0.027]
NSW	-0.074**	-0.299***	-0.198***	-0.025	0.036
	[0.036]	[0.044]	[0.051]	[0.071]	[0.038]
NT	-0.320***	-0.180***	-0.200*	0.035	-0.492***
	[0.063]	[0.069]	[0.103]	[0.127]	[0.061]
QLD	-0.376***	0.029	-0.116**	0.124*	0.025
	[0.039]	[0.046]	[0.054]	[0.074]	[0.040]
SA	-0.252***	0.220***	-0.306***	-0.135	0.111**
	[0.043]	[0.050]	[0.063]	[0.086]	[0.043]
TAS	-0.346***	0.276***	-0.209***	0.055	0.073*
	[0.044]	[0.052]	[0.063]	[0.083]	[0.044]
WA	-0.290***	0.014	-0.313***	-0.113	0.103***
	[0.039]	[0.046]	[0.055]	[0.077]	[0.040]
VIC	-0.131***	0.043	-0.221***	0.045	0.035
	[0.042]	[0.049]	[0.060]	[0.080]	[0.042]
Observations	33,238	33,238	33,238	33,238	33,238

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1; the year 1998 is the reference year; ACT is the reference State; dwelling type house, owning the house as tenure type and born in Australia are the respective reference categories.

After investigating the effect of insurance tax on the likelihood of taking out different types of insurances, we now want to see how expenditure on insurance changes with the tax rate. Since not all households purchase insurance, we will use a Tobit model to estimate insurance expenditure as a function of the tax rate rather than simple OLS as to also take no insurance as a ‘corner solution’ for non-insurers into account. The results of these Tobit regressions are reported in Table 10.

Column 1 reports results of the contents insurance for the subset of households who reported spending in the category. To have a clear identification of who did not purchase this particular insurance (and therefore is part of the ‘corner solution’), we exclude households who answered the joint house and contents insurance. This reduces our sample to 17,530 observations in this regression. The coefficient for the tax rate is not significant.[26] Other variables in the regression have the expected signs. If you have a higher income, are born in Australia, own a house, or are older, you spend more on contents insurance. As before, we run a robustness check where we include the value of contents in the house as a control. This reduces the sample further and the elasticity declines to -0.07 and remains insignificant. These results are of the same magnitude as what Tooth (2015) finds for content insurance in his Probit analysis. Tooth (2015) uses a similar sub-sample to ours and finds insignificant results for the contents insurance in the Tobit analysis.

Computer and appliances insurance results are presented in Columns 2 and 3. Both tax coefficients are insignificant, as in the Probit regressions. We still find the expected correlation with disposable income, and younger household heads purchase more computer insurance.

The results of the extra car insurance are presented in Column 4. Among the Tobit regressions this is the only one where the tax rate coefficient is significant. The implied elasticity is -0.94, which suggests that expenditure on extra car insurance declines by 9.4 percent when the tax rate increases by 10 percent, or about 1 percentage point. This takes into account the fact that some people may stop insuring their car or reduce the level of coverage resulting in lower premiums. The other variables in the regression suggest that people spend more on the extra car insurance if they have a higher income, have more members in the household, are younger (since it is more expensive to buy insurance), own a dwelling and do not live in a flat. As before, we run a robustness check including the value of the car(s) as a control. This reduces the sample size and the elasticity increases slightly to -1.12 and becomes more significant with a similar standard error of 0.036.

[26] Not excluding those observations from the sample and running the regression on the full sample produces similar results in magnitude and significance for the coefficient on the tax rate variable.

Table 10. Estimation of insurance expenditure as a function of the tax rate – Tobit estimation

VARIABLES	(1) Content Insurance	(2) Computer Insurance	(3) Appliances Insurance	(4) Comprehensive Car Insurance
Log(statutory tax rate)	-0.307	0.020	-0.007	-0.936**
	[0.200]	[0.027]	[0.016]	[0.384]
Log(disposable income)	1.713***	0.057***	0.013***	5.090***
	[0.145]	[0.006]	[0.004]	[0.163]
Dwelling value in $000	0.003***	-0.000**	-0.000	0.005***
	[0.000]	[0.000]	[0.000]	[0.001]
Number of persons in HH	-0.114**	0.001	0.006**	1.326***
	[0.046]	[0.004]	[0.003]	[0.082]
Born overseas	-1.037***	0.003	-0.008	-0.056
	[0.099]	[0.011]	[0.005]	[0.151]
Owning with mortgage	0.501***	0.006	0.015**	0.257
	[0.147]	[0.012]	[0.007]	[0.217]
Renting	-0.454***	-0.032***	-0.007	-1.336***
	[0.140]	[0.012]	[0.008]	[0.364]
Other tenure	-0.700***	-0.005	-0.024**	-0.197
	[0.220]	[0.023]	[0.011]	[0.483]
Age is 25 to 34	1.152***	-0.041	-0.002	-1.799***
	[0.132]	[0.029]	[0.012]	[0.499]
Age is 35 to 44	1.791***	-0.065**	-0.001	-4.020***
	[0.138]	[0.028]	[0.013]	[0.493]
Age is 45 to 54	1.948***	-0.070**	0.001	-0.596
	[0.149]	[0.028]	[0.014]	[0.503]
Age is 55 plus	2.361***	-0.118***	-0.021*	-1.299***
	[0.174]	[0.027]	[0.012]	[0.491]
Semi	-0.239**	-0.007	-0.002	-0.212
	[0.114]	[0.013]	[0.008]	[0.213]
Flat	-0.546***	0.009	-0.012	-1.349***
	[0.110]	[0.015]	[0.007]	[0.221]
Non-standard dwelling	-1.812***	-0.016	-0.024**	-1.038
	[0.284]	[0.037]	[0.011]	[0.796]
year==2003	-2.086***	0.010	-0.006	-7.162***
	[0.123]	[0.011]	[0.007]	[0.249]

year==2009	-1.990***	0.131***	0.043***	-8.142***
	[0.143]	[0.013]	[0.007]	[0.284]
year==2015	-1.856***	0.009	0.027***	-6.901***
	[0.147]	[0.011]	[0.008]	[0.332]
NSW	-0.494***	-0.095**	-0.022	1.145***
	[0.172]	[0.041]	[0.015]	[0.336]
NT	-0.066	-0.066	0.002	-4.320***
	[0.362]	[0.054]	[0.028]	[0.598]
QLD	-0.337*	-0.085**	0.009	-1.592***
	[0.187]	[0.041]	[0.016]	[0.331]
SA	0.179	-0.125***	-0.030**	-0.258
	[0.192]	[0.045]	[0.015]	[0.354]
TAS	0.015	-0.124***	-0.011	-1.871***
	[0.228]	[0.042]	[0.016]	[0.360]
WA	-0.557***	-0.128***	-0.022	1.016***
	[0.178]	[0.044]	[0.015]	[0.338]
VIC	0.094	-0.105**	-0.006	-0.549
	[0.256]	[0.045]	[0.017]	[0.363]
Observations	17,530	33,238	33,238	33,238

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1; the year 1998 is the reference year; ACT is the reference State; the dwelling type house, owning the house as tenure type and born in Australia are the respective reference categories.

3.5.2 Australian Prudential Regulation Authority (APRA)

Results of a regression using Equation 4 can be found in Table 11 below. The dependent variable is the sum of all insurance types that fall under the insurance tax (see Footnote 23). The model in the first column is the simplest elasticity specification with time and fixed effects without controls, we find the tax elasticity to be insignificant. In Column 2, we introduce the lagged dependent variable to control for simple dynamics in the specification. The tax coefficient and standard error become smaller and negative but stay insignificant. In Column 3, we include the log of population growth as a control variable. The elasticity estimate remains insignificant. As discussed in Section 3.5.2, since we only cover a short period with few changes in the State and Territories tax rates, we would not necessarily expect to identify any behavioural effects of the insurance tax.

Table 11. Elasticity of insurance premiums - quarterly data (lagged rates as instrument)

VARIABLES	(1) Statutory Tax Rate	(2) Statutory Tax Rate	(3) IV Tax Rate
Log(Tax Rate)	0.845	-0.069	-0.240
	[1.609]	[0.726]	[0.781]
Lagged Log(Tax Base)		0.798***	0.791***
		[0.034]	[0.036]
Log(Population)			-0.414
			[0.706]
Observations	140	128	128
R-squared	0.303	0.881	0.882
State dummies	8	8	8

Standard errors in brackets *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12 shows disaggregated estimates by insurance type. Each row represents an individual regression of log premiums on log tax rate with State and time fixed effects and a lagged dependent variable. We estimate the effect of taxes on all 13 categories of insurance. The regression coefficients of the logarithmic transformed tax variable for each model are reported in Column 2. The first row of results replicates the regression from Column 2 of Table 11, on the sum of all premiums, for comparison.

Table 12. Tax elasticities by insurance type (fixed effect estimates in logs)

(1) Logged	(2) Log(tax)	(3) _Constant	(4) Observations
Sum of all premiums	-0.005	4.97***	148
	(0.024)	(0.76)	
Commercial motor vehicle	-0.00099	7.16***	144
	(0.042)	(1.23)	
Compulsory third party (CTP)	-0.037*	2.82***	52
	(0.018)	(1.81)	
Consumer credit	-0.019	8.69***	142
	(0.078)	(1.27)	
Domestic motor vehicle	-0.0058	3.85***	144
	(0.02)	(0.77)	
Employers' liability	-0.12	12.2***	122
	(0.076)	(1.94)	
Fire and industrial special risks (ISR)	0.022	5.11***	144
	(0.048)	(1.199)	
House owners and householders	0.0027	2.41***	144
	(0.032)	(0.78)	
Mortgage	-0.028*	11.56***	144
	(0.017)	(1.06)	
Other - Category A	-0.12***	4.10***	124
	(0.044)	(1.16)	
Other accident	-0.032	12.94***	142
	(0.048)	(1.145)	
Professional indemnity	0.11	19.59***	137
	(0.10)	(1.277)	
Public and product liability	0.020	9.10***	144
	(0.039)	(1.136)	
Travel	-0.0025	12.26***	142
	(0.043)	(1.122)	

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We observe that neither the overall premium, nor most of the insurance expenditures show any significant changes with respect to taxes, while the magnitude and direction of most estimates are similar to results in the next section, only three insurance expenditures show statistical significance in their respective estimations: Compulsory third party (CTP)[27], mortgage and other insurance. Since we ran this estimation for all types of insurances available in the APRA data, even though the insurance tax applies to only about half of them, it is telling that the three significant estimates are among the types of insurance that fall under taxation. Results for CTP and mortgages suggest an elasticity of around -0.03 to -0.04, when transformed to percentage change elasticity for comparison we get -0.3 and -0.4, which suggest that a 1 percentage point rise in the tax rate leads to a 0.3-0.4 percent fall in expenditure on premiums for these two types of insurances. The third significant type of insurance is the category Other A with an elasticity of -0.12, about four times the elasticity of the other two. We then get a percentage point elasticity of -1.2, which says that a 1 percentage point rise in the tax rate will lead to a decrease of 1.2 percent in expenditure on total premiums for "Other A" insurance.

The biggest caveat of these APRA data regression results is the lack of over-time variation in the taxation variable. As discussed in the data section, the stamp duty for all States and Territories between 2013 and 2018 stays unchanged with the exception of the ACT, which has progressively reduced the stamp duty on insurance to zero. In other words, after we control for State specific differences in our regression, the coefficient on taxes is solely identified by variation in the ACT's tax changes, relative to all other States and Territories. The lack of variation explains the large standard errors and the absence of much statistical significance in these results. It also makes the regression results sensitive to the ACT's specific situation. While the APRA time series is short and only allows us to identify changes in the ACT tax rate, the higher frequency data can account more precisely for tax changes that occur during a financial year, therefore adding to the evidence which shows a modest but significant effect of taxes on insurance expenditure.

3.5.3 CGC Assessment Data

Table 13 shows results for the estimation using the CGC assessment data. While all models presented in Table 13 include time and State fixed effects, model specifications become more complex as we move in the table from left to right.[28] The results of the most basic

[27] Note that we have only very few observations for the CTP estimate.

[28] Due to space considerations and in favour of clarity we omit results for the time fixed effect coefficients from the results table.

elasticity specification model in Column 1 of Table 13 show the estimated effective tax rate elasticity without any other controls. The coefficient of -0.192 indicates that if the effective tax were to go up by 10 percent the tax base overall premiums would go down by 1.9 percent.

As discussed in the data Section 3.4.3, there are concerns about reverse causality with the calculation of the effective tax on the basis of current tax income and current premiums. Therefore, we instrument the effective tax rate with the statutory insurance tax rate in the model of Column 2 and throughout the rest of the models in the table. Using the instrumental variable specification in the simple model in Column 1, we get a smaller elasticity estimate of -0.049 in Column 2, which is no longer significant. The large F-statistic of 118 for the first stage suggests that this is a strong instrument.

Table 13. Elasticity of insurance premiums - annual data (statutory rates as an instrument for the effective tax rate) - Dependent variable log(tax base in $m)

VARIABLES	(1) Effective Tax Rate	(2) IV Tax Rate	(3) IV Tax Rate	(4) IV Tax Rate	(5) IV Tax Rate
Log(Tax Rate)	-0.192***	-0.049	-0.069*	-0.070**	-0.057*
	[0.025]	[0.044]	[0.041]	[0.029]	[0.030]
Lagged Log(Tax Base)				0.649***	0.618***
				[0.064]	[0.063]
Log(Income)			0.540***	0.133	0.056
			[0.159]	[0.115]	[0.119]
Log(Population)					0.351**
					[0.145]
Year dummies	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes
Observations	160	159	159	151	152
R-squared	0.972	0.966	0.970	0.987	0.987
Cragg-Donald F-Stat		118	123	142	134

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As we are concerned about serial correlation and want to control for differences in States development of disposable income and population over the 20-year period of our sample, we introduce these extra controls in Column 3 to 5. Controlling for disposable income the tax elasticity goes up to -0.069 and becomes significant. Including a lagged dependent variable in Column 4 to control for dynamics in the samples leaves the elastic value unchanged but reduces the standard error, thus making the coefficient more significant. Finally, controlling for all three variables including the State specific trends in population growth (Column 5), the tax elasticity declines slightly to -0.057. This is our preferred estimate. The changes in the elasticity estimate in the last three columns compared to Column 2 indicate that our model without any controls was previously mis-specified.

For comparison with the literature in Section 3.6 we convert the estimate presented in Column 5 to represent a percentage change elasticity by division with the average tax rate of 0.1. The percentage point change estimate of -0.57 implies that when the tax rate increases by 1 percentage point, expenditure on total premiums will decline by 0.6 percent.

3.6 Comparing the elasticity results to estimates from the literature

3.6.1 Domestic evidence

Only a few domestic studies attempt to measure the impact of insurance taxes on the decision of individuals or households to purchase insurance (the extensive margin) and, conditional on purchase, the amount of insurance (the intensive margin). Insurance taxes apply to many forms of insurance like homeowners' (building) insurance, mortgage insurance, travel insurance, motor vehicle insurance, etc. In some cases, the decision to purchase insurance is compulsory by law (like compulsory third party insurance), whereas in other cases it is optional (like contents insurance for a home). If one form of insurance is compulsory, it is likely to be less sensitive to changes in tax rates compared to other non-compulsory forms of insurance.

Both in Australia and internationally, the majority of academic studies that consider the price sensitivity of insurance to taxation, or price increases more generally, focus on a subtype of insurance (i.e. home insurance, flood insurance, agricultural insurance, etc.). In the Australian literature, the most frequent type of evaluation of insurance taxes measures the impact of insurance taxes on the extensive and intensive margin for building (homeowners) and contents insurance. The range of elasticities found in these articles, by intensive and extensive margin and type of insurance, is presented in Figure 8 and Figure 9, alongside the elasticities estimated by the authors for this report and presented earlier in this chapter.

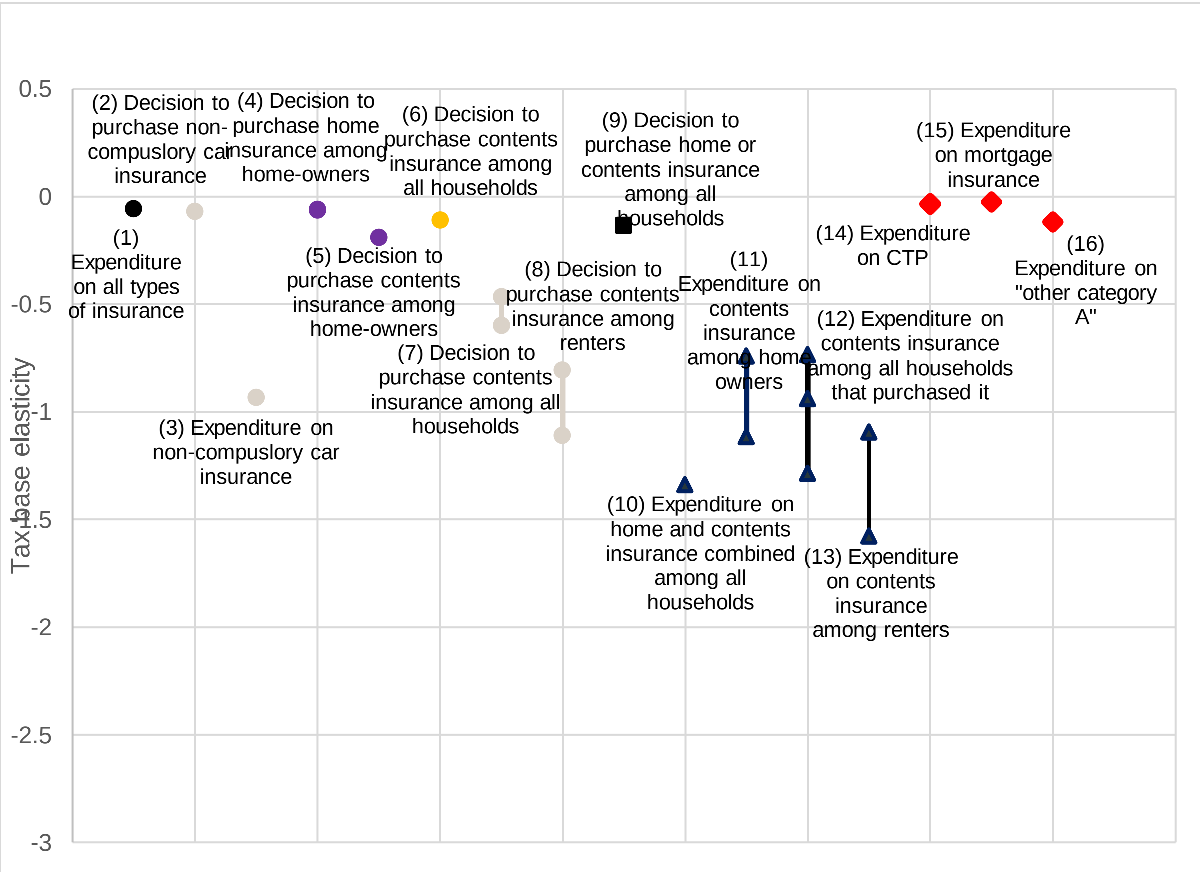
Since the magnitudes of the elasticities presented in Figure 8 can vary because of differences in the specifications used to measure insurance premiums and taxes, Figure 9 attempts to normalise the elasticities (for data points for which a normalised value could be calculated). Since a one percentage point change in a tax rate, approximately equals a one percent increase in price, normalisation was computed not only to facilitate comparisons between domestic studies, which calculate tax elasticities, but also with international studies which focus on price elasticities. In this sense we convert a tax rate elasticity estimate from a log-log specification to a percentage point change elasticity in dividing the estimated coefficient by the tax rate. For example, with an average tax rate of about 10 percent we have a normalised elasticity across all types of insurance, which we calculated above as -0.057 from the CGC data, of -0.57. Similarly, we convert all other estimates from our study and from the literature to be more comparable.

The results presented in both figures present several interesting findings. First, according to the authors' estimates across all types of insurance, the elasticity of the demand for insurance in response to a percentage point increase in the insurance tax, across all forms of insurance, is about -0.057. However, when compared to specific types of insurance, considerable heterogeneity arises.

For example, all of the elasticities presented on building and contents insurance are from two studies conducted by Barker and Tooth in 2008 and Tooth in 2015. In the 2008 study, the authors use data from the 1993-94, 1998-99 and 2003-04 waves of the HES to estimate the impact of a change in insurance taxes on households' decisions to purchase building (home) and/or contents insurance and the amount of coverage purchased (precisely, the amount spent on premiums). In the 2015 study, Tooth adds data from the 2009-10 wave of the HES.

As shown, the studies suggest that both the decision to purchase building and/or contents insurance, as well as the level of expenditure on insurance, are negatively affected by the tax on insurance premiums. A marked difference does seem to arise between the elasticities observed among homeowners and renters. For instance, homeowners seem relatively unresponsive to changes in insurance taxes on building (home) insurance, both in terms of the decision to purchase coverage and in terms level of the amount spent on coverage (the elasticities calculated for the latter were insignificant and do not appear on the graph). Homeowners also tend to be less responsive to changes in insurance taxes, when it comes to their decision to purchase contents insurance. By contrast, homeowners do seem to react more strongly to changes in taxes by reducing the *amount* spent on contents insurance. Renters, on the other hand, appear to be the most sensitive to changes in taxes levied on contents insurance. These results show how the elasticity for one type of insurance can vary based on consumer characteristics.

Figure 8. Elasticity of demand for insurance in response to an increase in insurance taxation in Australia, by type of insurance, as published in each study



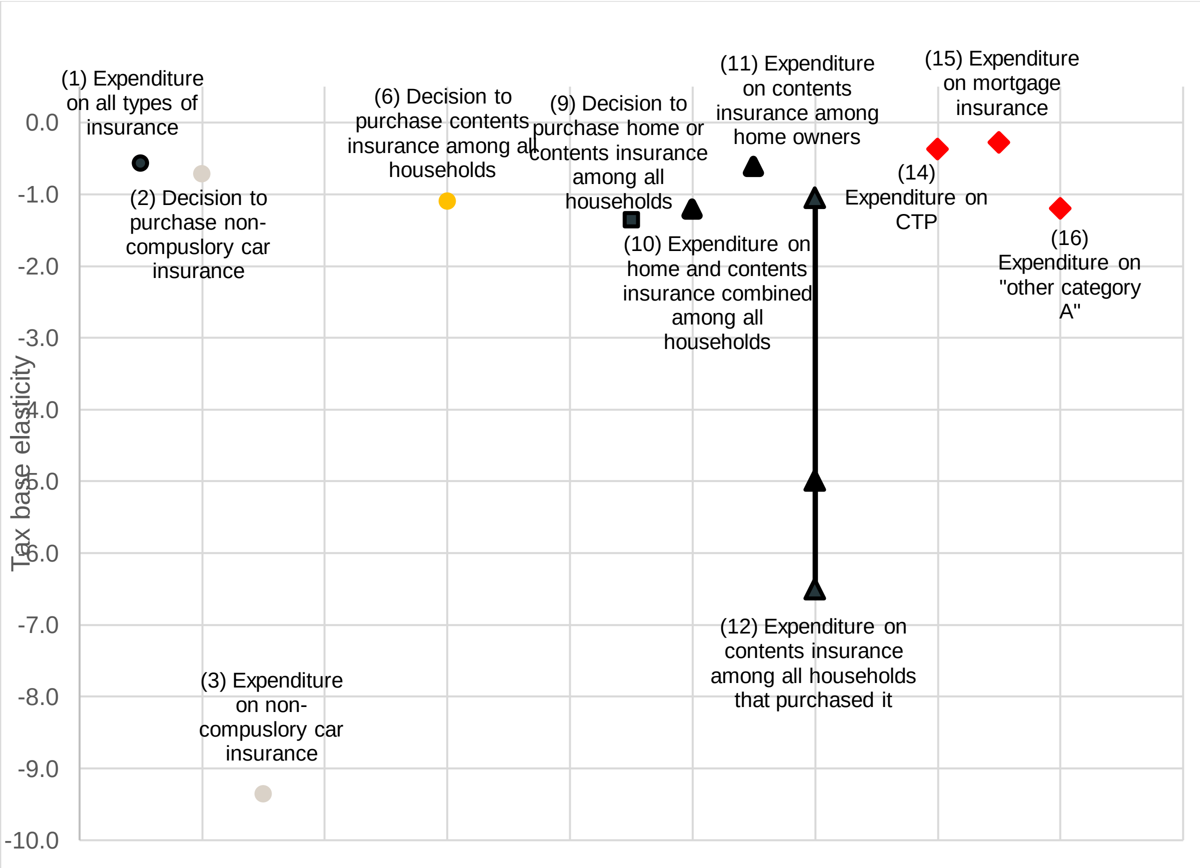
Notes: 1) Each point on the graph represents an elasticity calculated in various studies.

2) 1, 2, 3, 6, 9, 14, 15, and 16, are estimates calculated by the authors in the context of the terms of reference for this project. The remaining points are from the academic literature for Australia.

Source: Authors' compilation based on own estimates and review of the academic literature. The specific studies included in this graph can be provided on request.

Turning to the normalised version, Figure 9 presents similar findings. We see a normalised elasticity across all types of insurance, on the basis of the CGC data estimate of -0.57. Looking at the rest of the estimates in the figure the range of elasticities varies quite a bit depending on the type of insurance and subgroup of the population considered. For example, Tooth (2015) notes that the relatively high elasticity (>1) presented below in data point (10) is explained by two principle reasons. First, an insurance premium consists of two parts: one part for the pooled funds used to cover claims and a second part for the administration of the insurance fund itself (the "loading"). Since taxes apply to the entire premium however, they grossly increase the impact of taxes. Secondly, increasing taxes likely decreases the number of people insured and the amount for which they are insured, amplifying the impact taxes have on overall expenditure.

Figure 9. Demand elasticity for insurance (expenditure on insurance premiums) in response to an increase in insurance taxation in Australia, by type of insurance, normalised



Notes:

1) Each point on the graph represents an elasticity calculated in one of the studies.

2) 1, 2, 3, 6, 9, 14, 15, and 16, are estimates calculated by the authors in the context of the terms of reference for this project. The remaining points are from the academic literature for Australia. The elasticities have been normalised.

Source: Authors' compilation based on own estimates and review of the academic literature. The specific studies included in this graph can be provided on request.

Turning to other research, in a 2007 study, Tooth and Barker examine the effect of State taxes on non-insurance rates for buildings and contents insurance in Australia. In particular, they consider the removal of the Fire Services Levy (FSL) in Western Australia in 2003. The FSL, equal to about 19 percent, was phased out over a year, but partially offset by an increase in stamp duty from 8 to 10 percent. The authors show, using descriptive data trends, that following the elimination of the FSL, rates of non-insurance declined in Western Australia in 2004 relative to the national average. Tooth (2015) also estimates that removing insurance taxes would induce 242,000 households to buy content insurance and 38,000 households (one fifth of uninsured households) to buy home insurance. He calculates that such a reform would increase pre-tax insurance expenditure by around 13 percent.

Driessen and Evans (2015) consider the price sensitivity of the compulsory third party (CTP) insurance market in NSW. As previously mentioned, CTP insurance is compulsory across Australia. In this study, the authors do not estimate the impact of the tax on the decision to purchase insurance. Nevertheless, they do estimate the price sensitivity of CTP insurance consumers among the seven private insurers licensed by the Motor Accidents Insurance Regulation (MAIR). They conclude that for every percent higher that an insurer charges a customer, compared to the cheapest average premium available, the odds of the customer switching insurers increases by 13 percent, with younger customers (less than 25) more sensitive to price changes than older customers (over the age of 50). The price competition among insurers in this market suggests that in the absence of compulsory legislation, an increase in the insurance tax would likely reduce the uptake and level of coverage chosen. Another concern regarding the collection of insurance taxes in Australia is the regressive nature (ICA 2005).

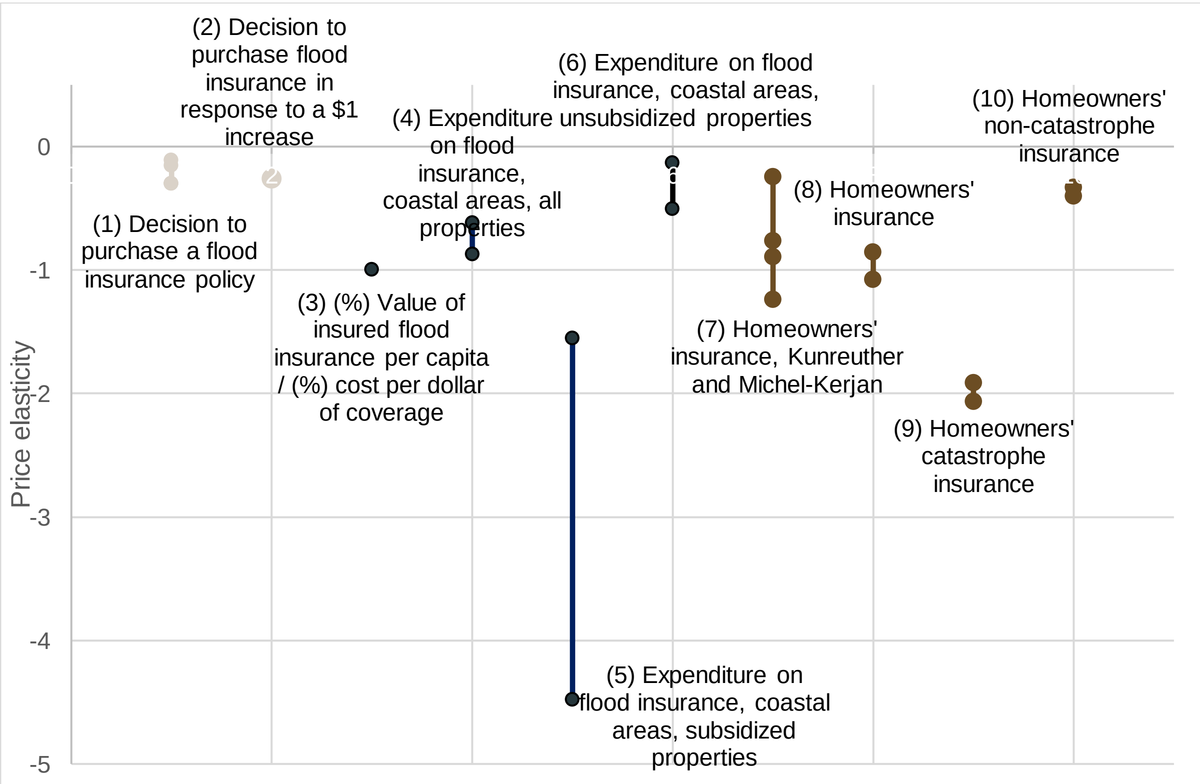
The overall results from Australian data suggest that a negative relationship exists between insurance taxation and the demand for insurance. The magnitude of this relationship, across all types of insurance, depends on the composition of the types of insurance purchased, institutional frameworks, and characteristics of the population in a specific State. Nevertheless, given the results of the various studies, it is perhaps not surprising that a computable generable equilibrium (CGE) based study of the Australian tax system by KPMG (2010) shows that the marginal excess burden (MEB) of insurance taxes is very high. Specifically, the study finds that raising revenue by one dollar results in a welfare loss of 67 cents. The high MEB is a result of the narrow tax base, high tax rates and the interaction of multiple taxes (KPMG 2010).

3.6.2 International evidence

Similar to the Australian evidence, most international studies measuring the elasticity of demand for insurance are confined to the analysis of one particular type of insurance. In addition, very few of these studies consider the impact of taxes, but instead focus more generally on the impact of a change in prices on demand for insurance.

Wang et al. (2017) provide an extensive review of the literature and elasticities calculated in several articles on homeowners and natural disaster insurance in the United States and the Netherlands. Selected studies from this review, which relate to the United States, are presented in Figure 10 below which shows the elasticity of demand for insurance, in response to a change in the price of flood or homeowners' insurance, at the intensive and extensive margins. In some cases, the definitions used to capture the demand and price of insurance can vary based on the definitions used by different authors.[29]

Figure 10. Demand elasticity for flood and homeowners' insurance in response to an increase in price, selected areas in the United States



Notes:

1) Each point on the graph represents an elasticity calculated in one of the studies.

Source: Authors' compilation based on own estimates and review of the academic literature. The specific studies included in this graph can be provided upon request.

The results presented in (1) and (2) show the elasticities calculated at the extensive margin. They suggest that the decision to purchase flood insurance is relatively inelastic. Part of the explanation is institutional since some mortgage lenders oblige homeowners to insure with

[29] The specific details regarding these calculations can be provided upon request.

flood insurance. While applicable to flood insurance, these results are consistent with those presented for building (home) insurance in Australia.

While the decision to purchase insurance is relatively inelastic, adjustments do tend to be made regarding the amount of insurance purchased, as indicated by the results in (3) to (6) which show the intensive margin for flood insurance. The elasticity also tends to vary by type of homeowner. For example, the six estimates presented for (4), (5) and (6) are from one study, Landry and Jahan-Parvar (2011), which differentiates coastal homes in selected areas of the US on the basis of whether they receive subsidised insurance rates from the federal government. They find that expenditure on flood insurance is elastic in subsidised properties, compared to unsubsidised properties for which expenditure on flood insurance is inelastic.

Presented in (7) to (10) are the results from various studies which consider the elasticity of demand for insurance, in response to a change in prices, for homeowners' insurance. Comparing catastrophe insurance to non-catastrophe insurance in New York and Florida, Grace et al. (2004) find that the demand for both insurances combined is somewhat response to price, but that the demand for catastrophe insurance in particular is elastic, while the demand for non-catastrophe insurance is inelastic (estimates for 8, 9 and 10).

Two other studies consider the sensitivity of the demand for mortgage and life insurance to prices. Recent work by Cox and Zwinkels (2017) suggests that only 30 percent of eligible households in the Netherlands insure their mortgage, despite the existence of significant economic incentives of doing so (i.e. a reduction in the interest rate which, over time, has a greater value than the cost of the insurance). This evidence points to the importance of other factors and context in the determination of demand for insurance. In a cross-country study across 28 countries, Browne and Kim (1993) find the demand for life insurance to be quite inelastic (-0.24) in terms of the amount of insurance purchased per dollar of insurance coverage.

The international literature on the elasticity of the demand for insurance focuses primarily on its responsiveness to price, as opposed to taxes. The literature suggests that, similar to the findings observed on the demand sensitivity for insurance in response to *taxation* in the *Australian* literature, the degree of *price* sensitivity across the *international* literature depends on the type of insurance, the institutional framework in place, and the profile of the subgroup of the population purchasing insurance. To the extent that the trends observed for the price sensitivity of the demand for insurance observed in the international literature also apply to changes in taxation (which is likely), then the international and domestic findings on the tax base elasticity to changes in insurance taxes are consistent.

3.7 Conclusion

Insurance tax, also known as stamp duty on insurance, is a State tax that is payable mainly on general insurance premiums. Across the States and Territories, the statutory tax rates applicable to insurance range from as high as 11 percent in SA to a low of 0 percent in the ACT. While there are various types of insurance (i.e. health insurance, building insurance, life insurance, etc.), not all forms are taxed equally across States and Territories, moreover their application and implementation can differ by jurisdiction. In 2016-17, revenues from insurance taxes comprised about 7.2 percent of State tax revenues.

This chapter assessed the demand for insurance in response to a change in taxes on insurance premiums using HES, APRA and CGC data. It found that using CGC data, across all insurance types, a one percentage point increase in the tax rate will reduce expenditure on total premiums by 0.6 percent. The elasticity however, does vary by type of insurance. For example, in some cases where insurance is compulsory (like compulsory third party or mortgage insurance), the estimates are less elastic. For example, a 1 percentage point rise in the tax rate leads to a 0.3-0.4 percent fall in expenditure on premiums for these two types of insurance. By contrast, in the case of expenditure on non-compulsory comprehensive car insurance, a one percentage point increase in the tax rate decreases expenditure on extra car insurance by about 9.4 percent. This effect is extremely large and takes into account the fact that some people may stop insuring their car or reduce the level of coverage resulting in lower premiums. While these estimates are based on a number of different data sources, they concur with the existing literature and suggest a significant negative elasticity exists. The estimate for the overall elasticity of insurance premiums in response to changes in the insurance tax of -0.06 represents a conservative measure of the behavioural effect of the tax rate on the tax base.

Internationally, the academic literature focuses on the impact of a change in prices (more generally) on the demand for insurance. The literature suggests that, similar to the findings observed on the demand sensitivity for insurance in response to *taxation* in the *Australian* literature, the degree of *price* sensitivity across the *international* literature depends on the type of insurance, the institutional framework in place, and the profile of the subgroup of the population purchasing insurance. To the extent that the trends observed for the price sensitivity of the demand for insurance observed in the international literature also apply to changes in taxation (which is likely), then the international and domestic findings on the tax base elasticity to changes in insurance taxes are consistent.

Taken together, the estimate for the overall elasticity of insurance premiums in response to changes in the insurance tax of -0.06 represents a robust and conservative measure of the behavioural effect of the insurance tax relative to findings in the domestic and international literature.

4. Motor Tax

4.1 Introduction

Taxes on road transport, coupled with growth in the stock of registered motor vehicles, allow a country to generate a significant amount of revenue at the Federal, State and Territory levels. However, while taxing motor vehicles can raise significant revenue, motor taxes can also be applied to offset the negative externalities generated by their use. Climate change, air pollution, traffic noise pollution, and traffic accidents are some of the negative externalities exacerbated by the use of motor vehicles. In addition, there are negative externalities that are specific to road transport and include water pollution, habitat and wildlife destruction, loss of landscape and time lost in traffic congestion. The wear and tear to public infrastructure engendered by the use of private motor vehicles should also be considered (Lignier 2011).

In general, there are three types of taxes that apply to motor vehicles: (1) upon the *transfer* of ownership or initial purchase of a new vehicle (this can include stamp duty and/or the application of a VAT or GST), (2) an annual registration fee on *vehicle ownership* (also referred to as a circulation tax or more commonly a licence fee), and (3) various taxes on *vehicle use* through fuel taxation, or congestion or road pricing. As previously mentioned, taxing motor vehicle use can serve both an environmental and revenue raising purpose. However, whether a motor vehicle tax is either revenue raising or environmental or both, depends on its implementation in the jurisdiction where it is applied. The purpose of motor vehicle taxation can also change. For example, while stamp duty and annual registration fees may have originated as revenue raising taxes, over time many countries have linked the amount of tax payable to CO2 emissions specific to a car's characteristics.

Across Australia, all three types of motor vehicle taxation are also applied, but with different criteria. In 2018, just over 19 million vehicles were registered in Australia, 75 percent of which were passenger vehicles. The number of total vehicles has also grown over time, increasing the tax base. For example, between 2013 and 2018, the number of registered motor vehicles in Australia grew by nearly 12 percent, exceeding the growth in the resident population over the same period by 4 percentage points.

This chapter presents an empirical assessment of the extent to which the demand for motor vehicles in Australia is sensitive to changes in the motor tax rate applied (also referred to as the elasticity of demand for motor vehicles in response to changes in State motor taxes). First, a brief overview of the theoretical underpinnings of motor taxes is provided and followed by a summary of the current rates in place in different States and Territories in Australia. Then estimates of the elasticity of demand for motor vehicles in response to changes in motor taxes are provided alongside a description of the data sources applied for the calculation. Finally, to provide a comparative benchmark, these results are compared to estimates calculated in studies from the academic literature in Australia and internationally.

4.2 Theoretical background and empirical strategy

Motor vehicle taxes are fees that were historically designed to finance infrastructure or general budget expenditure (Henry Tax Review 2008, Scutella 1999). Depending on their design, they can be inefficient and generate deadweight loss. Alternatively, they can be designed in ways that compensate for the negative externalities associated with automobile use. There are three general types of motor taxes observed across countries: (1) a tax on the transfer of ownership or initial purchase of a new vehicle (this can include stamp duty and/or the application of a VAT or GST), (2) an annual registration fee on vehicle ownership (also referred to as a circulation tax), and (3) various taxes on vehicle use through fuel taxation, or congestion or road pricing.

By design, stamp duty and annual registration fees impact consumers' purchasing behaviour in terms of their decision to purchase a motor vehicle and the type of vehicle purchased. The taxes increase the relative price of motor vehicles and potentially reduce demand for both new and used vehicles. The increased price leads to an inefficient allocation of motor vehicles. For instance, an older couple with adult children may refrain from downsizing their large motor vehicle because of the added costs of stamp duty. In this way, motor taxes may generate indirect costs associated with the use of old vehicles, leading to increased pollution and unsafe driving (Freebairn 2002, 2011). Alternatively, depending on how the tax is designed, it could encourage consumers to buy more environmentally friendly vehicles (i.e. if stamp duty or registration fees are inexistent or tied to CO2 emissions).

By contrast, taxes that target vehicle use directly, such as fuel taxes or congestion charges, may limit the amount of driving that actually occurs. For example, the congestion charge imposed in the city of London (11.50 GBP daily) for driving between 7:00am – 6:00pm from Monday to Friday aimed to discourage driving in the city during these hours. Similarly, fuel taxes increase the relative cost of driving. The different types of taxes are also interrelated.

For example, a very high fuel tax could encourage consumers to purchase more fuel-efficient vehicles, but without reducing any time spent driving, thereby potentially reducing fuel consumption without addressing congestion. This is particularly relevant if a consumer's willingness to pay for a vehicle is linked to expected future fuel costs.

In Australia, the States and Territories levy stamp duty and annual registration fees on motor vehicles, whereas the Commonwealth exclusively levies the fuel excise. Since the focus of this report is on the State and Territories' tax bases, this chapter focuses exclusively on the taxes levied by them. In summary, motor taxes are a heterogeneous group of taxes and the theoretical impact of the distortions introduced by their imposition depends on the objective of the tax and the value of the negative externalities they potentially redress.

While this chapter provides an overview of all motor taxes imposed by States and Territories, the empirical estimations focus exclusively on States and Territories' motor vehicle licence fees (registration fees).[30] No empirical estimations will be presented on the impact of stamp duty on motor vehicles. Our empirical strategy is to identify the effect of the motor tax (licence fees) on vehicle ownership/registration using the variation in the number of registered vehicles and taxes over time and across States. We employ a difference-in-difference specification using time and State/individual fixed effects. The following equation represents this strategy:

Equation 5

$$\log(Vehicles)_{s,t} = \beta \log(LicenceFee)_{s,t} + a_s + b_t + X_{s,t}\delta + \varepsilon_{s,t}$$

The number of registered vehicles, *Vehicles*, in State *s* at time *t* is represented by a State-specific effect, a_s, and captures all time-invariant characteristics of relevance for vehicle ownership. A time-specific effect, b_t, controls for common shocks to the tax base across jurisdictions due to the business cycle or common changes to federal regulation. Aside from State effects, the estimation employs time-varying locational characteristics X_{st}, such as for example population and/or income, which enter the model in logs. The tax rate $LicenceFee_{st}$, which varies across both location and time, enters in logs in order to estimate the elasticity of vehicle registrations in response to changes in motor taxes. ε_{st} is an error term. The varying data sources available mean that we will adjust the above general empirical

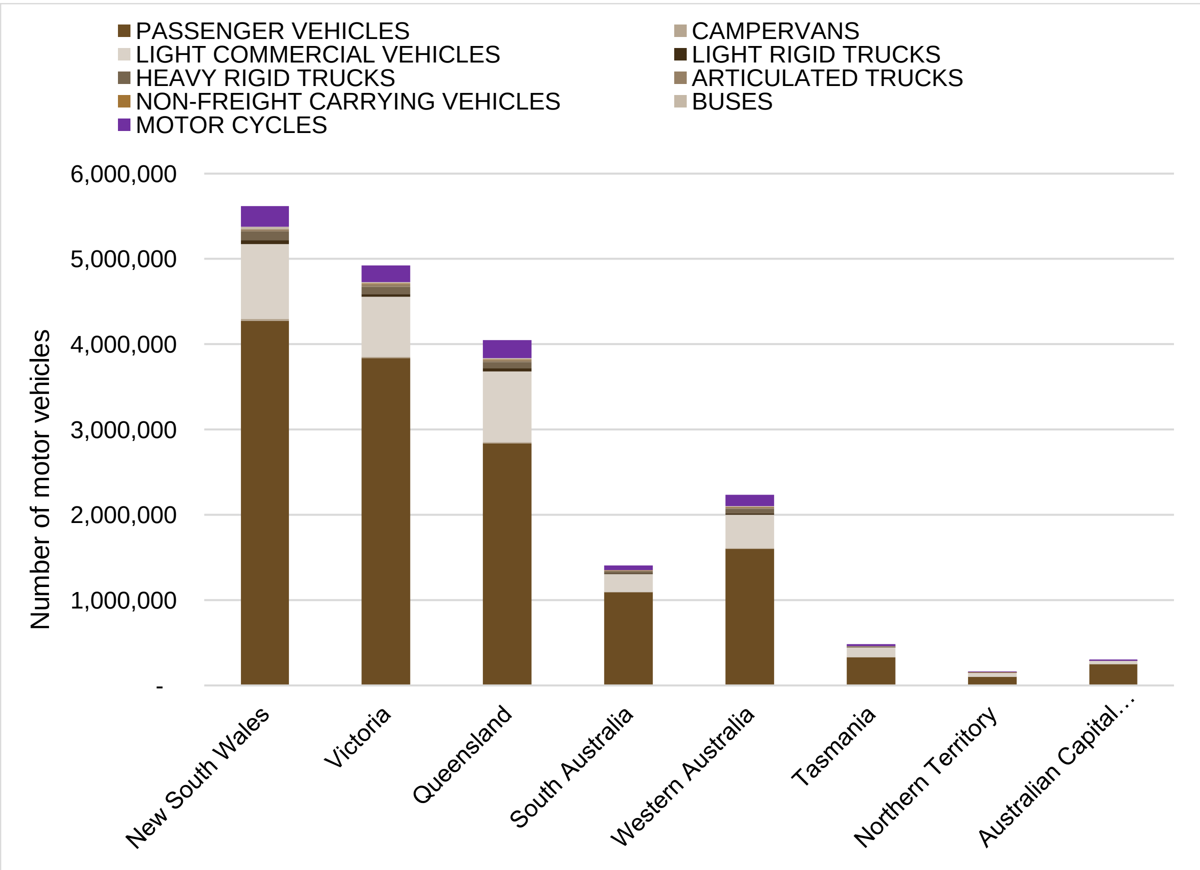
[30] We are following the categorisation of the CGC, which considers the registration or licence fee as the main subject under the heading of the motor tax (see the Commonwealth Grants Commission Summary of Revenue Bases).

specification according to the data in each respective section. In some cases, we have household level data, in which case the State effects are replaced by household effects and we typically include many more controls in the regression.

4.3 States' and Territories' tax policies

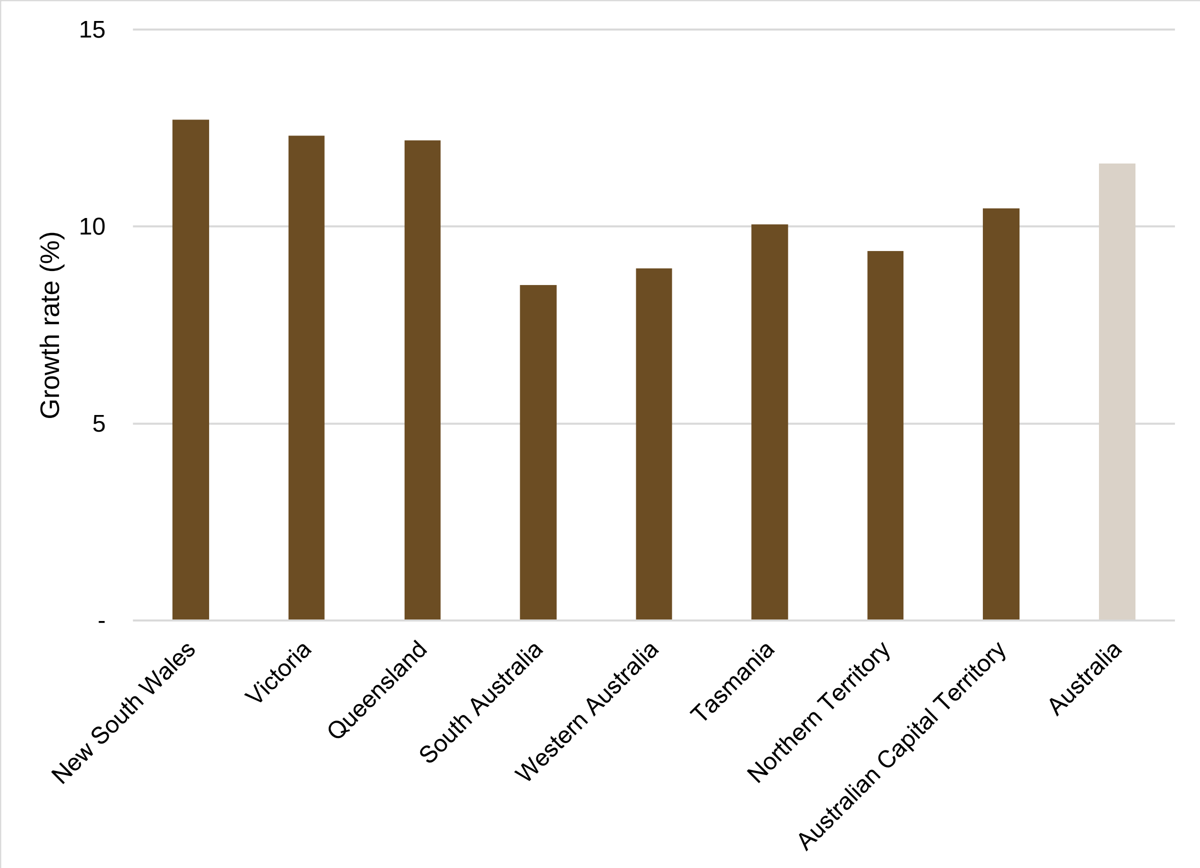
While the effectiveness of a tax depends on its design and implementation, as well as the tax rates applied, the amount of revenue collected also depends on the size of the tax base. Looking at the *stock* of motor vehicles, as shown by Figure 11, the composition of registered motor vehicles is relatively similar across States and passenger vehicles represent the majority of motor vehicles in Australia. In terms of size however, as of 2018, NSW, Victoria and Queensland have the greatest number of motor vehicles. The relatively large stock of registered vehicles observed in these three States in 2018, can be partially attributed to their size and the higher than average growth in the number of registered motor vehicles since 2013. For example, between 2013 and 2018, the number of registered motor vehicles in Australia grew by 11.6 percent, but by at least 12 percent in NSW, VIC and Queensland.

Figure 11. Composition of the stock of registered motor vehicles, by State and Territory, 2018



Source: ABS Motor Vehicle Census, Australia, 2018

Figure 12. Growth in the stock of registered motor vehicles in Australia by State and Territory 2013-2018



Source: ABS Motor Vehicle Census, Australia, 2018

Turning to the *types* of taxes, both stamp duty and annual registration fees apply to motor vehicles in Australia in the different States and Territories. The design of these taxes as well as the tax rates that apply however, are quite heterogeneous. For example, Table 14 presents the stamp duty that applies to motor vehicles across the various jurisdictions. As can be seen, in the majority of jurisdictions, new owners pay stamp duty based on the price of the vehicle or its market value, if higher. In many cases, heavy vehicles pay lower stamp duty than passenger cars. The ACT is the only jurisdiction that bases stamp duty off of the CO_2 emissions, suggesting that the primary purpose of stamp duty across Australia is largely to raise revenue (as opposed to addressing environmental externalities).

Annual registration taxes appear more strongly correlated with the size of the vehicle, corresponding to the higher levels of damage heavy vehicles cause to public infrastructure. A selection of the annual registration fees charged for privately owned vehicles is provided in Table 15. None of the annual registration fees are directly linked to emissions. Finally, taxes on the intensity of vehicle use include a fuel excise applied by the Commonwealth, as well as road tolls applied by certain States, particularly in metropolitan areas.

Motor tax *rates* for stamp duty and the annual registration taxes are as heterogeneous as the subgroupings to which they apply. For example, while the Northern Territories apply a 3 percent rate to all vehicles for stamp duty, NSW differentiates tax rates applicable by value of the vehicle, and all other States use a range of categories from values, to type of vehicle, number of cylinders or emissions total.

Historically, there have been problems with the regulation of road transport such as variation in regulations across Australia and charging systems that failed to reflect the costs that users imposed on the road network. In the 1996-97 Financial Year, several jurisdictions reported implementing road transport reforms designed to address these problems. As a main step, the Commonwealth Government enacted legislation setting out uniform national requirements for heavy vehicle registration. As a result, NSW, Victoria, Queensland, Western Australia, Tasmania, Northern Territory and the ACT reported implementing nationally agreed heavy vehicle charges.[31] This means there is very little, if any difference, in the actual taxation of heavy vehicles across States. The minimal variation in tax rates, combined with the very small share of heavy vehicles (see Figure 11) as a proportion of all motor vehicles, and their more limited contribution to overall motor tax revenue (19 percent on average across jurisdictions) preclude the calculation of a robust separate elasticity for heavy motor vehicles.

[31] Industry Commission's report - Summary of reported reforms (page 4)
https://www.pc.gov.au/research/supporting/microeconomic-reform-scoreboard/mers96-97.pdf

Table 14. Motor vehicle stamp duty payable on vehicle registration, by State or Territory

State	Value/types of vehicles	Rates
NSW	$0 – 44,999	3% of the value
	$45,000 and over	$1,350 + 5% of the value
VIC	Used vehicle (any value)	4.20% of the value
	Non-passenger car (any value)	2.70% of the value
	Passenger car value $0 - 65,094	4.20% of the value
	Passenger car valued over $65,094	5.20% of the value
QLD	Electric and hybrid—any number of cylinders	2.00% of the value
	1-4 cylinders, 2 rotors, steam powered	3.00% of the value
	5-6 cylinders, 3 rotors	3.50% of the value
	7 or more cylinders	4.00% of the value
SA	Non-commercial Vehicle: $0-1,000	1% of the value or a minimum of $5
	Non-commercial Vehicle: $1,000-2,000	$10+2% of the value
	Non-commercial Vehicle: $2,000-3,000	$30+3% of the value
	Non-commercial Vehicle: over $3,000	$60+4% of the value
	Commercial Vehicle: $0-1,000	1% of the value or a minimum of $5
	Commercial Vehicle: $1,000-2,000	$10+2% of the value
	Commercial Vehicle: over $2,000	$30+3% of the value
WA	Passenger vehicles: Up to $25,000	2.75% of the value
	Passenger vehicles: $25,001 - $50,000	[2.75+((value-25,000)/6,666.66)]%of value
	Passenger vehicles: Over $50,000	6.5% of the value
	Heavy vehicles	3% of the value (maximum $12,000)
TAS	Passenger vehicles: $0 - $600	$20
	Passenger vehicles: $600 - $35,000	3% of the value
	Passenger vehicles: $35,000 - $40,000	$1,050+11% of value over $35,000
	Passenger vehicles: over $40,000	$4% of the value
	Heavy vehicles	1% of the value or a minimum of $20
ACT	Vehicles emitting CO_2 less than 131g/km	$0
	Vehicles emitting CO_2 131–175g/km: value below $45,000	1% of the value
	Vehicles emitting CO_2 131–175g/km: value over $45,000	$450+2% of the value
	Vehicles emitting CO_2 176–220g/km: value below $45,000	3% of the value
	Vehicles emitting CO_2 176–220g/km: value over $45,000	$1,350+ 5% of the value
	Vehicles emitting CO_2 over 221g/km: value below $45,000	4% of the value
	Vehicles emitting CO_2 over 221g/km: value over $45,000	$1,800+ 6% of the value
NT	All types of vehicles	3% of the value

Note: * Vehicles with a gross mass over 4.5 tonnes are considered heavy while all other are passenger vehicles. For motor vehicle registration fees, driver's licence fee, rider's licence, learner's permit and licence test fee, see websites of State Revenue Offices.

Sources: http://www.revenue.nsw.gov.au/taxes/vehicle,

http://www.sro.vic.gov.au/node/1490,

https://www.qld.gov.au/transport/registration/fees/duty/about,

http://www.revenuesa.sa.gov.au/taxes-and-duties/stamp-duties/motor-vehicles,

https://www.finance.wa.gov.au/cms/State_Revenue/Duties/Calculation_of_Vehicle_Licence_Duty.aspx,

http://www.sro.tas.gov.au/motor-vehicle-and-insurance-duty/duty-on-motor-vehicles/motor-vehicle-duty-calculator,

http://www.treasury.nt.gov.au/TaxesRoyaltiesAndGrants/StampDuty/Pages/Duty-Types-and-Rates.aspx#motor_vehicle,

https://www.revenue.act.gov.au/motor-vehicle-duty

Table 15. Selected annual registration fees for personal vehicles, by State or Territory

State	Value/types of vehicles	Rates
NSW	Cars, station wagons, and trucks: Up to 975 (kg) 976 – 1154 (kg) 1155 -1504 (kg) 1505 – 2504 (kg) 8 other categories of weight up to 4325 – 4500 (kg)	 $211 private use, $343 business use $245 private use, $390 business use $299 private use, $472 business use $457 private use, $711 business use $1177 private use, $2227 business use
VIC	Sedan, station wagon, hatch & 4WD vehicles: Metropolitan area Outer Metropolitan Rural	 $817.60 $691.10 $569.00
QLD	Light vehicle, private use car, 4 cylinders (Specific registration fees can be calculated using a calculator on the Queensland government website)	$721.60
SA	Calculator provided online.	
WA	Light vehicles: Motor car, per 100 kg Caravan (motor propelled), per 100 kg Caravan (trailer type), per 100 kg Convertor dolly, per 100 kg 13 other categories of light vehicles	 $22.96 $22.96 $5.74 $11.48 Other rates
TAS	3 Cylinder – Class A and GVM < 3t 4 Cylinder – Class A and GVM < 3t 5 & 6 Cylinder Class A and GVM < 3t 7 & 8 Cylinder Class A and GVM < 3t	$543.16 $562.16 $595.16 $656.16
ACT	Passenger carrying private vehicles which do not exceed 4,500 kg: NRMA CTP provider up to 975 kg AAMI CTP provider up to 975 kg GIO CTP provider up to 975 kg APIA CTP provider up to 975 kg her rates apply for higher weight categories and other categories of vehicles, business, taxi, buses, etc.	 $919.60 $922.20 $915.60 $939.30

State	Value/types of vehicles	Rates
NT	Vehicles with four cylinders and an engine size less than 3000cc: 0001 – 0500 0501 – 1000 1001 – 1500 1501 – 2000 2001 – 3000 Other rates apply to other categories also of vehicles with more than four cylinders and bigger engines, motorcycles, and trailers and caravans.	 $606.30 $648.30 $702.30 $748.30 $748.30

Note: This table is meant to provide an indication of the heterogeneity in annual registration fees, which apply across the States and Territories. It is not intended to provide a comprehensive review.

Sources: https://www.rms.nsw.gov.au/roads/registration/fees/registration-costs.html;

https://www.vicroads.vic.gov.au/registration/registration-fees;

https://www.qld.gov.au/transport/registration/fees/cost

https://www.sa.gov.au/topics/driving-and-transport/vehicles-and-registration/vehicle-registration

https://www.transport.wa.gov.au/aboutus/transport-related-fees.asp?198

https://www.transport.tas.gov.au/fees_forms/registration_licensing/quick_reference_fees

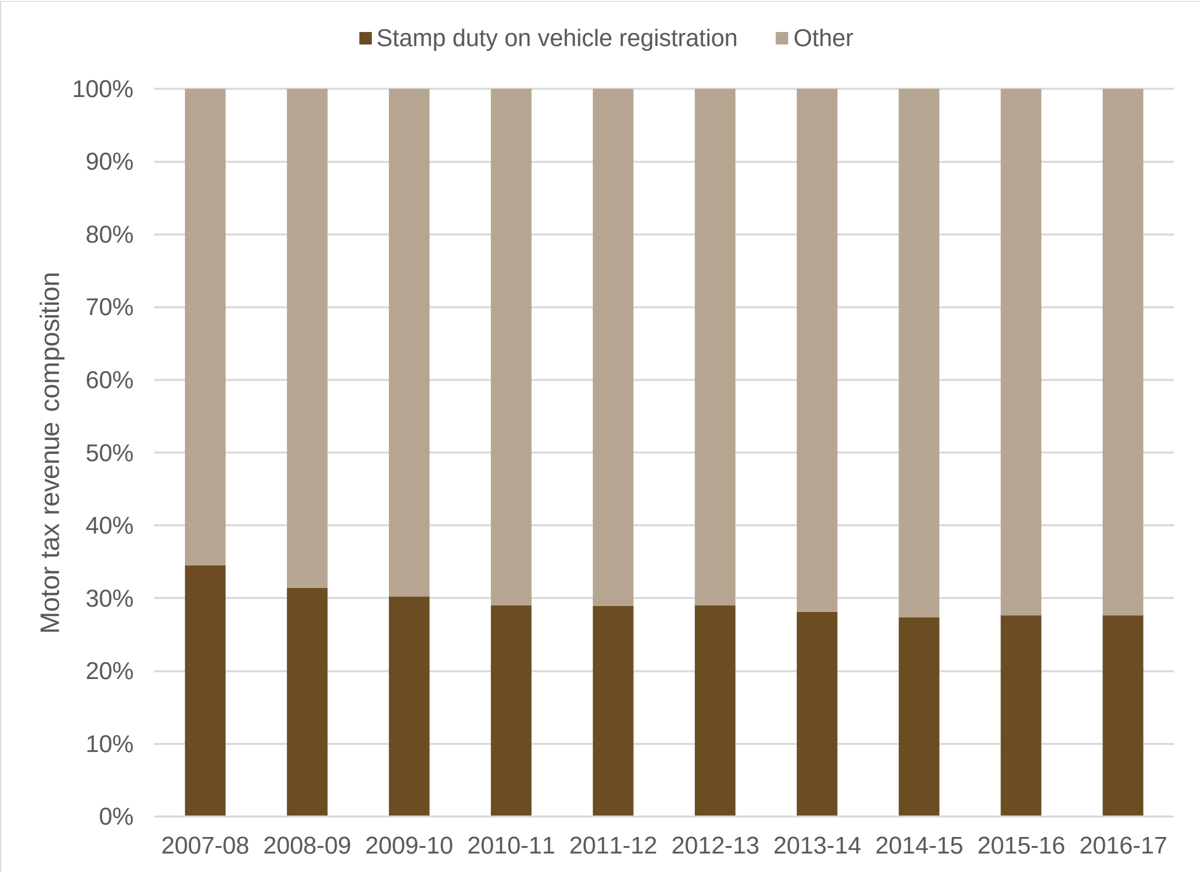
https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/694/~/motor-vehicle-registration-and-renewal#!tabs-9

https://nt.gov.au/driving/rego/fees/registration-fees

Despite the variation in tax rates and the stocks of registered vehicles across States, motor vehicle taxation has remained an important source of tax revenue, comprising about 12.5 percent of total State tax revenues in 2016-17.[32] There is however, variation by State. For example, in Tasmania and Queensland, motor tax revenue represented closer to 17 percent of State revenue in 2016-17, while in ACT and Queensland it represented closer to 9 percent. Across all States, stamp duty on vehicle registration, as a share of total motor tax, has also declined steadily from about 35 percent of total State motor tax revenue in 2007-08 to 28 percent in 2016-17 (Figure 13). This decline provides evidence of the growing importance of other forms of motor taxation, in lieu of stamp duty on vehicle registration.

[32] http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/5506.0Main+Features12016-17?OpenDocument

Figure 13. Composition of total State motor tax revenue



Source: ABS Government Finance Statistics, 2016-17

4.4 Data sources

4.4.1 Historical data on statutory licence fees

As previously mentioned, this chapter focuses on States and Territories' motor vehicle licence fees (registration fees) and not the stamp duty on motor vehicles. Data on historical statutory licence fees (motor taxes) is taken from the Western Australian Overview of State Taxes and Royalties, which provides information on Western Australia's taxes – including interstate comparisons.[33] As presented in Table 15 and in Table 16 below, licence fees in States and Territories are based on very different criteria, complicating interstate comparisons. For this reason, the interstate comparison used in this report is based on the licence fees in each State or Territory that applied to a specific, common, and privately used car in a given year. The Western Australian Overview of State Taxes and Royalties use a

33 Historic information is found in reports going back to the Financial Year 1999-00. https://www.treasury.wa.gov.au/StateFinancesArchive/#Overview_of_State_Taxes%23Economic_Brief https://www.treasury.wa.gov.au/Treasury/Publications/State_Taxes/

Holden Commodore with 6-cylinders up until the year 2015-16. From 2016-17 they swap to a 4-cylinder Toyota Camry SL Auto. The total cost of licence fees by State and Territory, broken down by the different components, is presented in Table 16.

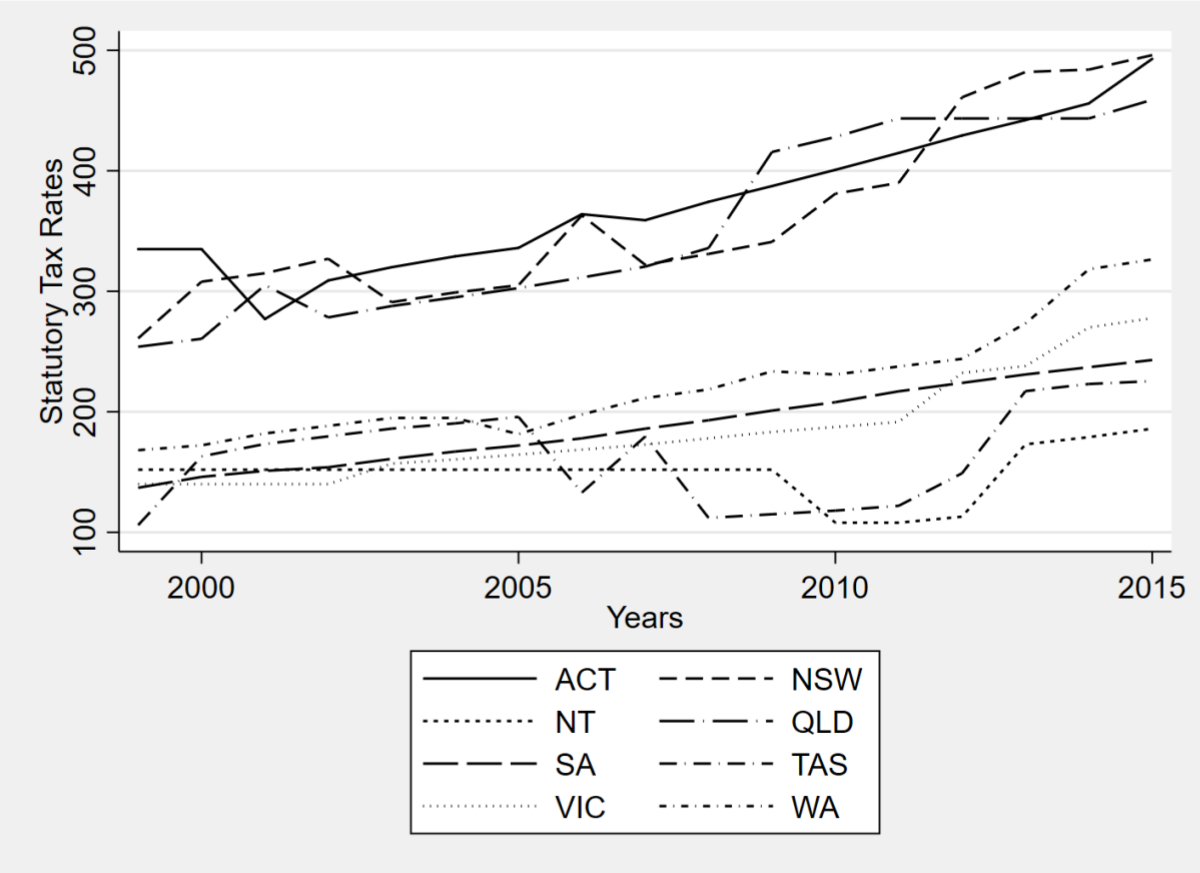
Table 16. Motor vehicle licence fees for a 2018 Toyota Camry SL Auto, 2018-19

	NSW	VIC	QLD	SA	TAS	ACT	NT	WA
Private registration								
Licence Fee	$523	$295	$321	$126	$205	$570	$184	$367
CTP insurance	$472	$521	$344	$584	$314	$583	$552	$431
Admin and recording fee	Nil	Nil	Nil	$22	Nil	Nil	$12	$18
Other fees and levies	Nil	Nil	$56	$32	$43	$29	Nil	Nil
Total	**$995**	**$817**	**$722**	**$764**	**$562**	**$1,183**	**$748**	**$816**
Business registration								
Licence Fee	$777	$295	$349	$126	$205	$883	$184	$367
CTP insurance	$494	$521	$361	$584	$314	$629	$552	$431
Admin and recording fee	Nil	Nil	Nil	$22	Nil	Nil	$12	$18
Other fees and levies	Nil	Nil	$61	$32	$43	$29	Nil	Nil
Total	**$1271**	**$817**	**$770**	**$764**	**$562**	**$1541**	**$748**	**$816**

Source: Western Australia Overview of State Taxes and Royalties 2018-19

Figure 14 shows the variation in State and Territories' licence fees over time. The licence fees paid per vehicle grew, in absolute terms, for all States over time. For example, they increased from $261 to $484 in New South Wales over this 17-year period. In addition, the fees are much lower in some States and grew at very different rates, providing enough variation to analyse a causal link between licence fees and vehicle ownership. The results of the elasticity analysis are presented in Section 4.5. The next section presents an overview of the HILDA and CGC data used to estimate State and Territories' tax base elasticity (elasticity of number of registered vehicles) in response to changes in State motor vehicle licence fees.

Figure 14. Licence fee applying to a Holden Commodore by State and Territory, 1999 - 2016



Source: Western Australian Overview of State Taxes and Royalties, various years.

4.4.2 The Household, Income and Labour Dynamics in Australia (HILDA)

The Household, Income and Labour Dynamics in Australia (HILDA) Survey is a household-based panel study that collects valuable information about economic and personal well-being, labour market dynamics and family life. It aims to tell the stories of the same group of Australians over the course of their lives. Starting in 2001, the HILDA Survey provides policymakers with unique insights about Australia, enabling them to make informed decisions across a range of policy areas, including health, education and social services.[34] The HILDA Survey follows the lives of more than 17,000 Australians each year over the course of their lifetime. HILDA is the only study of its kind in Australia. There are currently 17 waves corresponding between 2001 and 2017. In waves 2, 6, 10 and 14 the HILDA Survey asked participants about their ownership of motor vehicles. As a result, 4 years of panel data show how vehicle ownership of participants varies with licence fees in the different State and Territories. The data also provide a number of additional control variables, including disposable income, number of persons in the household, unemployment

[34] https://melbourneinstitute.unimelb.edu.au/hilda

status and relationship in the household. Table 17 provides summary statistics for the 17,512 observations for relevant variables from the HILDA data set.

Table 17. Summary statistics for HILDA variables used in the regression, 2014

Variable	Mean	Std. Dev.	Min	Max
Vehicles per Household	1.187	0.583	0	3
Annual Licence Fee	372.9	102.4	179	484
HH disposable income	95285	72033	0	1875354
Number of persons in household	2.887	1.50	1	13
Couple with kids <15	0.226	0.418	0	1
Couple no kid(s)	0.306	0.461	0	1
Couple with kid(s)>15	0.046	0.211	0	1
Alone with kid(s)	0.029	0.170	0	1
Student living at home	0.070	0.256	0	1
Living alone	0.161	0.367	0	1
Unemployed	0.042	0.202	0	1
Not in labour force	0.330	0.470	0	1

Figure 15 confirms the hypothesis that disposable income is correlated with vehicle ownership. For this reason, we include income as a control variable in the regression analysis. In Figure 16 we look at the average car ownership per household by State and Territory for the four observation points over the years 2002-2014. There is a difference in the level of average ownership of vehicles across States, which will be captured by the State fixed effect in the regression. More importantly, different patterns emerge over time, indicating variation we will want to explain in the regression analysis. Results are presented in Section 4.5.1.

Figure 15. Scatterplot of number of cars and household log disposable income over the sample period

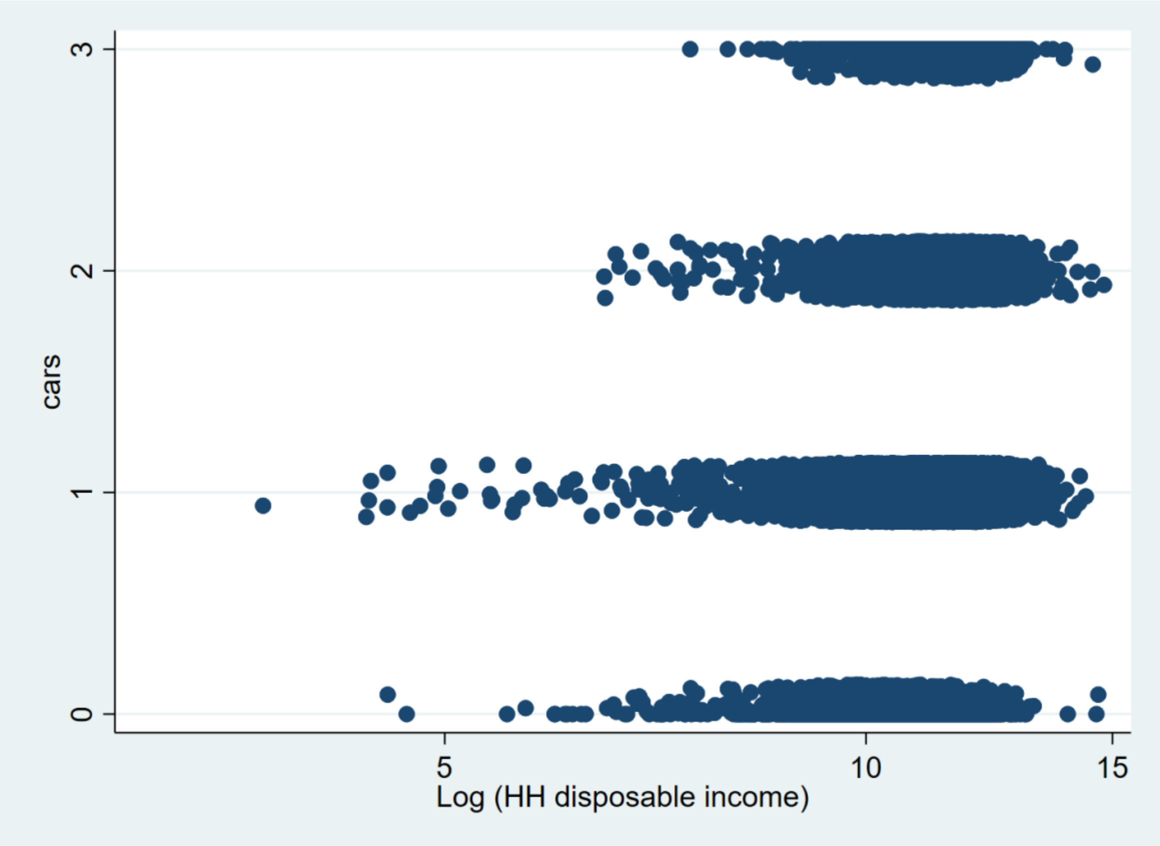


Figure 16. Average household vehicle ownership, by State and Territories over the sample period

Table 18 in Section 4.5.1 presents results for the estimation using the HILDA panel data set. We employ Equation 5 for the household level case. The index indicates individuals interviewed in the sample. Due to the nature of the dependent variable, we estimate the model with a Poisson specification[35] and as such the coefficients can be interpreted as elasticities.

4.4.3 CGC assessment data

The CGC data for licence fees is based on data from ABS statistics of motor vehicle ownership[36] for the tax base and data from the States on total tax revenue from motor vehicle licence fees on an annual basis. The tax base for motor tax is the number of registered cars in a given State. The CGC distinguishes between light and heavy motor vehicles. The light vehicle category is made up of registered passenger vehicles and light commercial vehicles. The heavy vehicles category is made up of heavy rigid trucks and articulated trucks.[37]

As discussed above, since heavy vehicles are taxed according to a national agreement, it is not possible to calculate a robust elasticity in the absence of enough cross-state variation. Moreover, even if there were sufficient differences across States for heavy vehicles, the registration costs would likely induce businesses that operate heavy vehicles to move to the State or Territory with the lowest registration taxes. For this reason, an analysis of the effects of taxation on these, much more mobile, vehicles (compared to passenger or light commercial vehicles) would not have a valid identification strategy. The CGC data starts with the Financial Year 1993-94 through 2016-17, leaving a panel data-set with 192 State-year observations.

[35] This is implemented using Hausman, Hall and Griliches estimator with xtpoisson command in Stata.
[36] ABS Table 9309.0 Motor Vehicle Census.
[37] The remaining ABS vehicle categories that are not used are campervans, light rigid trucks, non-freight carrying vehicles, busses and motorcycles.

Figure 17. Light vehicle ownership (tax base) in millions of vehicles, 1993 - 2017

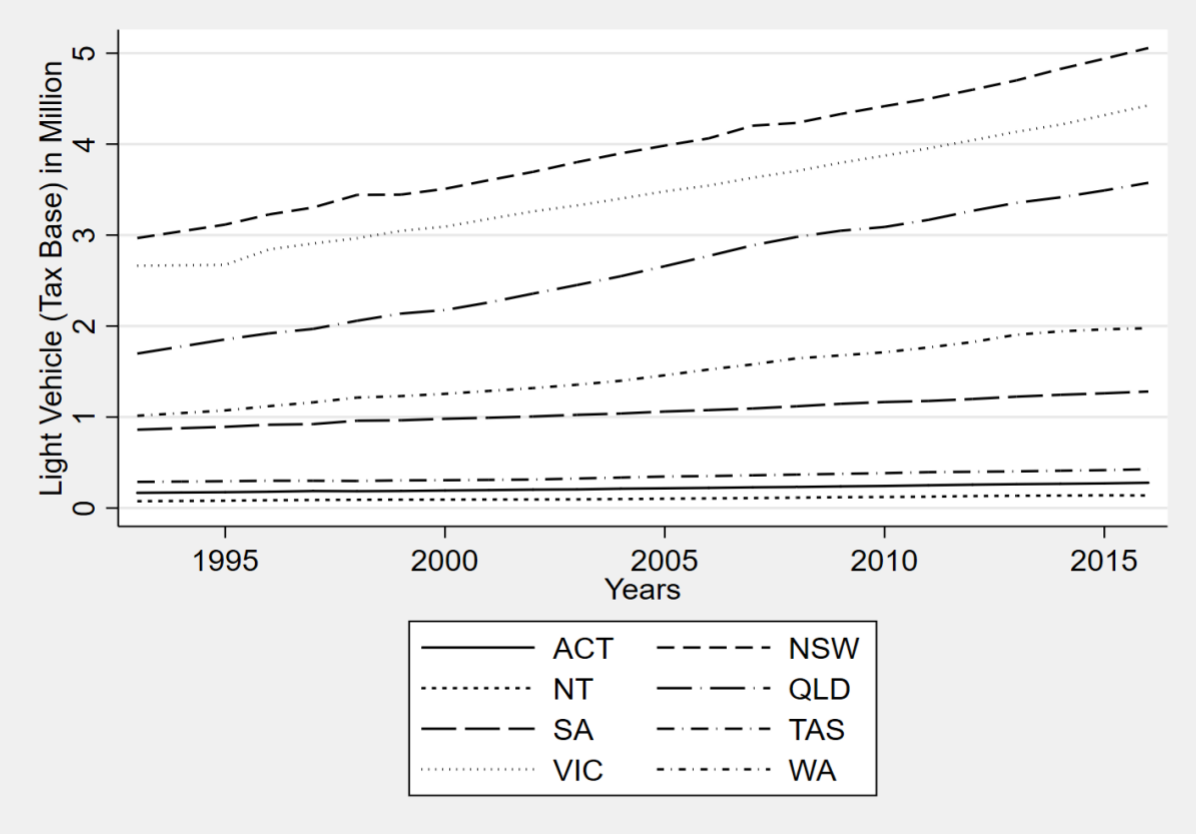


Figure 17 and Figure 18 provide an overview of the data. Figure 17 shows the development of the number of registered vehicles in States and Territories between 1993 and 2016. We see a strong increase in the tax base (number of registered vehicles) over the period. For example, in NSW the number of registered passenger vehicles and light commercial vehicles (light vehicles) rose from around 3 million in 1993-94 to about 5 million in 2016-17. Figure 18 shows the revenue States and Territories collected from light motor vehicle licence fees over the same period. Even greater growth is observed in revenue, compared to the tax base (number of vehicles). For example, in NSW, revenue rose from about $650 million in 1993-94 to $2.4 billion in 2016-17.

Figure 18. Light vehicle motor tax (tax revenue) in millions AUD, 1993-2017

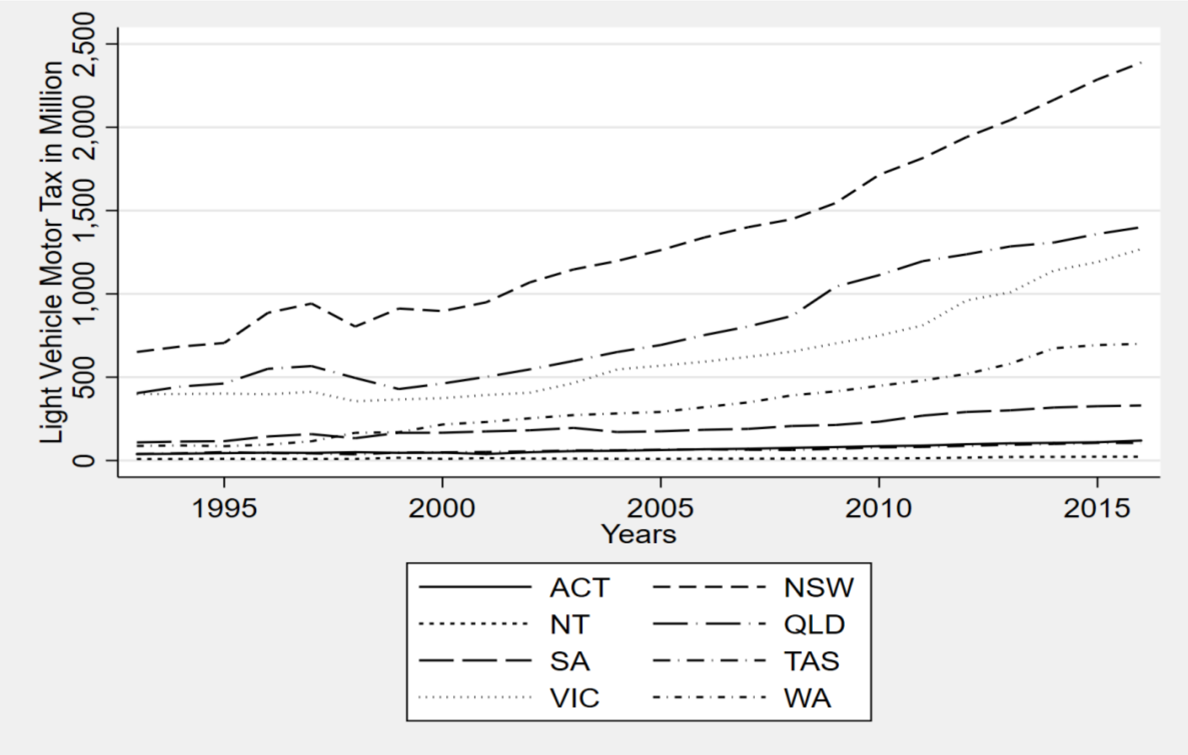


Figure 19 and Figure 20 provide a more detailed view for a single year. Figure 19 shows the number of registered passenger vehicles and light commercial vehicles per capita in the year 2016-17 Financial Year. There are differences in per capita ownership of cars across States and Territories. In the Northern Territory, the State with the lowest per capita car registration, per capita ownership is 32 percent lower than in Tasmania. People living in the ACT also own, on a per capita average, 17 percent fewer cars compared to Tasmanians. Many different reasons could explain the higher per capita vehicle ownership in Tasmania. For example, Tasmanians may need to travel more for work or they may have fewer public transport options. The State is also less densely populated. It is also possible that the cost of car ownership is lower in Tasmania.

Figure 20 shows the average licence fee per light vehicle by State and Territory in the 2016-17 Financial Year where big differences emerge across States. In the Northern Territory, the fees are almost a third of those in New South Wales. Among the larger States as well, there are sizeable difference, as vehicles in Victoria pay an average licence fee that is 40 percent lower than in New South Wales. Since we are interested in the effect of licence fees on the demand for car ownership, we might wonder if the higher fees in the ACT, over $400 a year, compared to the less than $250 fees in Tasmania, might explain the difference in ownership. However, the Northern Territory has the lowest licence fees ($165) and the lowest per capita ownership, challenging the aforementioned interpretation.

Figure 19. Light vehicle ownership (tax base) per capita in the Financial Year 2016-17

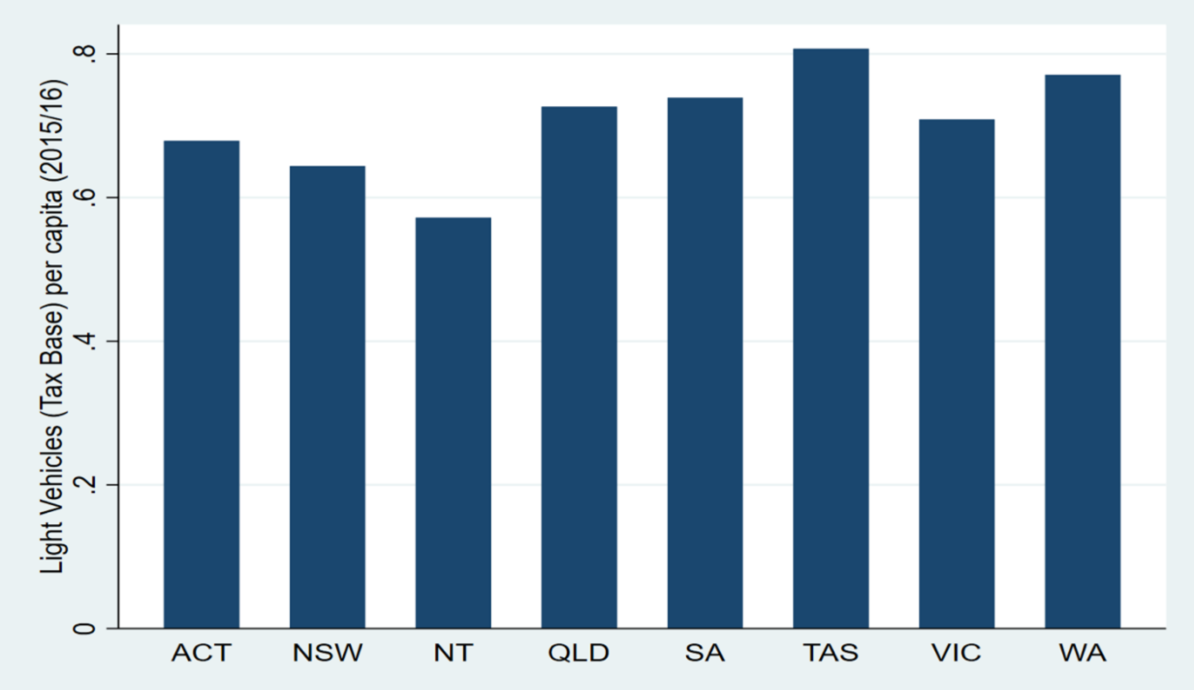
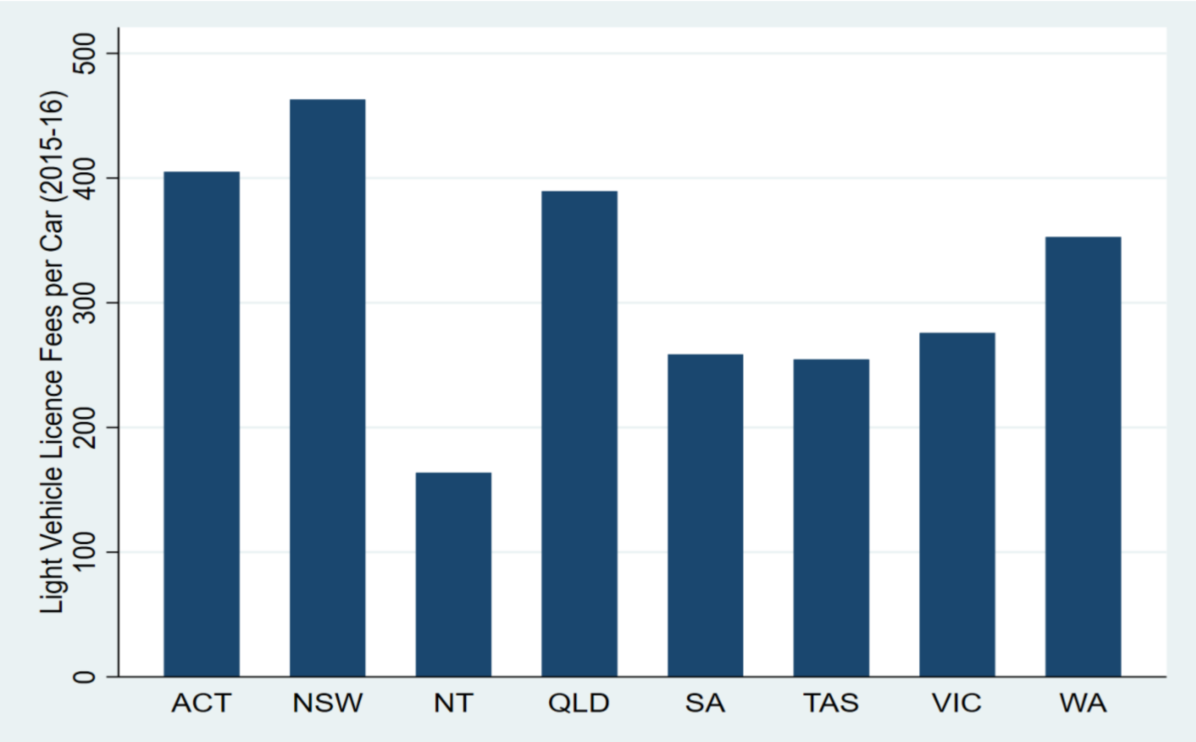


Figure 20. Light vehicle licence fee per vehicle in the financial year 2016 - 2017



To fully understand any behavioural effect of licence fees on car ownership, we build on the specification from Equation 5:

Equation 6

$$\log(Vehicles)_{s,t} = \beta \log(LicenceFee)_{s,t} + a_s + b_t + X_{s,t}\delta + \gamma \log(Vehicles)_{s,t-1} + \varepsilon_{s,t}$$

The variable *log(Vehicles)*$_{s,t}$ is the logarithm of the number of registered vehicles that are considered light vehicles for the purpose of the motor licence fees in State *s* during quarter *t*. The *log(LicenceFee)*$_{s,t}$ are (effective) licence fees per vehicle in logs, and b_t represent annual fixed effects. The time fixed effect captures any year-specific effects on ownership that are common across all States. For example, it captures the effects of a decrease in vehicles ownership due to the closure of Holden, the overall economy going down, and increased fuel prices due to the international price of oil. Including a State fixed effects, a_i, will control for the fact that Australian States and Territories differ in many ways that are relevant to car ownership. X_{st} represents further controls in the specification. We use annual population data from the ABS[38] as well as data on States' disposable income from the ABS[39,40]. Lastly, the lagged right-hand side term, *log(Vehicles)*$_{it-1}$, controls for autoregressive properties of the time-series and permits a simple pattern of dynamic adjustment of the tax base to changing local fees.

This specification allows for a difference-in-difference style inference where we identify changes in the number of registered vehicles through variation in the (effective) licence fees across States and over time.

One advantage of the CGC data is that we observe annual tax revenue as well as the tax base of motor tax insurance premiums for each State. These give us the opportunity to calculate an effective tax rate, which reflects the correct distribution of the types of cars that are registered and includes all exemptions and special regulations. This provides us with a much richer source of information. But it also introduces potential endogeneity, since we derive the effective tax rate by dividing State revenues by the tax base, as discussed in Chapter 5. We instrument the effective tax rate with the statutory tax rate in a two stage least squares regression in order to prevent estimation bias due to endogeneity. Figure 21 shows the effective and statutory tax rates for each State over time. As expected, we observe that the effective tax rate follows roughly the path of the statutory rate in the different States, but the effective tax rate shows more volatility, reflecting fluctuations in revenue or the tax base that are not due to tax rate changes.

We employ the Cragg-Donald Wald F-Statistics at the first stage regression as a measure of the strength of the instrument. Throughout the different specifications presented in Table

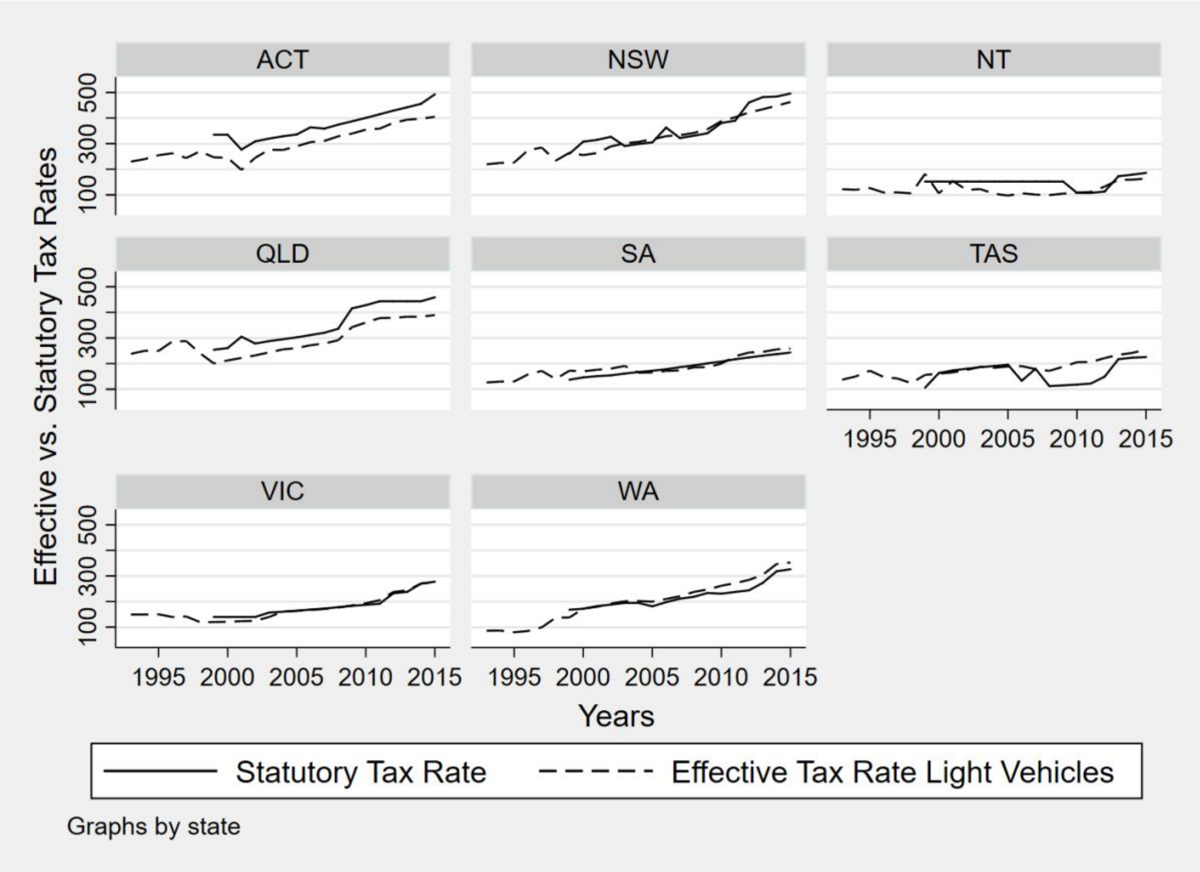
[38] The population data is taken from the ABS Table 3101, accessed via the ABS.Stat Metadata, and contains quarterly estimates or residential population by States. For the annual data analysis, we use the estimated population at the midpoint of the Financial Year, that is the estimated population at the end of December.

[39] The disposable income data is take from the ABS Tables 6523.0, which contains annual State level data for the Financial Years 1994-95 through to 2015-16 (latest release) with a number of gaps.

[40] The gaps in the disposable income data are linearly interpolated using the Stata command *ipolate*.

19, the value of the test statistic is very high, suggesting that this a strong instrument. The regression results with all relevant statistics are presented in Section 4.5.

Figure 21. Comparison of effective and statutory light vehicle licence fees over the sample period



4.4.4 Other data sources

We have also considered other data sources. The Australian Prudential Regulation Authority (APRA) data, which was introduced in the chapter on insurance tax, has Compulsory Third Party (CTP) motor vehicle insurance premiums listed as a separate insurance type. Theoretically, one could use the amount of CTP in a given State as an indicator for vehicle ownership. There are however, some challenges. First, the calculations would be, at best, a proxy for the actual numbers by vehicle type that are already published by the ABS. Second, the premiums paid are generally rounded to the nearest million. In smaller States and Territories, like the ACT with 33 million in CTP premiums paid, the rounding margin could be up to 1.5 percent. When trying to identify a relatively small effect, this degree of rounding margin could be too imprecise. Finally, CTP premiums are only reported for half of the States and Territories since APRA only reports *private* insurance premiums. In States where CTP is run through public entities, insurance data are not available.

The ABS Household Expenditure Survey has no data on the number of vehicles owned or insurance paid, with the exception of one variable describing the net value of vehicles owned. Since net value could represent multiple older cars, or one new and more expensive car, it is impossible to identify how many cars a household owns. This is an essential piece of information to determine the motor vehicle licence fees applicable to a particular household.

4.5 Elasticity results

4.5.1 The Household, Income and Labour Dynamics in Australia (HILDA)

Table 18 presents results for the estimation using the HILDA panel data set from our Poisson specification. All models presented in Table 18 include time and household fixed effects, model specifications become more complex as we move in the table from left to right. The results of the most basic elasticity specification model are in Column 1 of Table 18 and show the estimated effective tax rate elasticity without any other controls. Log(motor tax) is the log of the statutory motor vehicle licence fees as introduced in Section 4.4. The estimate in the first column presents an elasticity of car ownership with respect to licence fees of -0.036. The omitted reference year is 2014. The negative estimates on the earlier years suggest that car ownership per household is increasing over the time span. The remaining columns include other variables that are also expected to have effects on vehicle ownership. In Column 2, household disposable income is added and has as a strongly significant effect with an elasticity of 0.11, suggesting that if income increases by 10 percent vehicle ownership will increase by 1.1 percent. The tax elasticity coefficient stays virtually the same as in the previous column.

Table 18. Elasticity of car ownership - Poisson estimation

VARIABLES	(1) HH Car Ownership	(2) HH Car Ownership	(3) HH Car Ownership	(4) HH Car Ownership	(5) HH Car Ownership
Log(motor tax)	-0.036**	-0.035*	-0.039**	-0.035**	-0.034*
	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]
Log (HH disposable income)		0.108***	0.069***	0.046***	0.045***
		[0.006]	[0.006]	[0.006]	[0.006]
Number of persons in household			0.051***	0.034***	0.034***
			[0.003]	[0.004]	[0.004]
Couple with kids <15				-0.013	-0.014
				[0.009]	[0.009]
Couple no kid(s)				0.004	0.004
				[0.009]	[0.009]
Couple with kid(s)>15				-0.016*	-0.016*
				[0.010]	[0.010]
Alone with kid(s)				-0.104***	-0.105***
				[0.020]	[0.020]
Student living at home				0.073***	0.074***
				[0.012]	[0.013]
Living alone				-0.173***	-0.174***
				[0.015]	[0.015]
Unemployed					-0.034**
					[0.014]
Not in labour force					0.000
					[0.007]
year==2002	-0.044***	0.005	-0.036***	-0.056***	-0.056***
	[0.010]	[0.011]	[0.011]	[0.010]	[0.011]
year==2006	-0.021***	0.005	-0.020**	-0.033***	-0.032***
	[0.008]	[0.009]	[0.008]	[0.008]	[0.008]
year==2010	-0.012**	-0.002	-0.014**	-0.020***	-0.020***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
Observations	45,671	45,406	45,406	45,406	45,406

Number of individual	13,818	13,764	13,764	13,764	13,764

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

In Column 3, we introduce the number of people in the household as a control. This variable is similarly strongly significant. The elasticity goes up very slightly to -0.04. In Column 4, we introduce a number of variables describing categories of relationships in household. The elasticity drops slightly back down to the previous level. Finally, in the last column we add employment status as a final control. While unemployment has a significantly negative effect on car ownership, the tax elasticity does not change. We find very stable estimates for the motor tax elasticities across the different model in Table 18 of about -0.035. Thais finding suggests that if license fees increase by 10 percent car ownership will drop by 0.35 percent.

4.5.2 CGC assessment data

Table 19 presents results for the estimation using the CGC assessment data. While all models presented in Table 19 include time and State fixed effects, model specifications are more complex as we move in the table from left to right.[41] The results of the most basic elasticity specification model can be found in Column 1 of Table 19 and show the estimated effective tax rate elasticity without using an instrument or any other controls. The estimate suggests a positive relationship with an elasticity of 0.040.

As discussed in more detail in Section 4.4.3, there are concerns about endogeneity regarding the calculation of the effective tax on the basis of current tax income and current premiums. Therefore, we instrument the effective tax rate with the statutory insurance tax rate. The results of this approach are presented in Column 2. An IV approach is also applied to the remaining models (columns) in the table. The sample size reduces with the IV modelling since the available statutory data discussed in section 4.4.1 is only available from Financial Year 1999-00 onwards. The change in the statutory comparison definition in the year 2016-17 (from a Holden to a Camry) leads us to exclude the last year from the sample.[42] Using the instrumental variable specification, the elasticity estimate becomes negative but is insignificant at -0.048 as the error term more than doubles. The F-statistic of 36 for the first stage suggests that this is a strong instrument.

[41] Due to space considerations and in favour of clarity we again omit results for the time fixed effect coefficients from the results table.

[42] The regression results with the last year of the sample included are virtually identical to the once presented in Table 19.

Table 19. Elasticity of motor vehicle licence fees (light vehicles) - Annual data (statutory rates as instrument for effective tax rate) - Dependent variable log(tax base)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Effective Tax Rate	IV Tax Rate	IV Tax Rate	IV Tax Rate	IV Tax Rate
Log(Tax Rate)	0.040**	-0.048	-0.030***	-0.048***	-0.056***
	[0.019]	[0.046]	[0.011]	[0.012]	[0.013]
Lagged Log(Tax Base)			0.964***	0.855***	0.830***
			[0.024]	[0.036]	[0.037]
Log(Income)					0.059**
					[0.024]
Log(Population)				0.169***	0.173***
				[0.042]	[0.042]
Observations	184	136	136	136	136
R-squared	0.948	0.950	0.997	0.997	0.997
Number of States	8	8	8	8	8
Cragg-Donald F-Stat		42	49	33	40

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

To address concerns about serial correlation, and account for differences in States' trends in disposable income and population over the 20-year period of the sample we introduce further controls in Column 3 to 5. Column 3 introduces a lagged dependent variable to the model to control for dynamics in the samples. As a result, the tax elasticity nearly halves to -0.030 and becomes significant as the error term reduces 4-fold. Including a control for State specific population growth in Column 4 makes the elasticity estimate more significant at -0.048, with very little change to the standard error. Finally, in Column 5 controlling for all three variables, including the State specific trend in growth of disposable income, the tax elasticity increases slightly to -0.056. The changes in the elasticity estimate and its error term in the last three columns compared to Column 2 indicate that without controls our model is mis-specified. By adding more controls in the last three Columns, the estimate remains fairly robust and ranges between -0.03 and -0.06. The richest model in Column 5 is our preferred estimate. The coefficient of -0.056 implies that when the licence fees goes up by 10 percent the number of light motor vehicles will go down by 0.6 percent.

4.6 Comparing the elasticity results to estimates from the domestic and international literature

Most of the recent academic literature on the impact of motor taxes, in particular stamp duty and annual registration taxes (licence fees), on consumer behaviour has emerged alongside changes in the design and objectives of the taxes.[43] For example, mandatory CO2 emissions reduction targets for new passenger cars has at least partially spurred the introduction of stamp duty and annual registration taxes which are linked to CO2 emissions or fuel consumption of motor vehicles across the European Union (The Greens EFA, 2018; Brand et al., 2013; Hennessy and Toll, 2011). The evaluation of the impact of these changes instituted across the EU permeates the academic literature.

In Australia however, no such changes have recently occurred. Motor taxes apply at different rates to different subgroups of vehicles and the ACT is the only jurisdiction to have linked one of its taxes to CO2 emissions. The absence of significant policy changes in this area in Australia at least partially explains the lack of academic research on the topic in Australia. Given the limited research on motor taxes in Australia, this section combines both the domestic and international literature. However, as previously mentioned, the impact of motor taxes across countries are informative, but not directly comparable, because of the differences in the design and objectives of motor taxes which vary across countries.

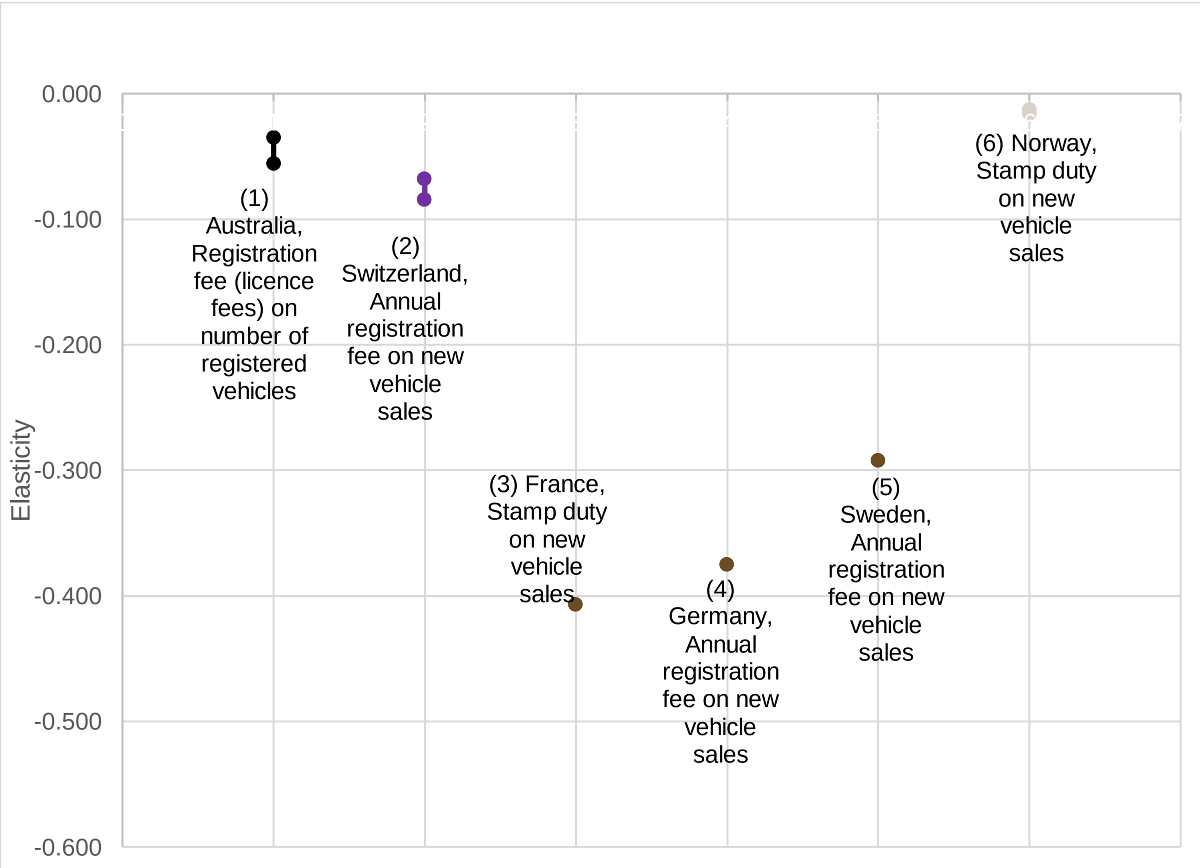
Consistent with theoretical predictions, Australian studies indicate that motor taxes have economic costs. A study by AEPL (2008) indicates that the consumption elasticity of tax revenues (the effect of a change in consumption resulting from a one dollar increase in tax revenues) is highest for motor taxes. Their estimated elasticity is on average 1.3 times larger than that of the personal income tax. More importantly, the estimated elasticity is much higher for businesses than for households. A recent study by AACL (2015) also identifies motor taxes as one of the most inefficient State taxes and shows that raising revenues through motor taxes by one dollar reduces welfare by 37 cents.

Figure 22 presents the elasticities calculated by TTPI for Australia (presented in the previous sections), alongside elasticities calculated in the international literature. The estimates from the CGC and HILDA data reach similar conclusions about the magnitude of the elasticity in

[43] There is an extensive body of academic literature which has focused on the impact of fuel taxation on the demand for fuel and for motor vehicles. However, since the fuel excise is imposed by the Commonwealth in Australia, as opposed to the States and Territories, these studies have been excluded from the literature review.

Australia. In addition, at a first glance, compared to other international studies, the elasticities for Australia are the smallest, suggesting that an increase in licence fees impacts the number of registered vehicles less in Australia than in other countries. It is however, important to note that the estimates from other countries exclusively focus on the impact of a change in motor taxes (both stamp duty or licence fees) on the sales of *new* vehicles. By contrast, the estimates from the Australian data consider the impact of an increase in licence fees on the *total stock of all* registered vehicles. This distinction is important since changes on the margin (the sale of new vehicles) are likely to be more responsive to policy changes, while the overall composition of the stock of all vehicles changes more slowly. A second important difference between the results presented for Australia and other countries is the form of taxation. Some elasticities refer to an increase in stamp duty, whereas others show the results of a change in licence fees (registration or circulation taxes).

Figure 22. Demand elasticity for motor vehicles in response to an increase in stamp duty or registration fees (licence fees), available countries



Notes: 1) Each point on the graph represents an elasticity calculated in one of the studies.

2) With the exception of Norway, all elasticities are based on log-log specifications. Norway's elasticity can be interpreted as the effect of a 1000 NOK increase in stamp duty (which is equal to about 1 percent of the average stamp duty) on new vehicle sales (log-linear).

Source: Authors' compilation based on own estimates and review of the academic literature. The specific studies included in this graph can be provided upon request.

Despite the difference in the definition of the stock of vehicles used in the domestic and international studies, the international results remain informative about the potential responsiveness of vehicle sales to changes in taxes. For example, in Switzerland, annual motor registration fees are set at the State (cantonal) levels. Between 2005 and 2011 various cantons differentiated their annual registration fees by fuel economy or CO2 emissions of the vehicle (through the use of higher fees and feebates). Alberini and Bareit (2017) identify the impact of annual registration fee by exploiting the variation in rates across cantons and over time. They found that an increase in fuel costs and the annual registration motor fees reduced the sales of new vehicles. Interestingly, the elasticities presented for Switzerland are only slightly larger than in Australia, despite the exclusive focus in Switzerland being on sales of *new* vehicles.

Klier and Linn (2015) compare the impact of policy changes to vehicle taxation in France, Germany and Sweden. While the impact of stamp duty was evaluated in France, changes to registration fees (licence fees) were considered in Germany and Sweden. Focusing on the latter two countries, Germany and Sweden initially taxed vehicles based on engine size and weight and modified their taxes to increase linearly with CO2 emissions (in 2009 in Germany and 2006 in Sweden). In 2007, Sweden also introduced a rebate for vehicles emitting less than 120g CO2 per km. Compared to Switzerland and Australia, the elasticities presented in the figure suggest that sales of new vehicles were more responsive to the tax policy changes in Germany and Sweden.

Two other elasticities are also presented in the table, for France and Norway, but are not comparable to the estimates presented for Australia since they consider stamp duty instead of licence fees. As presented earlier, Klier and Linn (2015) consider the case of France, where stamp duty was charged based on horsepower, but changed. In 2008, France subsidised vehicles with less than 100 grams of C02 per kilometre and taxed those above 250g CO2 per kilometre. The observed elasticity of -0.407 suggests that a one percent increase in stamp duty decreases sales of new vehicles by -0.407 percent.

Similarly, in Norway, the vehicle tax (stamp duty) was reformed in 2007 by changing the link between the amount of tax paid and engine size to the potential CO2 emissions of the vehicle. The policy was implemented to achieve the emissions reduction mandated by the European Commission. In their evaluation, Ciccone (2014) found that the reform reduced the average C02 intensity of newly purchased cars by incentivising a shift towards greener cars and diesel vehicles.   Yan and Eskeland (2018) also study the impact of the changes introduced in Norway. They find that a 1000 NOK increase in stamp duty (which is equal to about 1 percent of the average stamp duty), reduces new vehicles sales by between 1.25 and 1.58 percent.

The domestic and international academic literature on the demand for motor vehicles in response to changes in motor taxes suggests that the elasticity can range from relatively inelastic (Australia, Switzerland) to quite elastic (Norway) or somewhere in between (Germany, Sweden or France). The differences in responsiveness to motor taxes internationally vary because of the taxes applied and measurement used. For example, while the studies on Australia, Switzerland, Germany, and Sweden focus on licence fees, those in Norway and France refer to stamp duty. They also vary in terms of the different policies' design, objectives and implementation.

4.7 Conclusion

Motor vehicle taxes can apply upon the *transfer* of ownership or initial purchase of a new vehicle, on *vehicle ownership* or through *vehicle use*. Multiple taxes can be imposed simultaneously and they can serve an environmental purpose (to offset negative externalities) and/or a revenue raising purpose. In Australia, motor taxes largely seem to remain revenue raising tools. Taxes on motor transfers and vehicle ownership fall within the jurisdiction of States and Territories. In 2018, just over 19 million registered vehicles were registered in Australia, 75 percent of which were passenger vehicles. The number of total vehicles has also grown over time, increasing the tax base. In 2016-17, motor taxes represented approximately 12.5 percent of State and Territory revenue.

This chapter assessed the demand for motor vehicles in response to a change in licence fees (*taxes on vehicle ownership*) using HILDA and CGC data. It found that the demand for motor vehicles is relatively inelastic in response to changes in licence fees. According to estimates based on HILDA, a ten percent increase in licence fees will decrease car ownership of light motor vehicles by about 0.35 percent. Using data from the CGC, the elasticity implies a 0.6 percent reduction in vehicle ownership as response to a 10 percent increase in licence fees.

Internationally, motor vehicle taxes serve different purposes and can be designed and implemented in distinct ways. Moreover, even if designed and implemented in the same way, the tax rates can be set at different levels. For these reasons, the estimates calculated for Australia are not directly comparable with studies in other countries. These differences also explain the range in elasticity estimates observed across different countries. For example, the demand for motor vehicles in response to a change in motor taxes is relatively inelastic in some countries (Australia, Switzerland), quite elastic (Norway) in others, or falls somewhere in between (Germany, Sweden or France).

As far as we can compare results the findings in this chapter are consistent with each other and the international literature, while being at the lower end of the range found within in the literature. This suggests that the estimate for the elasticity of car ownership in response to changes in the licence fees of -0.06 is a robust and conservative measure of the behavioural effect of motor tax.

5. Stamp Duty

5.1 Introduction

Stamp duty, also known as conveyance duty, is a State tax on the sale of a property, including a home, land, or a commercial property.[44] Stamp duty is usually paid by the buyer and is based on the sales price of the property (or its market value if higher). While stamp duty is a form of property tax, unlike land tax or municipal (local) rates which are recurrent, it is a one-off payment made at the point in time of the transfer of a property. Taxes on transactions, like stamp duty, are simple to administer but among the more inefficient taxes (Henry Tax Review, 2008). They distort purchasing decisions, mobility, and resource allocation. They are also inequitable since those who move more frequently pay more tax. A recent CGE study on Australia finds that a higher stamp duty rate reduces welfare by 72 percent of the revenues generated through the higher rate (Cao et al. 2015). The authors argue that stamp duties have the highest relative marginal excess burden compared to all major Australian taxes.

This chapter presents an empirical assessment of the extent to which the demand for property in Australia is sensitive to changes in the stamp duty rate applied (also referred to as the elasticity of demand for property in response to changes in stamp duty rates). The demand for property will be measured by the number of property transactions and the change in house prices. First, a brief overview of the economic theory underpinning stamp duty is provided and followed by a summary of the current rates in place in different States and Territories in Australia. Then estimates of the elasticity the demand for property in response to changes in stamp duty rates are provided alongside a description of the data sources applied for the calculation. Finally, these results are compared to estimates calculated in studies from the academic literature in Australia and internationally.

5.2 Theoretical background

While the legal incidence of stamp duty usually falls on the buyer, the economic incidence of the tax can fall on buyers (by raising the cost of the property) or sellers

[44] Stamp duty on conveyances is also levied on the transfer of insurance and motor vehicles. Stamp duty averages around 3 percent of the property value in Australia (Davidoff and Leigh 2013).

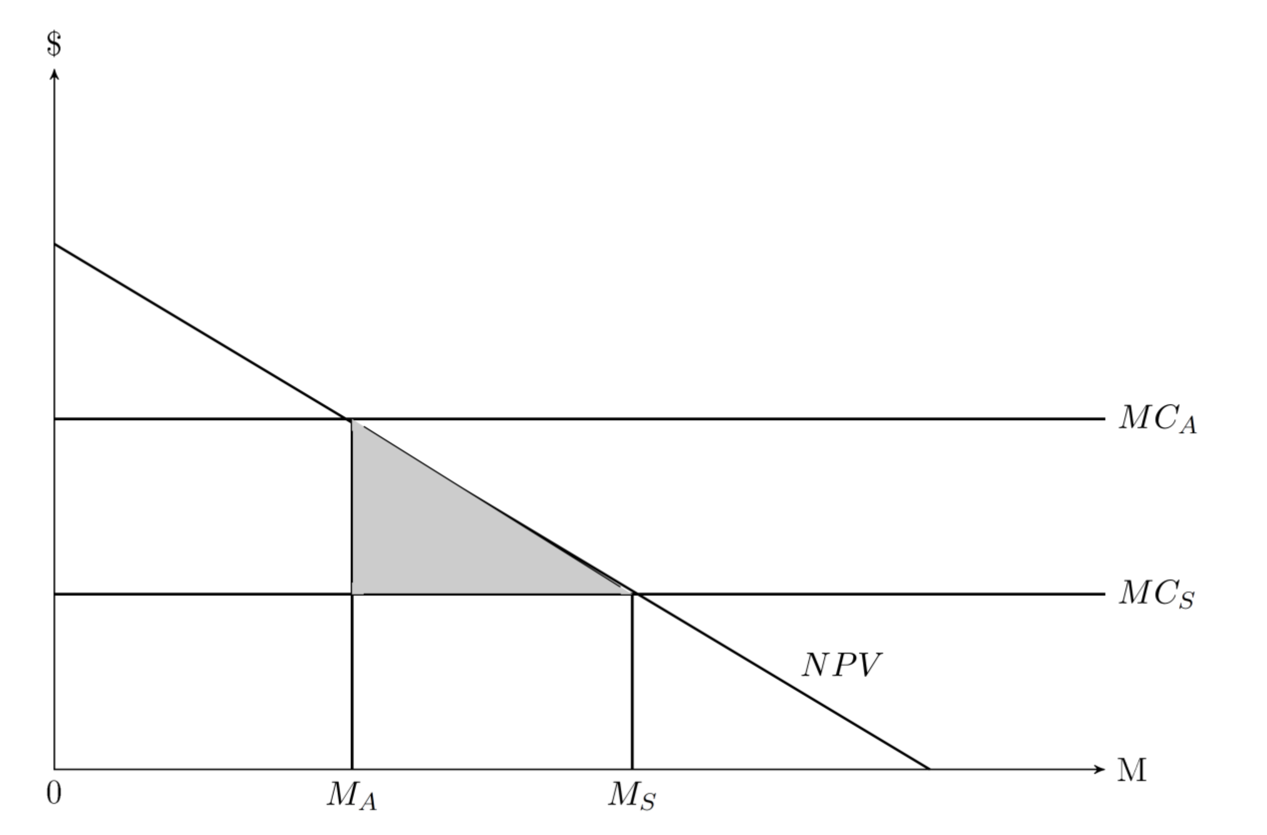
(by lowering the pre-tax sales price) or both (Henry Tax Review 2008; Davidoff and Leigh 2013). The incidence is determined by the relative elasticities of the two groups. If buyers are more price inelastic than sellers – meaning that their demand for houses is unlikely to respond (much) to increases in house prices engendered by an increase in taxes – then buyers will bear most of the tax burden. By contrast, if buyers are more price elastic than sellers, their demand for houses will decrease in response to an increase in taxes. As a result, in this second case, sellers will bear the burden of the tax and house prices will fall by the amount of the tax. In other words, if sellers bear the full burden of the tax, it will be fully capitalized into the price of the property.

In addition to house prices, stamp duties can influence homeowners' behaviour in a number of ways. First, a higher tax can increase the gap between the value of the deposit required by buyers and the value of the home being sold. The magnitude of this gap can influence buyers' decisions to purchase a home, impacting the number of transactions that occur in the property market. Second, stamp duty can impact mobility. Homeowners may be less willing to move to properties that would have been optimal for them in the absence of the stamp duty (O'Sullivan et al. 1995; Mirrlees et al. 2011). For example, people may fail to move closer to jobs and choose to regularly commute long distances. Finally, stamp duties can also generate inefficiencies in resource allocation. For example, anticipating future requirements, potential buyers may choose to buy larger/smaller properties compared to their current requirement to avoid future transactions. Existing homeowners might choose to renovate or extend their current homes instead of moving. The 'slab' structure of stamp duties can also have a negative impact on welfare because big cliff-edges in the amount of tax payable at certain thresholds may create perverse incentives to avoid payments (Mirrlees et al. 2011).

The costs associated with stamp duty can, depending on the slope of the demand curve, generate welfare loss. Such a case is depicted in Figure 23, where the net present value (NPV) or demand curve is sloping downward rather than being inelastic. A market equilibrium is reached at the optimal number of moves (M_S) where the demand equates the moving costs (MC_S). Moving costs include physical transfer costs, legal fees and stamp duties. An imposition of (or increase in) stamp duty will shift the moving cost curve upward, e.g., to MC_A. The optimal number of moves is now

M_A, determined by the intersection of NPV and MC_A curve, and is lower than the previous moving frequency. The deadweight loss (DWL) created in this hypothetical case by the stamp duty (resulting from a lower number of moves) is indicated by the shaded triangle. As evident from Figure 23, the deadweight loss can be higher or lower depending on the slope of the NPV curve and the size of the stamp duty. It remains an empirical question if there is a big, small or zero welfare loss due to stamp duty. If one finds a small to zero change in the number of transferred properties, it would imply that there is a negligible deadweight loss associated with the property transfer tax.

Figure 23. Efficiency cost of excess stamp duty depends on the slope of the demand curve



Source: Albon (1997).

Earlier theory-based studies find negative welfare effects of stamp duties. Lundborg and Skedinger (1999), using a search model, find that transaction taxes with endogenous house prices reduce welfare by creating lock-in effects. In a theoretical dynamic life-cycle model of housing demand, Nordvik (2001) finds that a transfer tax rate of 2.5 percent decreases the number of moves by the model households over the life cycle from three to one with an associated deadweight loss of 17-34 percent. Thus, perhaps unsurprisingly, studies unanimously recommend replacing stamp duties by a broad-based municipal land or property tax or by a value-added tax (see, e.g., Henry Tax Review 2008; Mirrlees et al. 2011; Wood et al. 2012; Cao et al. 2015; Freebairn 2009, 2016; Wood et al. 2016; Whelan and Parkinson, 2017).

Turning to the empirical strategy, a simple OLS model may suffer from endogeneity due to the mechanical relationship between house prices and stamp duty. In particular, the relationship between house prices and stamp duty cannot be interpreted as a causal effect of stamp duty on house prices because the amount of stamp duty that has to be paid is a function of the house price. An instrumental variable strategy can be employed to address this issue. We discuss the data specific instruments in the respective data sections.

With the appropriate instrument in place, a log-log model can be used to estimate the elasticity of house prices with respect to stamp duty. Depending on the data the model may include individual property characteristics or suburb or State level fixed effects as well as time fixed effects to capture macroeconomic common shocks. This will lead us to a general regression model shown in the following equation, a difference-in-difference style approach to estimate the elasticity:

Equation 7

$$\log(PropertyValue)_{s,t} = \beta \log(StampDuty)_{s,t} + a_s + b_t + X_{s,t}\delta + \gamma \log(PropertyValue)_{s,t-1} + \varepsilon_{s,t}$$

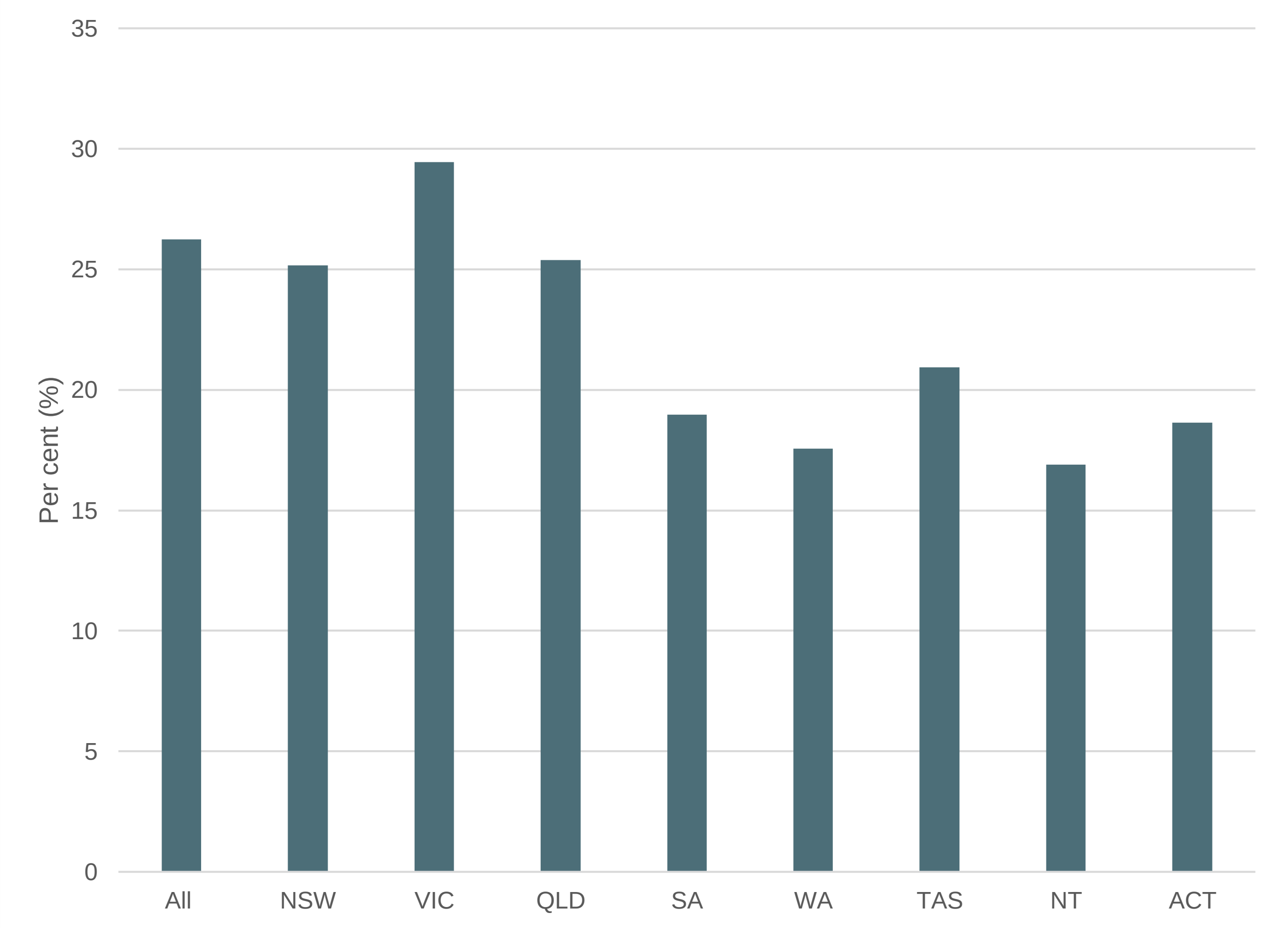
The value of sold properties, $PropertyValue_{s,t}$, in suburb s at time t is represented by a suburb-specific effect, a_s, and captures all time-invariant characteristics of relevance for sales in that suburb. A time-specific effect, b_t, controls for common shocks to the tax base across jurisdictions due to the business cycle or common changes to federal regulation. Aside from suburb effects, the estimation employs time varying locational characteristics X_{st}, such as population and/or income, which enter the model in logs. The tax rate $StampDuty_{st}$, which varies across both location and time, enters in logs in order to estimate the elasticity of sold property values in response to changes in stamp duty. ε_{st} is an error term. The varying data sources available mean that we will adjust the above general empirical specification according to the data in each respective section. For example, in some cases we only have aggregate data at the State level, in which case the suburb effects become State level effects. In other instances, we have individual sales data, in which case there may not be multiple sales for all properties and we cannot use fixed effects but would typically include many more household level controls in the regression.

Lastly, the lagged right-hand side term, *log(PropertyValue)*$_{it-1}$, included among the explanatory variables adds a time-series dimension and takes into account a simple pattern of dynamic adjustment of the tax base to changing local conditions. In this way, following Buettner (2003), we impose our specification as a partial adjustment model. The sections on the different data will specify the employed empirical strategy in more detail and discuss the choice of instrument.

5.3 States' and Territories' tax policies

In Australia, stamp duty has existed since pre-federation. Following the Second World War however, as rates of homeownership increased, death duties were progressively abolished and stamp duty rates were increased to offset the loss of revenue (Mangioni 2015). Since then, stamp duty revenue has grown due to increases in property values and bracket creep (i.e. as property values rose, the stamp duty thresholds remained unchanged). In 2016-17, stamp duties on conveyance represented about 26 percent of total State tax revenues, but this ranged from about 17 percent in the Northern Territory to nearly 30 percent in Victoria (Figure 24). However, stamp duty revenues can be volatile, since they depend on property turnover.

Figure 24. Stamp duty on property transactions as a percentage of all State tax revenue in 2016-17

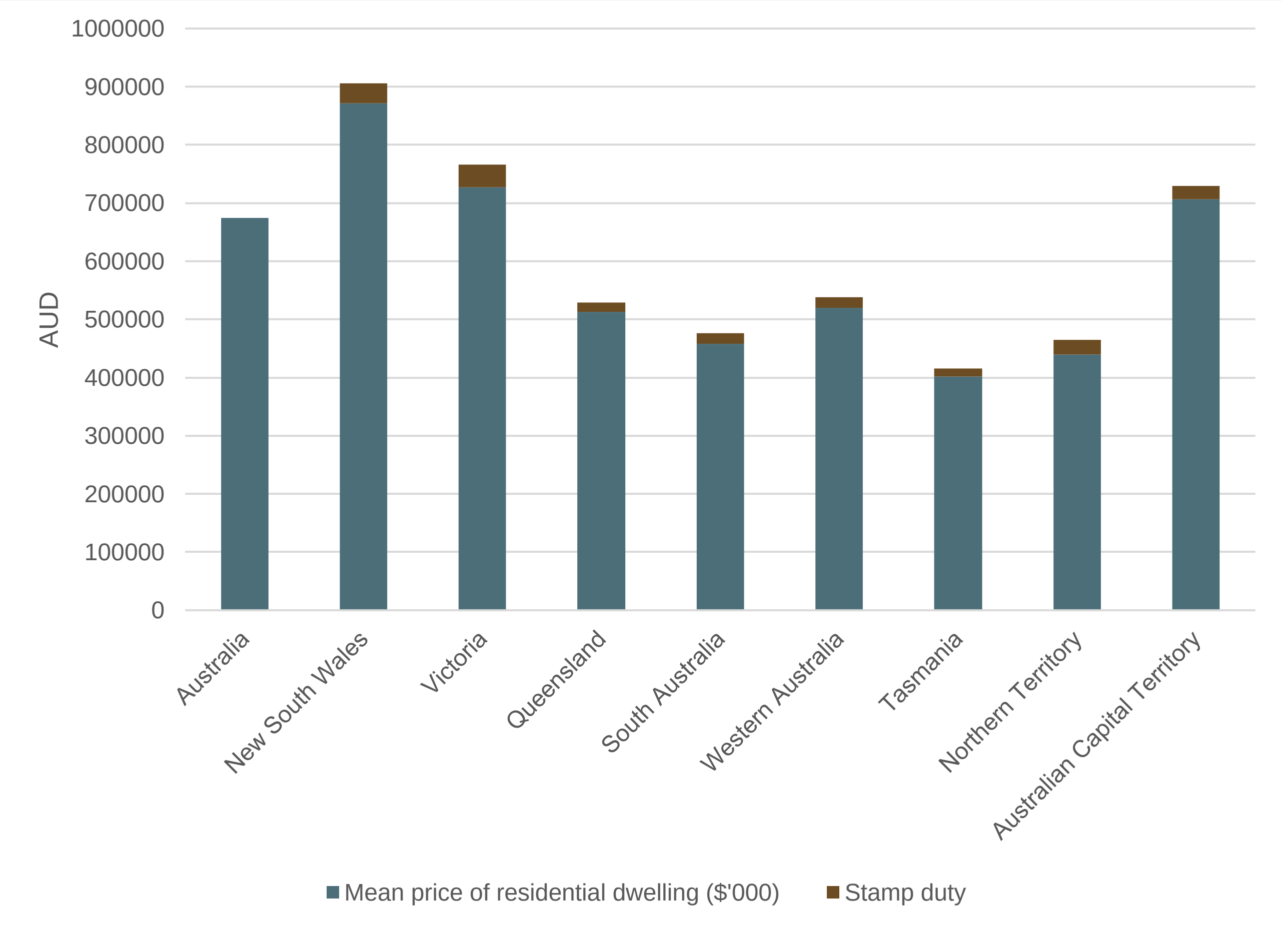


Source: ABS Government Finance Statistics, Australia, 2016-17

The difference in revenue collected from stamp duty across States is at least partially a result of differences in home values. Figure 25 presents the average price of residential dwellings in Australia by state and territory in September 2018. The average price is highest in New South Wales and lowest in the Northern Territory. This figure also shows the amount of stamp duty collected for a residential dwelling equal to the mean house price. A second difference is the variation in rates and thresholds applied by the States and Territories. Most of the States also have programs providing concessional rates for first home buyers and other groups.[45] Current stamp duty thresholds and rates on residential property by State are listed in Table 20 below.

[45] For a detail list of concessions, see the State/Territory Government websites.

Figure 25. Mean price of residential dwellings in Australia in September 2018, by State and Territory



Source: http://stat.data.abs.gov.au/Index.aspx?DataSetCode=RES_DWEL_ST#

Table 20. Stamp duty/transfer duty on residential property: thresholds and rates across States

State	Property sale price	Marginal stamp duty rate
NSW	$0 - $14,000	1.25% of property sale price
	$14,001 - $30,000	$175 + 1.50% of property sale price over $14,000
	$30,001 - $80,000	$415 + 1.75% of property sale price over $30,000
	$80,001 - $300,000	$1,290 + 3.50% of property sale price over $80,000
	$300,001 - $1 million	$8,990 + 4.50% of property sale price over $300,000
	$1 million - $3 million	$40,490 + 5.50% of property sale price over $1 million
	Over $3 million	$150,490 + 7.00% of property sale price over $3 million
VIC	$0 - $25,000	1.40% of property sale price
	$25,001 - $130,000	$350 + 2.40% of property sale price over $25,000
	$130,001 - $960,000	$2,870 + 6.00% of property sale price over $130,000
	Over $960,000	5.50% of property sale price
	$130,000 - $440,000	$2870 + 5.00% of property sale price over $130,000*
	$440,000 - $550,000	$18,370 + 6.00% of property sale price over $440,000*
QLD	$0 - $5,000	No stamp duty payable
	$5,001 - $75,000	1.50% of property sale price over $5000
	$75,001 - $540,000	$1,050 + 3.50% of property sale price over $75,000
	$540,001 - $1,000,000	$17,325 + 4.50% of property sale price over $540,000
	Over $1,000,000	$38,025 + 5.75% of property sale price over $1,000,000
SA	$0 - $12,000	1% of property sale price
	$12,001 - $30,000	$120 + 2.00% of property sale price over $12,000
	$30,001 - $50,000	$480 + 3.00% of property sale price over $30,000
	$50,001 - $100,000	$1,080 + 3.50% of property sale price over $50,000
	$100,001 - $200,000	$2,830 + 4.00% of property sale price over $100,000
	$200,001 - $250,000	$6,830 + 4.25% of property sale price over $200,000
	$250,001 - $300,000	$8,955 + 4.75% of property sale price over $250,000
	$300,001 - $500,000	$11,330 + 5.00% of property sale price over $300,000
	Over $500,000	$21,330 + 5.50% of property sale price over $500,000
WA	$0 - $120,000	1.90% of property sale price
	$120,001 - $150,000	$2,280 + 2.85% of property sale price over $120,000
	$150,001 - $360,000	$3,135 + 3.80% of property sale price over $150,000
	$360,001 - $725,000	$11,115 + 4.75% of property sale price over $360,000
	Over $725,000	$28,435 + 5.15% of property sale price over $725,000
TAS	$0 - $3,000	$50
	$3,001 - $25,000	$50 + 1.75% of property sale price over $3,000
	$25,001 - $75,000	$435 + 2.25% of property sale price over $25,000
	$75,001 - $200,000	$1,560 + 3.50% of property sale price over $75,000
	$200,001 - $375,000	$5,935 + 4.00% of property sale price over $150,000
	$375,000 - $725,001	$12,935 + 4.25% of property sale price over $375 000
	Over $725,000	$27,810 + 4.50% of property sale price over $725,000
ACT	$0 - $200,000	1.40% of property sale price or $20, whichever is greater
	$200,001 - $300,000	$2,800 + 2.40% of property sale price over $200,000
	$300,001 - $500,000	$5,200 + 3.80% of property sale price over $300,000
	$500,001 - $750,000	$12,800 + 4.78% of property sale price over $500,000
	$750,001 - $1,000,000	$24,750 + 6.30% of property sale price over $750,000
	$1,000,001 - $1,454,999	$40,500 + 6.80% of property sale price over $1,000,000
	Over $1,455,000	4.91% of the property sale price
NT	$0 - $525,000	$(0.06571441 \times V^2) + 15V$ [where V = (property sale price)/1000]
	$525,001 - $3,000,000	4.95% of property sale price
	$300,001 - $5,000,000	5.75% of property sale price
	Over $5 million	5.95% of property sale price

Note: **Only applicable to Principal Place of Residence (PPR)*

Sources: http://www.revenue.nsw.gov.au/taxes/transfer-land, http://www.sro.vic.gov.au/node/1491, https://www.qld.gov.au/housing/buying-owning-home/transfer-duty-rates, http://www.revenuesa.sa.gov.au/taxes-and-duties/stamp-duties/real-property-land, https://www.finance.wa.gov.au/cms/uploadedFiles/_State_Revenue/Duties/Schedule%20of%20Duty%20Rates.pdf, http://www.sro.tas.gov.au/property-transfer-duties/rates-of-duty, http://www.treasury.nt.gov.au/TaxesRoyaltiesAndGrants/StampDuty/Pages/Duty-Types-and-Rates.aspx,

https://www.revenue.act.gov.au/land-duties/land-duties?result_1060955_result_page=4

5.4 Data sources

This section gives an overview of the data sources we employ to estimate Australia's states' and territories' level stamp duty elasticity. The elasticity of stamp duty can be estimated by employing micro data or macro data in combination with the State and Territory stamp duty rates and thresholds discussed above.

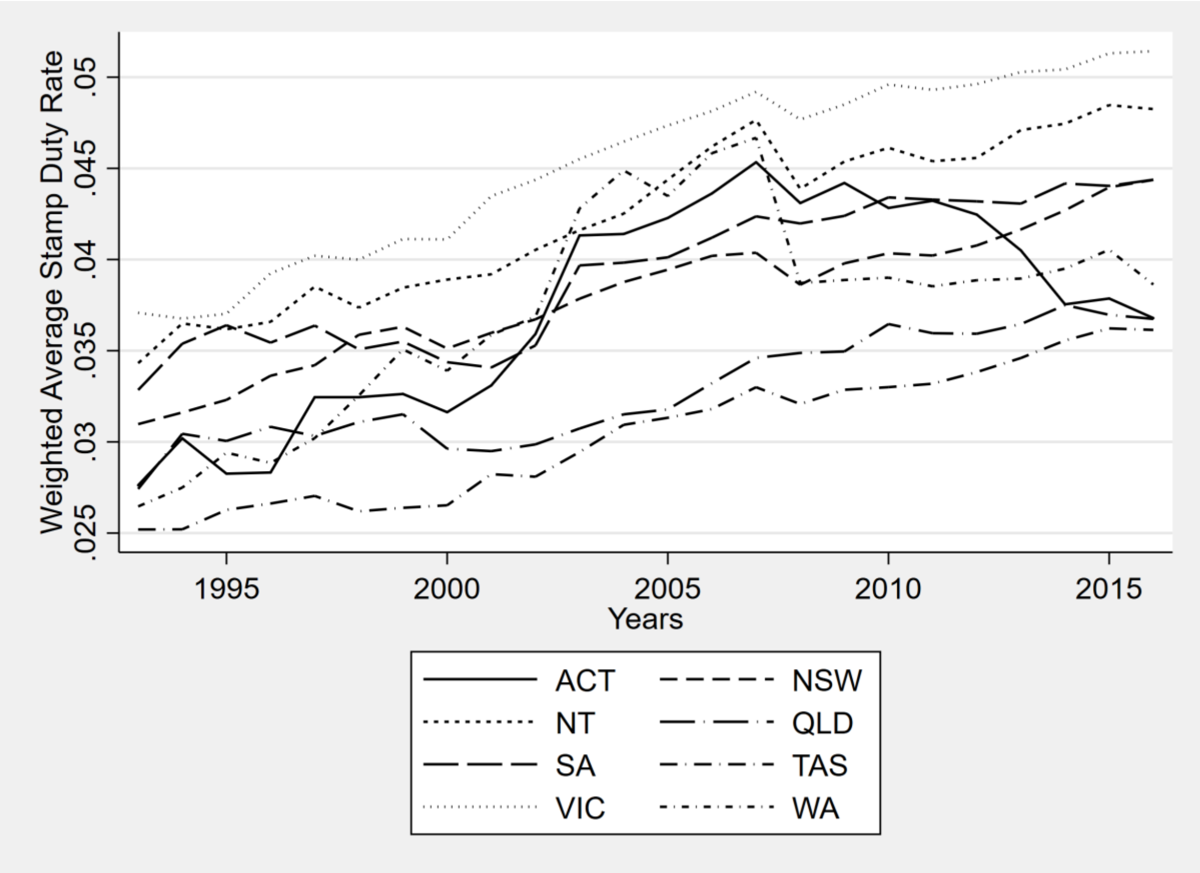
5.4.1 Historical data on statutory stamp duty rates

Data on tax rates were obtained from legal archives. Tax on sold property values is more complex than other types of tax, like insurance tax. There is no single rate for any of the States and Territories but rather a schedule of rates according to the property price. This step-wise schedule with increasing tax rates for more expensive property makes it a progressive tax. As can be seen from the schedule of taxes presented for all the states and territories in Table 20, the property transfer tax schedules vary across jurisdictions. Accordingly, we use the exact tax rate schedule to calculate the stamp duty for a specific property or suburb average.

With more aggregated data, like the CGC data source described below, we calculate a representative stamp duty tax rate. Given the data, which is disaggregated by value ranges of properties sold, we use the mean point of the upper and lower end of the range and calculate the statutory tax rate for that amount. For aggregate value data, like the State level data used in the CGC data section, we will calculate a weighted average over all value categories to get a single tax rate for a State in a given year. Where the weights are the value category total sold property values for the given year.

A visual presentation of these calculated annual rates can be found in Figure 26. As observed, most states' and territories' average stamp duty rates increased over this 24-year period from roughly 3 percent to about 4.5 percent. This is first and foremost due to bracket creep. Absent changes in the statutory rates, the progressive tax rate schedule and the strong increase in property prices during the preceding decades resulted in an increase in average stamp duty rates. We also start to spot ACT's property tax reform, which started in 2012, and Western Australia's reduction of rates across all value ranges in 2008.

Figure 26. Weighted average stamp duty rate over all sales by States and Territories, 1993 - 2016



5.4.2 CoreLogic Sales Data on suburb level

CoreLogic is the largest provider of property information in Australia.[46] CoreLogic accesses a range of government data relating to property transactions, primarily through the Valuer Generals of each State and Territory. Through the ANU Data Archive we have a comprehensive suburb level monthly panel of housing sales data available for 1990-2016. The data includes, for each suburb and month, the average sales price, the type of house and the moving average of house sales over the past year. The tax base is the value of sold properties, which we calculate as price times the number sold on a suburb level basis.

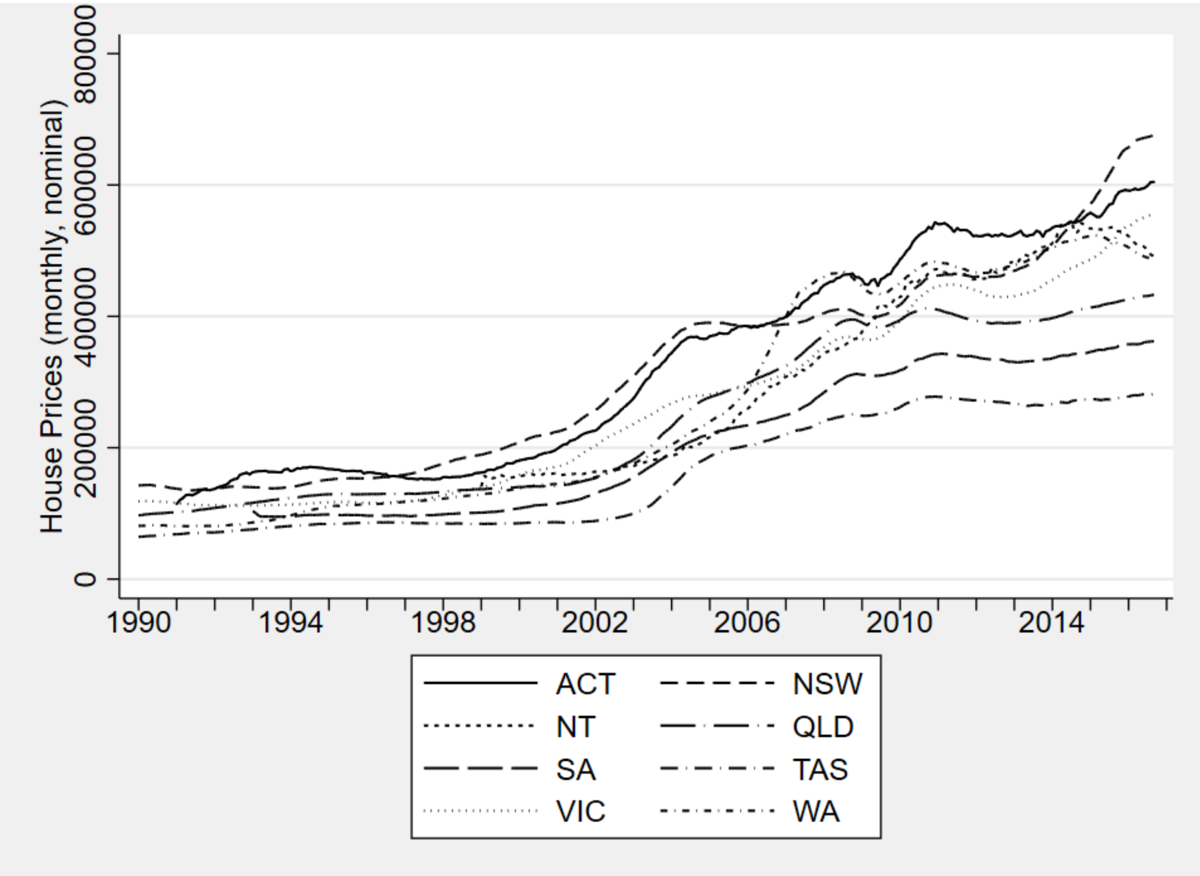
Overall, we have price data on over 2000 suburbs for 27 years for three house types, which gives us an overall sample of over 2 million observations. We will use the

[46] https://www.corelogic.com.au/about-us

combined house type of units and flats in the regressions. When analysing the monthly data, we are left with about 600,000 observations and for the analysis of the annual data we are left with about 50,000 observations.

Figure 27 gives an overview of house price trends by State in the CoreLogic data. We see a strong upward trend in the house price data: in nominal terms, in some States the average house price grew seven-fold over this long period.[47]

Figure 27. Average house price trends by State and Territory 1990-2017



Turning to the empirical strategy, as discussed in the introduction, the challenge is that the relationship between house prices and stamp duty cannot be interpreted as a causal effect of stamp duty on house prices because the amount of stamp duty that has to be paid is a function of the house price (see the progressivity discussion above). An instrumental variable strategy needs to be employed to address this issue. For this type of suburb level data Davidoff and Leigh (2013) suggest the counterfactual to be

[47] Note we are not concerned with deflating sale prices for our econometric analysis as we employ time specific effects that will account for national inflation. The ABS does not provide State level inflation series. One other avenue we have not taken is to use a price index of capital cities, but we run a specification with State-specific time effects, which accounts for differing inflation tendencies across States and Territories.

the stamp duty on an average house in a postcode area that would have prevailed if, given an initial point in time, house prices in the postcode area had developed over time according to the national trend.

Similar to Davidoff and Leigh (2013), we use postcode fixed effects to remove the initial price distribution and time fixed effects to remove national price changes. Removing observations of the initial period from the analysis sample is necessary to avoid potential problems caused by regression towards the mean. The resulting instrument identifies within-state policy changes. The instrument is considered valid because it is a counterfactual measure that has no direct effect on actual house prices. At the same time, the instrument is likely to be highly correlated with the actual stamp duty. The resulting empirical model represents a difference-in-difference type regression approach using an instrument for stamp duty. As the Corelogic data is aggregated to the suburb level, we will use the specification laid out in Equation 7 for the analysis, where the panel variable, *s*, now represents the suburb level observations. The time variable, *t*, represents months in the most disaggregated regressions or years in the annualised data.

We start with the analysis of the annual data equivalent to Davidoff and Leigh (2013) but we employ a much longer time series of 27 years and consider a finer regional (SA2) level. We then move to using the most detailed version of the Corelogic data and analyse the suburb level data on a monthly basis. The results are presented in Section Elasticity estimation5.5.

5.4.3 CGC assessment data

The CGC data for stamp duty on property sales is obtained from State Revenue Offices for both tax base and revenue. The tax base for stamp duty is based on the total value of transactions in a State over the Financial Year. The CGC obtains the data disaggregated by 16 value ranges, going in steps of $100,000 up to $1.5 million. The 16 categories of value range were introduced with the 2010 Review; previously the CGC collected data for eight ranges of property value categories. Given the five-year rolling window of data collected by the CGC, we have data for the 16 categories from the 2003-04 Financial Year onwards. We will make use of the entire sample starting with the Financial Year 1993-94 through 2016-17. This leaves us with a panel data set containing 192 State-year observations for the aggregate annual regression models and 2,432 State-value range-year observations in the disaggregated value range regression analysis.

Figure 28 through Figure 30 provide an overview of the data. Figure 28 shows the development of the value of sold property in States and Territories between 1993 and 2016. We see a strong increase in the tax base (value of sold properties) over the sample period. For example, in NSW the value of sold properties rose from around 39 billion dollars in 1993-94 to about 215 billion dollars in the Financial Year 2016-17. Figure 29 shows the revenue collected from these sold properties through stamp duty and reveals that even bigger growth is observed in revenue. For example, in NSW revenue rose from about 1.2 billion to 9.1 billion dollars over the same period.

Figure 28. Value of sold properties (tax base) in billions of dollars by state and territory, 1993 - 2016

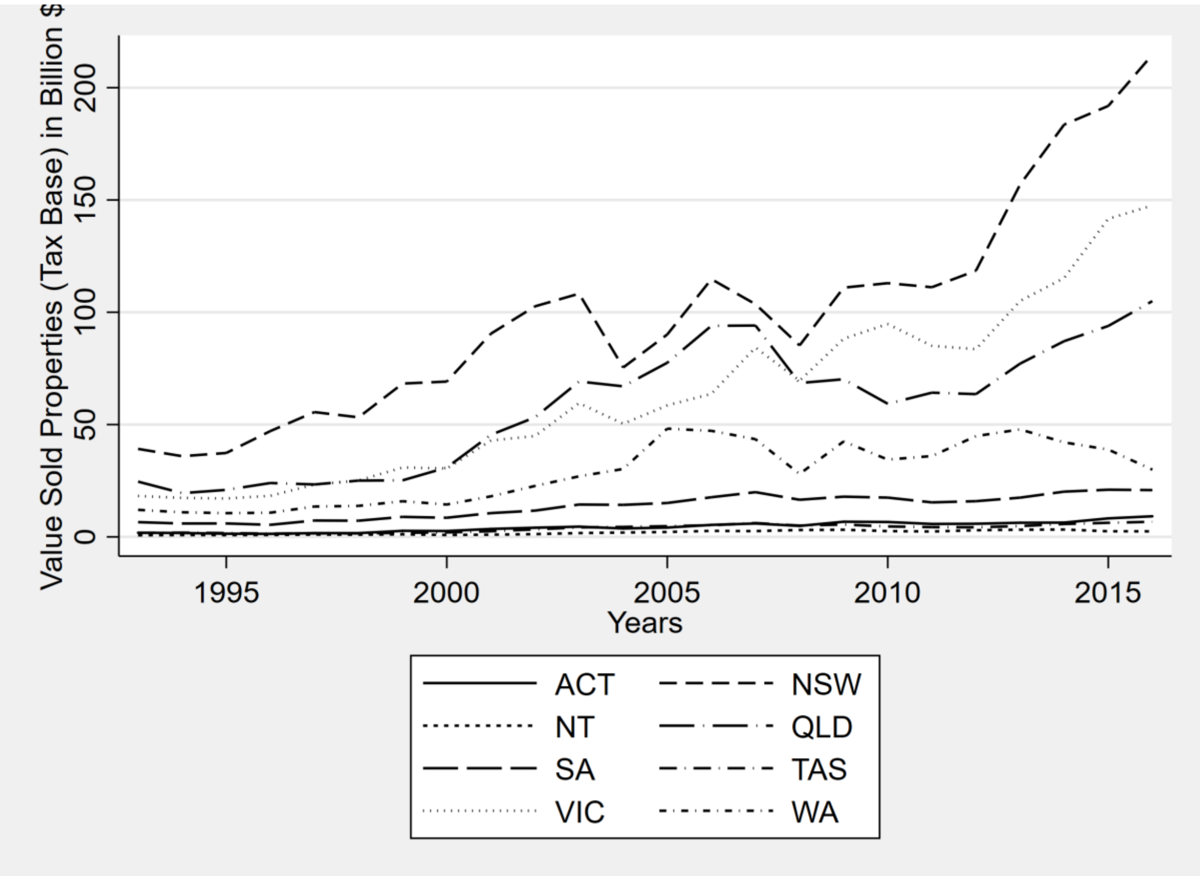
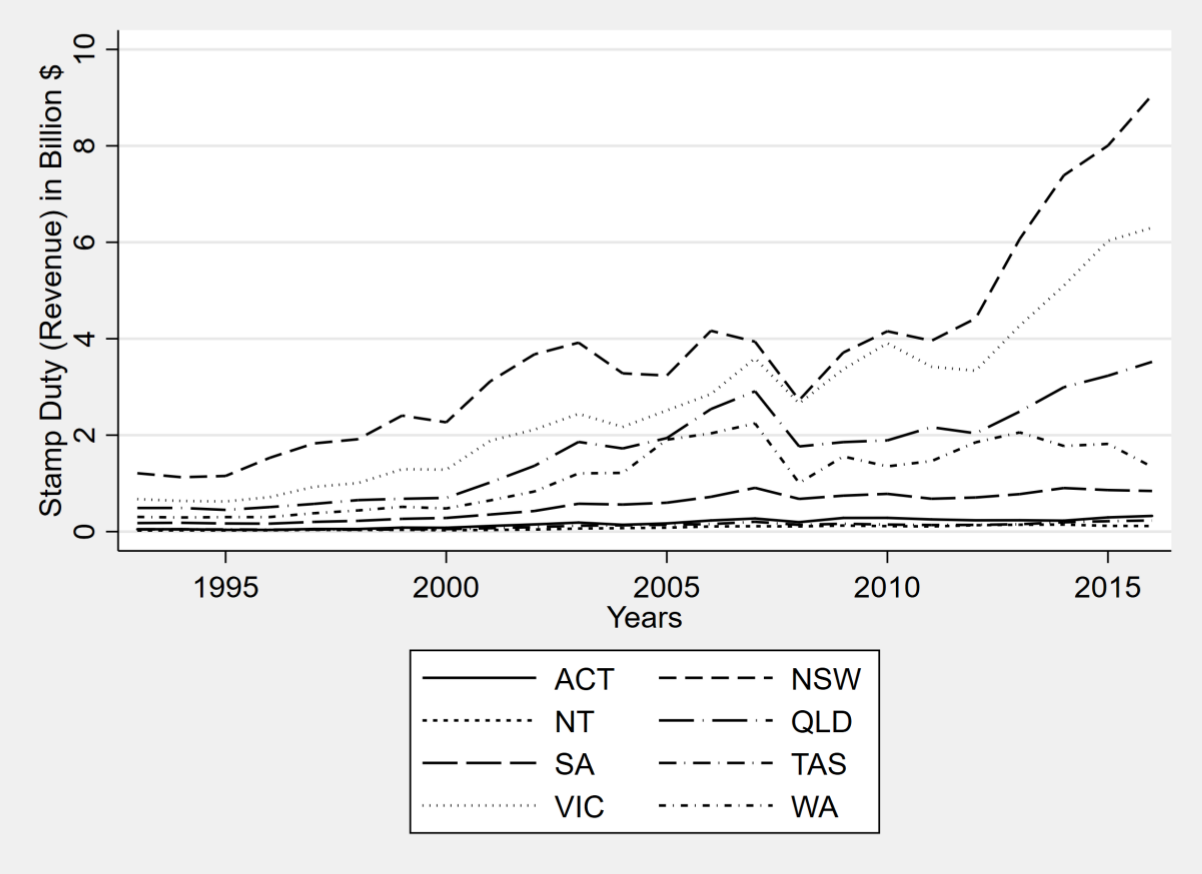


Figure 29. Stamp duty (tax revenue) in billions of dollars by State and Territory, 1993 - 2017



Since we are interested in the effect of taxes on the demand for and prices of properties, we might wonder if lowering the tax rate as done in the ACT or WA has an effect on the expenditure on properties. To shed light on the behavioural effect of the tax itself, we have to move to a regression-based analysis. We use the specification of Equation 7 for annual State level data and the value range data. In the latter case there is an extra index, *v*, in the equation for the specific value range. We will use a more conservative dummy specification by including State by value range dummies. The other control variables we employ vary on the State level basis. Adjusting this equation, we use the following model specification:

Equation 8

$$\log(PropertyValue)_{s,t,v} = \beta \log(Tax)_{s,t} + a_{s,v} + b_t + X_{s,t}\delta + \gamma \log(PropertyValue)_{s,t-1,v} + \varepsilon_{s,t,v}$$

Apart for the added index, *v*, the only other change compared to Equation 7 is the variable of interest $log(Tax)_{s,t}$. It represents the stamp duty tax rate under the assumption that it is constant across all value ranges, hence it has no index *v*. We use disposable income and population data from the ABS[48] as time varying controls in X_{st}.

One advantage of the CGC data is that we observe annual tax revenue as well as the tax base of property sales for each State. These give us the opportunity to calculate an effective tax rate that includes all exemptions (like first home buyers rebate), other rules, and special cases in the State's tax regulation, which we usually never observe in sales data. We calculate the effective tax rate by dividing State revenues by total State premiums. The derived effective tax rate is therefore a much more precise measure of taxation, including more information compared to the statutory tax rates that can be found on the States' websites. But this derived measure could potentially also introduce endogeneity.

The argument here is much less clear cut than the example in the Insurance Tax Chapter. We would need an external shock that affects some States differently, say a lower reserve bank rate which leads to more affordable loans for first home buyers (as well as other buyers) but the effect only comes through in States with lower average house prices, and is not discernible in States with higher average house prices. Under this scenario we would as a result have an increase in the value of sales for those States affected by this exogenous asymmetric shock, while at the same time, due to the first home buyers' rebate, the average effective tax rate goes down in those States. This would imply a negative correlation between the tax rate and the tax base, even though this is only a result of the asymmetric shock and tax rates have not changed. Again, this is less an issue here than in the insurance tax case, but we will include an instrumental variable estimation as robustness check, where we instrument the effective tax rate with the weighted statutory tax rate in a two stage least squares regression in order to address this potential endogeneity.

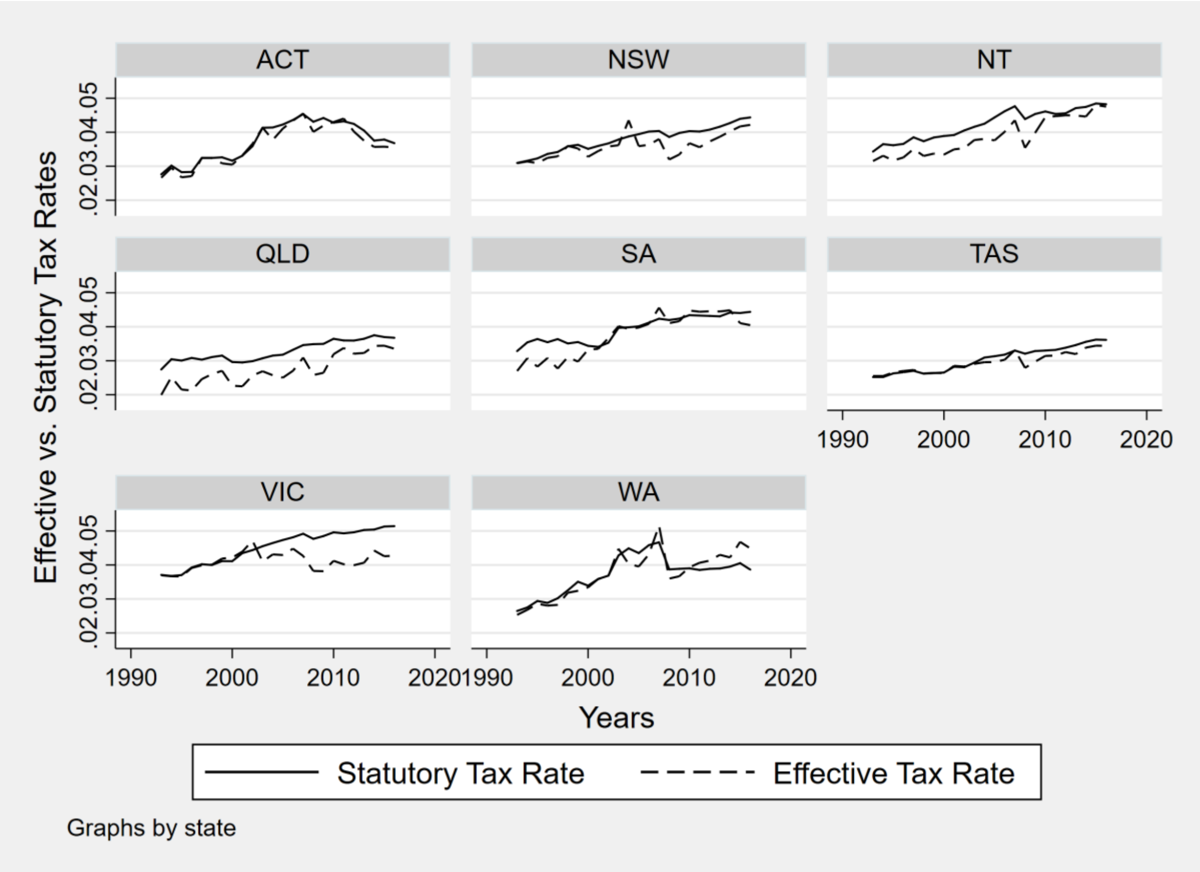
Figure 30 shows the effective and statutory tax rates for each State over time. As we can see, the effective tax rate follows, for most States and Territories, the variation in the statutory rate changes, but the effective rate picks up other fluctuations in revenue (or the tax base) that are not due to tax rate changes. There are also other sizeable divergences that might be due to exemptions, such as the first home buyers rebate. These divergences might be the explanation for the very different results we get with the statutory and effective tax rate for this form of taxation. A deeper analysis of the

[48] The disposable income and population data come from ABS Tables 65230 and 3101, respectively, and represent annual income and population estimates by State.

cause of the divergences between the effective and the statutory tax rates for some States and periods would be a valuable future research direction.

The Cragg-Donald Wald F-Statistics of the first stage regression measures the strength of the instrument. Throughout the different specifications presented in Table 24 the value of the test statistic is very high, suggesting that our instrumental variable is strong. The regression results with all relevant statistics are presented in section 5.5.

Figure 30. Comparison of effective and statutory tax rates over the sample period



5.4.4 Other data sources

We have also considered other data sources. Especially individual sales data, where we have access to sales data for the ACT over a 10-year period, but for a number of reasons this will not help in the analysis of stamp duty. Firstly, a single State analysis, in which we observe a time series rather than a panel, does not allow us to control for property market changes over time (as we have done with time fixed effects in all our models in this chapter). Figure 27 has shown the steep non-linear trend in the housing price data which, together with the fact that only infrequent, small and monotone changes are observed over the period in the stamp duty schedule, makes it hard to identify a meaningful causal relationship without time controls. Furthermore, the individual sales price, which would be the outcome variables for individual sales data, usually varies with characteristics of the property far more than with any tax. In the ACT sales data there are only a few property-specific characteristics included, which would be a problem. Moreover, even if we had a large cross State dataset of sales with with property characteristics, it would be hard to control for all factors sufficiently, such that the preferred solution would be to work with property fixed effects.

For these reasons, while a long Australia-wide panel of individual sales (with repeated sales of the same properties) would provide us with a more precise calculation of stamp duty, we may still end up preferring aggregate data on a monthly or annual basis. That is simply because without the aggregation we cannot explicitly run regressions on the tax basis, nor would we be able to use lagged variables in the way that we have done above. Despite all these arguments analysing a large panel as described above would be a valuable direction for future research.

5.5 Elasticity estimation

5.5.1 Results: CoreLogic sales data on suburb level

Adhering to the empirical strategies laid out in the data sections, we start with the annual regressions in Table 21 before presenting monthly regression results below in Table 22. The dependent variable in all the regressions is the log of the value of sold properties in a given year (or month) within a suburb.

Column 1 of Table 21 presents results for a simple analysis of the relation between tax base and stamp duty. We find a significantly positive link, which indicates that we have to be concerned that the relationship is driven by the fact that suburbs with higher house prices pay higher stamp duty due to the tax schedule.

Columns 2 through 5 use an instrumental variable (IV) to address this mechanical relationship between house prices and stamp duty. The instrument is the stamp duty that would be paid in the suburb if house prices since the first sample period had developed with the national trend. We can reject that the proposed instrument is a weak instrument given the large values for the Cragg-Donald F-Statistic in all IV models. Using the instrument in model 2 makes the stamp duty coefficient negative and significant at -0.25. This elasticity suggests that an increase in stamp duty of 10 percent will lead to a reduction in the tax base by 2.5 percent. Adding a lagged stamp duty to the model (Column 3) to capture a delayed behavioural response makes the overall (long-run) effect small: the estimated combined effect of stamp duty is -0.077 and the result is still significant. Adding a lagged dependent variable to the model (Columns 4 and 5) to address issues of autocorrelation in the dependent variable leaves the estimated stamp duty coefficient small and insignificant.[49]

Table 21. Stamp duty elasticity estimation - Corelogic suburb level annual data 1990-2017

VARIABLES	(1) No IV	(2) IV	(3) IV with Lags	(4) IV with LHS Lag	(5) IV with Lags & LHS Lag
Log(Stamp Duty) [α_1]	0.620***	-0.247***	-0.813***	0.007	-0.057
	[0.019]	[0.089]	[0.146]	[0.023]	[0.052]
Lagged Log(Stamp Duty) [α_2]			0.736***		0.082
			[0.113]		[0.050]
Lagged Log(Tax Base)				0.705***	0.702***
				[0.010]	[0.010]
Long-Run Stamp Duty Effect $\sum\alpha_i$			-0.077**		0.024
			[0.031]		[0.022]
Observations	52,084	50,023	47,918	47,918	47,918
R-squared	0.810	0.740	0.707	0.895	0.892
Number of Suburbs	2,073	2,072	2,070	2,070	2,070
Cragg-Donald F-Stat		2543	592	3891	618

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

[49] Using the log stamp duty is the standard in the literature. As a comparison with all our other calculations on different taxes, including in this chapter, we also ran these same regressions with the stamp duty tax rate as the explanatory variable. The results were qualitatively identical to those presented in the report.

Now we turn to the monthly Corelogic dataset to estimate the relation between value of sold properties and stamp duty on a monthly suburb level basis. Table 22 is structured in the same way as Table 21 above. Column 1 presents results for a tax base on stamp duty model without any instrument. The relation is again significantly positive, and we should be wary of endogeneity. Columns 2 through 5 use the same instrument as described above to address this issue. The Cragg-Donald F-Statistic in all IV models suggest again that this is indeed a very strong instrument. Employing the instrument in the model in Column 2 turns the stamp duty coefficient negative and significant with a value of -0.36. This elasticity suggests that an increase in stamp duty of 10 percent will lead to a reduction in the tax base of 3.6 percent. Adding a lagged stamp duty in Column 3 to capture a possible delayed behavioural response leaves the overall (long-run) effect unchanged, the estimated combined effect of stamp duty over 2 periods is -0.37 and significant.[50] Adding a lagged dependent variable in Columns 4 and 5 lowers the estimated stamp duty coefficient dramatically but it remains significant. The estimated long-term effect of stamp duty in column 5 is -0.008, which suggest that a 10 percent change in the tax will lead to a 0.08 percent change in the tax base.

[50] Including multiple lags of the explanatory variable is especially appropriate for the higher frequency data. We have run this specification with up to 12 lags as to be equivalent to the annual data and the results remain virtually unchanged.

Table 22. Stamp duty elasticity estimation - Corelogic suburb level monthly data 1990-2017

VARIABLES	(1) No IV	(2) IV	(3) IV with Lags	(4) IV with LHS Lag	(5) IV with Lags & LHS Lag
Log(Stamp Duty) [α_1]	0.581***	-0.359***	-0.445***	-0.004**	-0.130**
	[0.019]	[0.065]	[0.143]	[0.002]	[0.057]
Lagged Log(Stamp Duty) [α_2]			0.079		0.122**
			[0.115]		[0.057]
Lagged Log(Tax Base)				0.972***	0.974***
				[0.001]	[0.001]
Long-Run Stamp Duty Effect $\sum\alpha_i$			-0.366***		-.008***
			[0.0665]		[0.0018]
Observations	594,027	593,536	590,949	591,692	590,812
R-squared	0.797	0.708	0.706	0.989	0.988
# of Suburbs	2,073	2,073	2,073	2,073	2,073
Cragg-Donald F-Stat		33000	4217	47000	4235

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

5.5.2 Results: CGC assessment data

Table 23 and Table 24 present results for the estimation using the CGC assessment data in aggregate annual form. Table 25 and Table 26 present results for the disaggregated data at value range.

All models presented in Table 23 and Table 24 include time and State fixed effects.[51] Model specifications become richer and more complex as we move in the table from left to right. While Table 24 presents results using an instrument for the tax rate, we start with Table 23, which analyses the connection between sale value and the effective tax rate. The results of the most basic elasticity specification can be found in Column 1 of Table 2, which shows the estimated effective tax rate elasticity without

[51] Due to space considerations and in favour of clarity we again omit results for the time fixed effect coefficients from the results table.

any controls. The estimate suggests a significantly negative relationship with an elasticity of -0.44. As we go from Column 1 through to Column 4, we gradually add more controls to address concerns about autocorrelation and to account for differences in States' trends in disposable income and population over the 20-year period of the sample.

Column 2 introduces a lagged dependent variable to the model to control for dynamics in the samples. As a result, the tax elasticity declines (in absolute terms) to -0.33 and stays significant as the error term similarly reduces as well. Including a control for State-specific population growth in Column 3 leaves the elasticity estimate unchanged. Finally, in Column 4, controlling for all three variables, including the State-specific trend in growth of disposable income, the tax elasticity further diminishes to -0.29. We observe that when gradually adding more controls in the last three columns, the estimate remains fairly robust at around -0.3, which indicates that when the stamp duty increases by 10 percent the total value of sales will decline by 3 percent.

Table 23. Elasticity of stamp duty - effective tax rate estimations in logs

VARIABLES	(1) Effective Tax Rate	(2) Effective Tax Rate	(3) Effective Tax Rate	(4) Effective Tax Rate
Log(Tax Rate)	-0.435***	-0.334***	-0.333***	-0.292***
	[0.143]	[0.104]	[0.104]	[0.107]
Lagged Log(Tax Base)		0.754***	0.755***	0.763***
		[0.055]	[0.057]	[0.057]
Log(Income)				-0.357
				[0.239]
Log(Population)			-0.027	0.098
			[0.234]	[0.247]
Observations	192	184	184	184
R-squared	0.930	0.964	0.964	0.965
Number of States	8	8	8	8

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

As discussed in the data section, there are concerns about endogeneity with regards to the effective tax rate as it is calculated on the basis of tax income and sale values. Therefore, we present regression results based on an IV approach in Table 24. We instrument the effective tax rate with the weighted average statutory stamp duty rate.[52] An IV approach is applied to all models in Table 24. Using the IV specification, the elasticity estimate becomes positive and insignificant for all models, suggesting no clear effect. The F-statistic for the Cragg-Donald weak identification test are between 64 and 75 for the first stage, suggesting that the instrument is not weak. As mentioned above, a better understanding of the nature of the difference in the two tax rate measures would be a useful direction for research.

Table 24. Elasticity of stamp duty - IV estimations (statutory tax as instrument for effective tax)

	(1)	(2)	(3)	(4)
VARIABLES	Tax Rate IV	Tax Rate IV	Tax Rate IV	Tax Rate IV
Log(Tax Rate)	0.347	0.095	0.079	0.138
	[0.289]	[0.200]	[0.189]	[0.198]
Lagged Log(Tax Base)		0.766***	0.771***	0.783***
		[0.057]	[0.060]	[0.060]
Log(Income)				-0.606**
				[0.267]
Log(Population)			-0.080	0.134
			[0.245]	[0.259]
Observations	192	184	184	184
R-squared	0.919	0.961	0.961	0.962
Number of States	8	8	8	8
Cragg-Donald F-Stat	64	64	75	71

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

We next turn to the more disaggregated CGC data where we have value ranges as an extra dimension, *v*. We now have 176 State-value-range dummies, as each State's

[52] See details about the construction of the variable in the data section 5.4.1.

value range has its own fixed effect (instead of eight State fixed effects as in the models above), and similarly many more observations. The tables are built in the same way as above. First, Table 25 presents the results without any instruments followed by IV regression results in Table 26.

The results of the basic elasticity specification can be found in Column 1 of Table 25 with the estimated effective tax rate elasticity, without any controls, being large and significant at -1.04. As we go from Column 1 through to Column 4 we gradually add more controls to address the aforementioned concerns. In Column 2, reporting results from a model with lagged dependent variable, the tax elasticity declines (in absolute terms) to -0.44 but stays highly significant. Including further controls for State income and population growth in Columns 3 and 4 leaves the estimated elasticity virtually unchanged at about -0.43. We observe that when adding controls in the last three columns, the estimate remains fairly robust at around -0.43 which implies that when the stamp duty increases by 10 percent the total value of sales will decline by 4.3 percent.

Table 25. Elasticity of stamp duty - effective tax rate estimations at value range level

	(1)	(2)	(3)	(4)
VARIABLES	Effective Tax Rate	Effective Tax Rate	Effective Tax Rate	Effective Tax Rate
Log(Tax Rate)	-1.042***	-0.440***	-0.424***	-0.432***
	[0.180]	[0.121]	[0.122]	[0.122]
Lagged Log(Tax Base)		0.797***	0.798***	0.798***
		[0.021]	[0.021]	[0.020]
Log(Income)			-0.731***	-0.635***
			[0.184]	[0.210]
Log(Population)				-0.413
				[0.348]
Observations	2,432	2,256	2,256	2,256
R-squared	0.273	0.788	0.790	0.790
Number of State-Value-Range	176	176	176	176

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

We present regression results based on an IV approach at the value range level in Table 26. We instrument the effective tax rate with the average value range statutory tax rate. The IV approach is applied to all models in Table 26. Using the IV specification, the elasticity estimate becomes positive and insignificant for all models. The F-statistic for the Cragg-Donald weak identification test are between 60 and 77 for the first stage, suggesting that the instrument is not weak. As suggested above, more research is needed to understand the difference between the results with and without the instrument.[53]

[53] It could be that that the instrument successfully eliminates a spurious correlation between the effective tax rate and the tax base. On the other hand, it remains possible that the above constructed weighted average statutory tax rate misses some important tax properties or introduces a bias due to its construction (see discussion in Section 5.4.3).

Table 26. Elasticity of stamp duty - IV estimations (statutory as instrument for effective tax) at value range level

VARIABLES	(1) Tax Rate IV	(2) Tax Rate IV	(3) Tax Rate IV	(4) Tax Rate IV
Log(Tax Rate)	0.884	0.159	0.129	0.094
	[1.271]	[0.216]	[0.211]	[0.224]
Lagged Log(Tax Base)		0.823***	0.822***	0.821***
		[0.022]	[0.022]	[0.021]
Log(Income)			-0.885***	-0.839***
			[0.169]	[0.202]
Log(Population)				-0.160
				[0.324]
Observations	2,432	2,256	2,256	2,256
R-squared	0.122	0.772	0.776	0.778
Number of State-Range	176	176	176	176
Cragg-Donald F-Stat	60	73	77	73

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

5.6 Comparing the elasticity results to estimates from the domestic and international literature

There are no studies in the literature that estimate the tax base elasticity of property taxes directly, which makes a direct comparison of the results in this chapter difficult. There are however limited studies that consider the impact of stamp duty on the value and number of property transactions in Australia and internationally which we will discuss here.

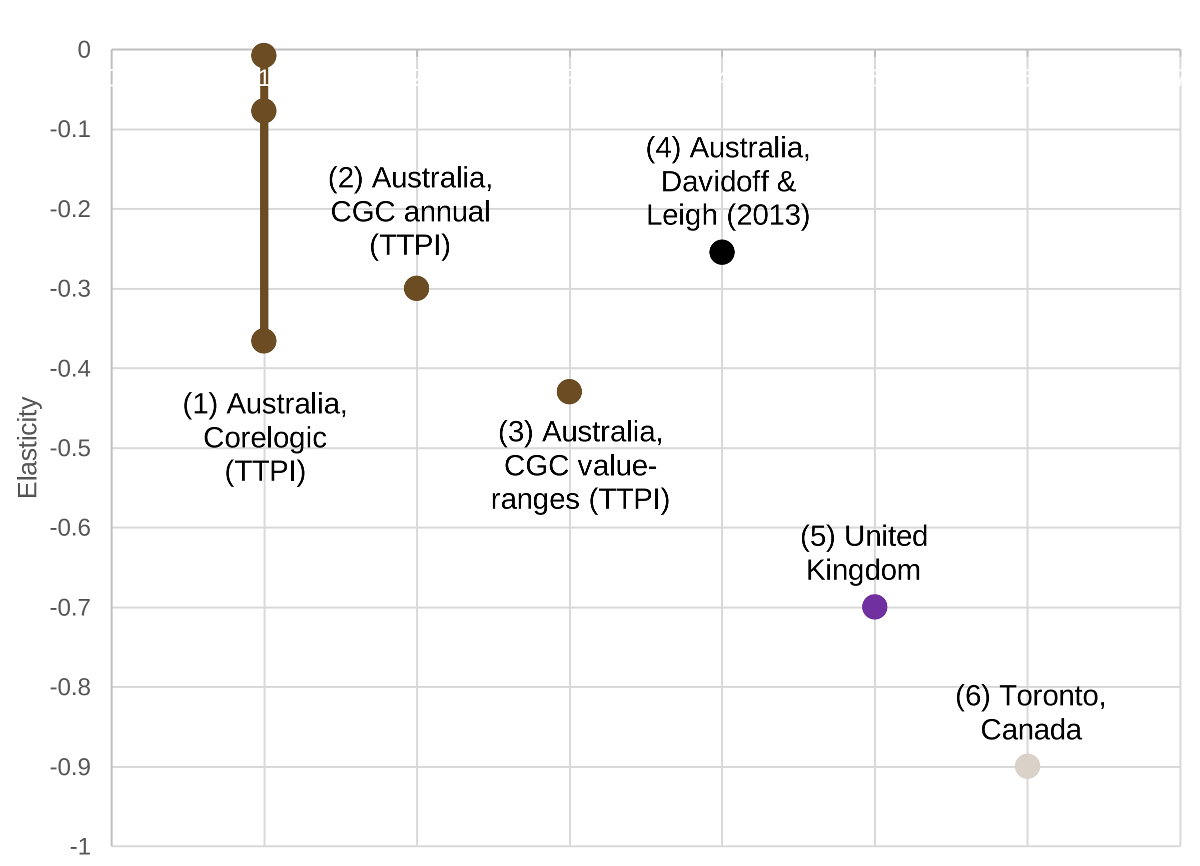
Davidoff and Leigh (2013) is the best known recent domestic study that evaluates the effect of stamp duty on property prices and the number of property transactions in Australia. Using data from 1995 to 2005 (with some variation by State), they estimate the impact of stamp duty on house prices and the number of homes sold. Using an IV approach, the authors find that stamp duty lowers house prices. In particular, they find that a 10 percent increase in stamp duty lowers house prices by about 2.5 percent in the first year (Figure 31). Since stamp duty, on average, represents 4 percent of the price, the decrease in house prices suggests that sellers bear the full burden of the tax.

Other international studies also consider the effect of changes in stamp duty on housing transactions, property prices and welfare. For example, in the United Kingdom, in the wake of the global financial crisis, stamp duty was temporarily reduced by 1 percent of the purchase price for transactions (property sales) valued at 175,000 GBP or less. Using a difference-in-difference design, Besley et al. (2014) study the impact of the stamp duty holiday and observe that, on average, a one percent cut in stamp duty lowers house prices by 0.70 percent (Figure 31). They find that buyers and sellers partially share the tax burden.

Among other international studies, Dachis et al. (2012) also exploit a natural experiment arising from Toronto's imposition of a Land Transfer Tax in early 2008 to estimate its impact on the market for single-family homes. They find that housing prices declined by about the same amount as the tax, implying that the tax was fully capitalised into the price.

Looking at turnover, the Australian and international literature conclude that stamp duty reduces the number of transactions that occur. However, the extent to which the number of transactions declines varies by country. Davidoff and Leigh (2013) find that a 10 percent increase in stamp duty in Australia lowers turnover by 3 percent in the first year and by 6 percent over a 3-year period. Besley et al. (2014) consider the impact of the stamp duty holiday in the UK on the number of property transactions and estimate that it resulted in an 8 percent increase in property transactions. While this is higher than the estimate for Australia (in absolute value), the authors acknowledge it is likely an upper limit given the temporary nature of the stamp duty reduction. In Toronto, Dachis et al. (2012) found that 1.1 percent stamp duty caused a decline of 15 percent in the number of sales. Hui and Liang (2015) also confirm that stamp duties in Hong Kong significantly lower the overall number of transactions in the property market.

Figure 31. Change in property prices in response to a 1 percent increase in stamp duty, selected countries



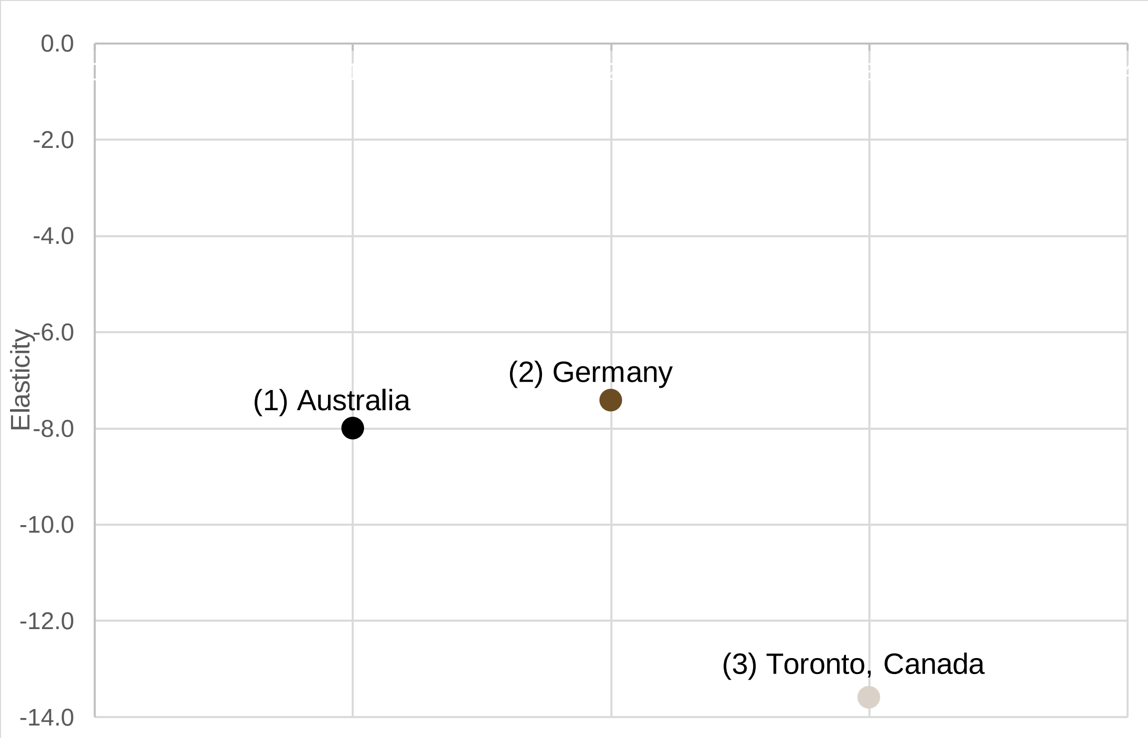
Notes:

1) Each point on the graph represents and elasticity calculated in one of the studies.

Source: Authors' compilation based on review of the academic literature. The specific studies included in this graph can be provided upon request.

Turning to the impact of a change in the stamp duty tax rate, in Germany, Fritzsche and Vandrei (2018) consider the impact of changes in the real estate transfer system. Prior to 2006, German States all had the same rate. Since then however, States could set rates independently. Exploiting the variation in the changes in the real estate transfer tax rates between 2006 and 2014, the authors find that a one percentage point increase in the stamp duty tax rate decreases the number of transactions for single family homes by about 7 percent. This estimate is in line with that calculated for Australia by Davidoff and Leigh (2013) who find that a 1 percentage point increase in the stamp duty tax rate (from 3.3 percent to 4.3 percent in 2005) lowers sales by about 8 percent (Figure 32).

Figure 32. Change in the number of property transactions in response to a 1 percentage point increase in the stamp duty tax rate, available countries



Notes: (1) Each point on the graph represents and elasticity calculated in one of the studies.

Source: Authors' compilation based on review of the academic literature. The specific studies included in this graph can be provided upon request.

Other studies which evaluate the impact of stamp duty consider its effect on other factors such as welfare or mobility. For example, Buettner (2017) finds that State-level stamp duties in Germany lead to a substantial welfare loss. The author's preferred estimate indicates that an additional Euro of revenues raised through this tax is associated with an increase in the deadweight loss of about 67 cents, a large economic cost. Among other studies in the UK, Hilber and Lyytikainen (2017) exploit a discontinuity in the tax schedule of homeowners with self-assessed house values on either side of a cut-off value at which the tax rate jumps from 1 percent to 3 percent. They find that a higher stamp duty negatively affects housing-related and short distance moves but does not affect job-induced or long-distance mobility. These results suggest that transfer taxes distort housing markets rather than labour markets.

Ommeren and Leuvensteijn (2005) demonstrate that transaction costs negatively affect an owners' probability of moving in the Netherlands. In particular, as a percentage of the value of the residence, a one percentage point increase in the value of transaction costs decreases residential mobility rates by 8 percent. Work on stamp duty has also been done in the US. For example, Kopczuk and Munroe (2015) examine the ‘mansion tax’, a variant of stamp duty applied in New York, and find that both buyers and sellers have strong incentives not to transact near the threshold above which the tax applies. They observe that the effect of the mansion tax falls on the seller and may exceed the value of the tax.

5.7 Conclusion

Property transaction tax, also commonly known as stamp duty, is a State tax that is payable on the sales price of a property. Across the States and Territories, the statutory tax rates applicable follow different schedules with varying value ranges and tax rates. Most of the States also have programs providing concessions for first home buyers and other groups. Conveyance duty is one of the most important State taxes. In 2016-17, revenues from this tax represented about a quarter of total State tax revenues.

This chapter assessed the change in the value of sold properties (tax base) in response to a change in stamp duty using sales data by Corelogic and aggregated States’ revenue and tax base data collected by the CGC. According to the CGC data, a 10 percent percent increase in the tax rate will reduce the overall value of sold properties by 3-4 percent. This is a relatively large effect for a tax which is on average about 4-5 percent of the sales price of the house, but we note that this includes the extensive as well as intensive margin, that is, both changes in prices and in quantity of houses sold. The results are also comparable to the literature which calculates results of the same magnitude for the price changes (see Figure 31).

Using Corelogic sales data we find effects of 0.1-3 percent on the value of sold properties for a 10 percent tax change depending on the specification chosen. More research is needed to pin down the estimate further within the properties of this large sales data set, as mentioned above the analysis of a large panel of cross States individual sales data would be a useful research direction.

While these estimates are based on a number of calculations using data with different levels of aggregation, each with its advantages and shortcomings, the results are similar to the lower end of findings in the existing international and domestic literature on price effects of taxation. We note the estimates of the pure effect on prices are only a lower bound of the overall behavioural effect on the tax base (which includes any effects on quantity), suggesting that our estimate for the elasticity given the institutional data of about -0.3 represents a plausible and, within the literature, conservative measure of the behavioural effect of the tax rate on the tax base.

6. Land Tax

6.1 Introduction

Land is potentially one of the most efficient tax bases since it is by definition immobile and fixed in supply. It is imposed on landholders for the value of the land they own. In theory, an efficient land tax would apply to all forms of land ownership. By doing so, a lower rate could be applied to a broader tax base and distortions introduced by exempting some land from taxation could be avoided. In practice, however, the jurisdiction(s) responsible for levying land tax, the concepts used to assess and value land, and exemptions to the land tax base vary within and across states and territories in Australia. The implementation of land tax also varies in these three dimensions internationally as well.

In Australia, while a land tax has operated since 1884, the level of government responsible for its collection has changed over time (Mangioni 2015). Between 1788 and the late 1880s, it was administered by the colonies (the future states) at the state and local levels. Following federation, all three levels of government administered the tax until 1910, when the states stopped collecting it. In 1952 however, the authority to collect land tax reverted back to the states and local governments. The states and local councils have retained the authority over land taxation ever since.

The valuation techniques applied to land across the different jurisdictions within Australia also vary. Internationally, the following three broad categories of valuation most frequently are used to define the value of land: capital-improved value (CIV); income or annual rental value (ARV); or land or site value (LV or SV). Capital-improved value refers to the market value of the land, buildings, and any other improvements made. Annual rental value refers to an estimate of the value that a landlord would receive if she rented her property at market rates. Land or site value generally refers to the value of the land, without buildings, but including improvements like filling, excavation, retention and services to the land. Across a summary of 122 countries, nearly half use CIV (43 per cent), one-third ARV, and about 13 per cent use LV or SV. Some Australian states and territories also apply a fourth category of valuation:

unimproved capital value (UCV).[54] UCV is similar to LV/SV in that it excludes buildings on land, but unlike LV/SV, it also excludes any improvements made to the land in terms of soil fertility, excavation, or retention. Urbanisation however, has gradually reduced the relevance of the UCV as increasingly less land remains undeveloped.

Looking at the exemptions to the land tax base in Australia, these differ depending on whether the jurisdiction in question refers to the state and territory level or the local level. At the state and territory level, the exemptions are similar and generally apply to the primary residence, primary production, and investment properties below a specific threshold (which varies by jurisdiction). These regulations exempt at least 80 per cent of *property owners*, resulting in an extremely narrow tax base (Mangioni 2015). By contrast, local government land taxes apply hardly any exemptions, resulting in coverage that extends to at least 98 per cent of all *property owners* (Mangioni 2015).

The differentiation between state and local land taxes is that while the former provides a source of general revenue, the latter is hypothecated for the provision of local infrastructure. This distinction is further emphasized by the difference in nomenclature used to refer to land taxes levied by the state or territory or the local government. While land taxes levied by the states or territories are referred to as “land tax”, those levied on land by local governments are often referred to as “local or municipal rates”. Since the scope of research for the purposes of the CGC is limited to the tax bases of states, the remainder of the chapter will use “land tax” to refer to those taxes on land levied exclusively at the state or territory level.

This chapter presents an empirical assessment of the extent to which the demand for land in Australia is sensitive to changes in the land tax rate applied (also referred to as the elasticity of demand for land in response to changes in land taxes). First, a brief overview of the economic theory of land taxation is provided and followed by a summary of the current rates in place in different states and territories in Australia. Then estimates of the elasticity the demand for land in response to changes in land taxes are provided alongside a description of the data sources applied for the calculation. Finally, to provide a comparative benchmark, these results are compared

[54] The value of land in its natural state is typically referred to as ‘unimproved capital value’. Including the value of improvements made to that land, such as clearing and earthworks, is referred to as the ‘site value’. In both cases, the value of any buildings and structures built on the land is excluded from the tax base (Gabbitas and Eldridge 1998). In contrast, property taxes are usually based on the assessed market value of developed properties (Arnott and Petrova 2006).

to estimates calculated in studies from the academic literature in Australia and internationally.

6.2 Theoretical background and empirical strategy

There are certain characteristics of land that make it a particularly attractive tax base. First, since land is immobile, by definition, it cannot move itself to a destination with a higher investment return. Second, there is a fixed supply of land (i.e. Australia cannot geographically expand to create more land) and this supply cannot change in response to a change in taxes (i.e. Australia will not shrink if land tax increases). Since the supply of land is fixed and immobile, an increase in the rate of land taxation can only affect the price of land, not the quantity available or used. Finally, from an administrative perspective, the immobility and fixed supply of land make it a particularly effective tax, since it is difficult to evade (even if the land valuation can make it costly to administer). These characteristics lower the economic costs (distortions in behaviour) associated with taxation and are reflected by a low marginal excess burden (MEB), indicating that land taxes are more efficient than many other State taxes (Albon 1997, Freebairn 2002).

The efficiency of a land tax however, depends on the magnitude of the exemptions which apply. Exemptions narrow the tax base and, in theory, should not apply, since their introduction distorts land-owners' decisions regarding both the type of land to purchase and the best use of their existing land holdings. For example, if an exemption applies to owner-occupied homes (i.e. land tax only applies to investment properties), then an investor may choose to invest in a different type of asset with a higher after-tax return. Similarly, if an investor already owns land and knows that certain types of land use are exempt from tax, she may change the particular use of her land. Finally, exemptions can also change the distribution of the economic incidence of land tax. Under a broad-based land tax, owners bear the cost of the tax in the form of lower land values. Prospective land buyers will reduce the amount they are willing to pay by the expected value of the future land tax payments. By contrast, if some forms of land are untaxed, there is scope for the incidence to be distributed differently between the buyer and the seller. For example, a landlord could pass some or all of the land tax onto the rental payments paid by tenants.

The definition of land value applied also affects the efficiency of a land tax. For example, taxing improvements made to land and/or buildings built upon land could disincentivize investment and home improvements. In an early study, Pollock and Shoup (1977) find that a shift from general property taxation toward site value taxation can raise the degree of capital intensity of land. Recent work by the Productivity Commission (2017) concludes that there is a strong case to collect taxes based on unimproved land value. In this way, maximising land tax revenue and abolishing other taxes could minimise economic distortions (Ingles 2016).

While a potentially efficient tax base however, land tax is not necessarily the most targeted means to ensure the vertical equity of the tax system. While the states and territories with land tax set the rates progressively – higher rates at higher land values – land value reflects part, but not all, of the total wealth of a taxpayer. It also may not correlate with her actual income, which can vary over an individual's lifetime. For example, a young person's income likely exceeds their wealth, whereas a retiree's wealth likely exceeds their income (once they've saved for retirement and finished paying their mortgage) (Mangioni 2015). Moreover, in the case of Australia, where land tax exemptions apply to owner occupied housing, land taxes could actually be regressive since low-income households are less likely to be homeowners and land tax may be passed through to them by landlords through rent payments (Gabbitas and Eldridge 1998).

Turning to the empirical strategy, a simple OLS model may suffer from endogeneity due to the mechanical relationship between unimproved value and land tax. In particular, the relationship between property value and land tax cannot be interpreted as a causal effect of land tax on property values because the amount of tax that has to be paid is a function of the property value. An instrumental variable strategy can be employed to address this issue. We discuss the data specific instruments in the respective data sections. With the appropriate instrument for the tax in place, a log-log model can be used to estimate the elasticity of unimproved/site values with respect to land tax.

From a theoretical point there are two main mechanisms through which land tax can have an effect on the tax base. One is through an increase in the type of property that is included in the land tax base, like an increase in investment properties. This could happen contemporaneously. That is, similar to all other taxes considered in this report, we would expect a behavioural effect following the introduction of a new tax schedule which would be reflected in the market outcome and observed in the data.

The other mechanism is through a change in property prices. Land value (unimproved or site value) is not determined as a market outcome, as is the case with sold property prices or insurance purchases. The effect of land tax on residential property would work through a delayed reaction to sales prices of built properties and empty land. The State's Valuer General determines the values on the basis of past sales in a complex methodological way. To determine the land value, States either take the value at a certain time of the year or the average value over the last three years (Henry Tax Review 2008).

To capture this possible delayed effect, we will implement a lagged explanatory variable specification. The lag could be one or more years. The elasticity estimates estimated in this chapter are presented to show their robustness to different lag length of the independent tax rate variable as well as to the usual inclusion of controls and dynamic specification. This leads to a general regression model shown in the following equation, a difference-in-difference style approach to estimate the elasticity:

Equation 9

$$\log(UCV)_{s,t} = \beta_1 \log(tax)_{s,t} + \beta_2 \log(tax)_{s,t-1} + \cdots + a_s + b_t + X_{s,t}\delta + \gamma \log(UCV)_{s,t-1} + \varepsilon_{s,t}$$

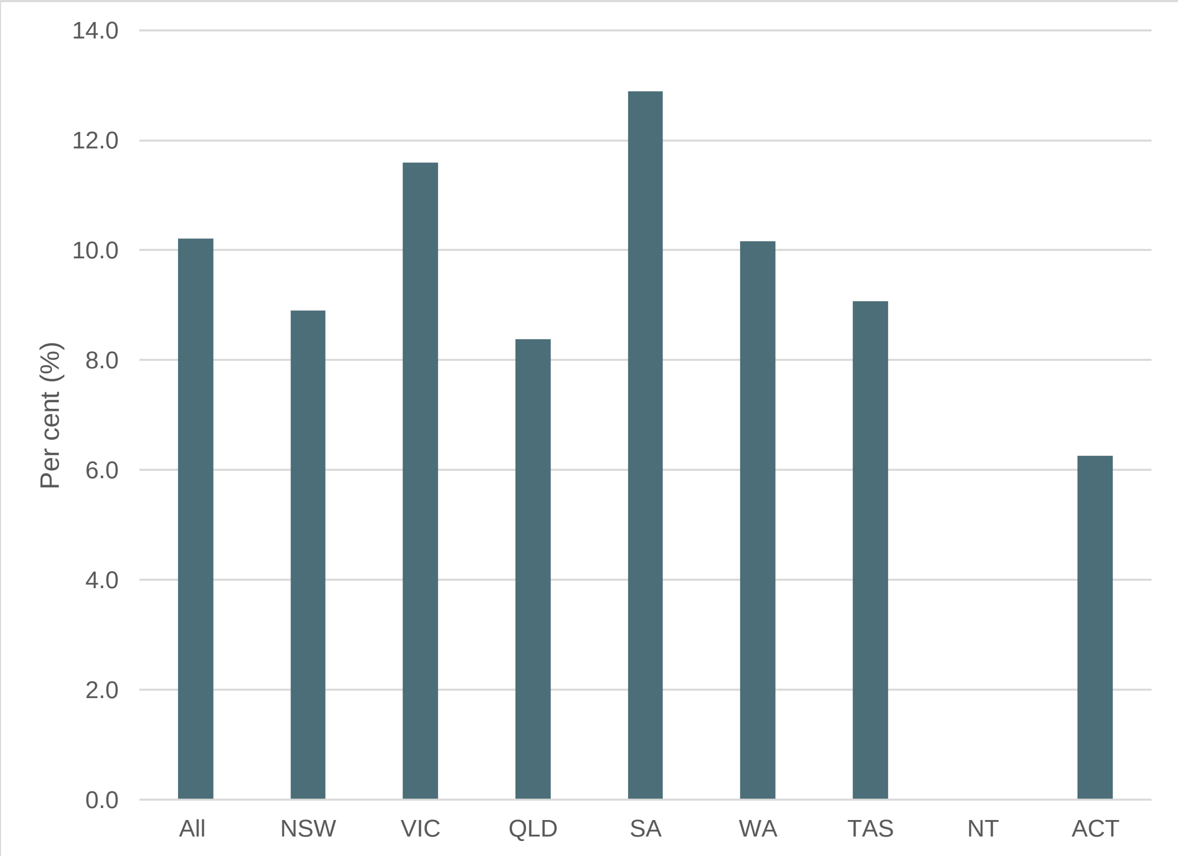
Where $UCV_{s,t}$, is the unimproved/site value in state *s* at time *t.* UCV is explained by a state-specific effect, a_s, and captures all time-invariant characteristics in state *s*. A time-specific effect, b_t, controls for common shocks to the tax base across jurisdictions due to the business cycle or common changes to federal regulation. Aside from state effects, the estimation employs time varying locational characteristics X_{st}, such as population and/or income, which enter the model in logs. The tax rate $landtax_{st}$, which varies across both location and time, enters in logs in order to estimate the elasticity of unimproved land value in response to changes in tax. The equation includes a lagged tax term to represent further such terms could be added. ε_{st} is the error term.

Lastly, the lagged right-hand side term, $log(UVC)_{it}$, included among the explanatory variables makes this a dynamic specification which accounts for most patterns of serial correlation by implementing a simple dynamic adjustment of the tax base to changing local conditions. In this way, following Buettner (2003), we impose our specification as a partial adjustment model. The sections on the different data will specify the employed empirical strategy in more detail and discuss the instrument use.

6.2 States and Territories' tax policies

In Australia, property taxes include taxes on immovable property as well as taxes on financial and capital transactions, like stamp duty. Land tax is one type of immovable property tax. In 2016-17, total land tax revenue amounted to $8.4bn, which represented 24 per cent of total state *property* tax revenue. This percentage varied considerably by state or territory. For example, land tax represented about 11 per cent of the ACT's total property tax revenue, whereas it represented about 31 per cent in South Australia. As a share of *total* state tax revenue, land tax represented about 10 per cent across all states and territories (Figure 33). This ranged from 0 per cent in the Northern Territories (which does not collect it) to nearly 13 per cent in South Australia.

Figure 33. Land tax as a percentage of total state tax revenue in 2016-17, by state and territory



Source: ABS Government Finance Statistics, Australia, 2016-17

The variation observed in the revenue collected by the different states and territories arises for several reasons. First, not all jurisdictions impose land tax. In particular, while most States and Territories in Australia do collect land taxes from landowners, the Northern Territory does not. Second, the different jurisdictions vary by how they define the value of land. New South Wales, Victoria, Queensland, South Australia and Tasmania currently use the land/site value as the tax base. By contrast, Western Australia and the Australian Capital Territory still rely on the UCV (Mangioni 2014). Land valuations are conducted by the State's Valuer General, or, as in the case of Victoria, by individual municipalities that are coordinated by the Valuer General. As previously mentioned, to determine the land value, States either take the value at a certain time of the year or the average value over the last three years (Henry Tax Review 2008).

Composition of the tax base is also a potential source of difference among states' land tax revenue. As indicated in the introduction, while land tax exemptions are similar across the states and territories, the percentage of tax-exempt land in each state or territory could vary. At the national level, Gabbitas and Eldridge (1998) estimate that exemptions reduce the land tax base by around 50 per cent. A more recent estimate indicates that the exemption of owner-occupied housing excludes about 60 per cent of land (and 75 per cent of residential land) from the tax base, while primary production contributes to the exclusion of another 10 per cent (Ingles 2016).

Differences in the land tax rates represent another source of variation across the States and Territories. Table 27 presents current rates and thresholds of land taxes in Australia. As shown, the amount of land tax owed for a property can vary significantly depending on the state or territory in which it is located. While the rates are generally progressive[55] however, the progressivity may discourage large-scale investment in land, resulting in an overrepresentation of small investors in the housing market.

[55] Land taxes fall primarily on rental housing due to exemptions for owner occupied housing (Freebairn 1999).

Table 27. Land tax rates and thresholds in Australia

State	Land (unimproved/site) Value	Marginal land tax rate
NSW	$0–$549,000	$0
	$549,000-$3,357,000	$100+1.6% land value
	$3,357,000 and over	$45,028 + 2% of land value over $3,357,000
VIC	$0–$250,000	$0
	$250,000 - $600,000	$275 + 0.2% of land value over $250,000
	$600,000 - $1,000,000	$975 + 0.5% of land value over $600,000
	$1,000,000 - $1,800,000	$2,975 + 0.8% of land value over $1,000,000
	$1,800,000 - $3,000,000	$9,375 + 1.3% of land value over $1,800,000
	$3,000,000 and over	$24,975 + 2.25% of land value over $3,000,000
QLD	$0–$600,000	$0
	$600,000–$1,000,000	$500 + 1 % of land value over $600,000
	$1,000,000–$3,000,000	$4,500 + 1.65 % of land value over $1,000,000
	$3,000,000–$5,000,000	$37,500 + 1.25 % of land value over $3,000,000
	$5,000,000 and over	$62,500 + 1.75 % of land value over $5,000,000
SA	$0- $353,000	$0
	$353,000 - $647 000	$0.50% of land value over $353,000
	$647,000 - $941,000	$1,470 + $1.65% of land value over $647,000
	$941,000 - $1,176,000	$6,321 + $2.40% of land value over $941,000
	Over $1,176,000	$11,961+ $3.70% of land value over $1,176,000
WA	$0-$300,000	$0
	$300,001-$420,000	$300
	$420,000-$1,000,000	$300 + 0.25% of land value over $420,000
	$1,000,000-$1,800,000	$1,750 + 0.90% of land value over $1,000,000
	$1,800,000-$5,000,000	$8,950 + 1.80% of land value over $1,800,000
	$5,000,000-$11,000,000	$66,550 + 2.00% of land value over $5,000,000
	Over $11,000,000	$186,550 + 2.67% of land value over $11,000,000
TAS	$0 – $24,999	$0
	$25,000 - $349,999	$50+0.55% of land value over $25,000
	Over $350,000	$1,837 + 1.5% of land value over $350,000
ACT	$0- $150,000	0.50% of land value
	$150,000 - $275,000	$750+0.60% of land value over $150,000
	$275,001 - $2,000,000	$1,500+1.08% of land value over $275,000
	Over $2,000,000	$20,130+1.10% of land value over $2,000,000

Note: The NT does not collect land taxes. An additional fixed cost of $1,145 applies for all thresholds in ACT.

Sources: http://www.revenue.nsw.gov.au/taxes/land

http://www.sro.vic.gov.au/node/1486#general

https://www.qld.gov.au/environment/land/tax/calculation/individuals

https://www.revenuesa.sa.gov.au/taxes-and-duties/land-tax/rates-and-thresholds

http://www.finance.wa.gov.au/cms/State_Revenue/Land_Tax/What_is_Land_Tax_.aspx#rate_scale

http://www.sro.tas.gov.au/land-tax/rates-of-land-tax

https://www.revenue.act.gov.au/land-tax?result_1060955_result_page=2

6.3 Data sources

This section gives an overview of the data sources we employ to estimate Australia's States and Territories level land tax elasticity. Any data source we want to study we need to combine with information about land tax rates and thresholds.

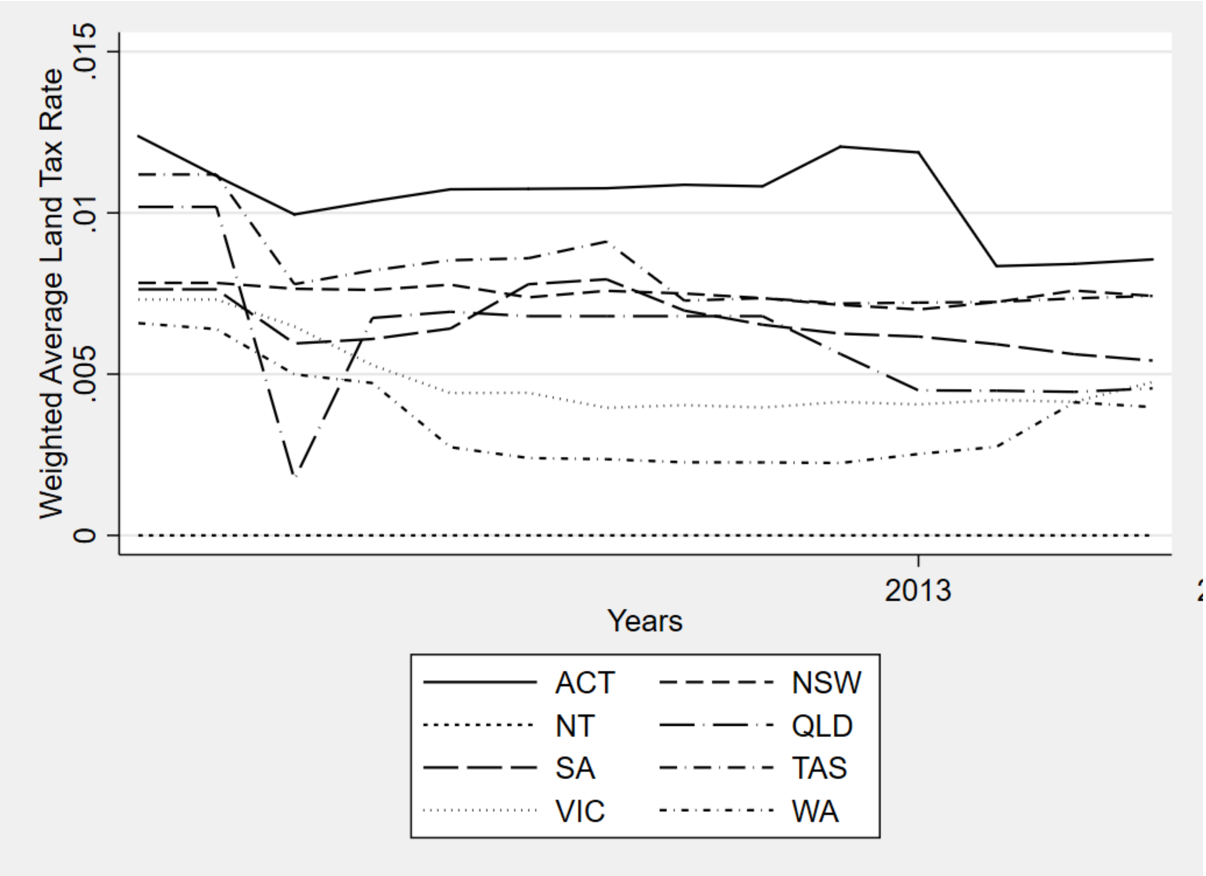
6.3.1 Historical data on statutory stamp duty rates

Data on land tax rates and thresholds are publicly available and can be obtained from State and Territory Revenue Offices websites, budget reports or other historical rate documents. Tax on property values is more complex than for example the insurance or motor tax. There is no single rate for any of the States and Territories but rather a schedule of rates according to the unimproved property value. This step-wise schedule with increasing tax for more valuable property makes it a progressive tax. As can be seen from the schedule of taxes presented for all the States and Territories in Table 27, the land tax schedules vary in their rates and thresholds across jurisdictions. Accordingly, we will use the exact tax rate schedule to calculate the land tax for a specific property value.

With the CGC data source described below, we will calculate a representative land tax rate. Given the data, which is disaggregated by value ranges of properties, we will use the mean point of the upper and lower end of the range and calculate the statutory tax rate for that amount given the tax schedule for the respective state and time. For aggregate value data, like the state level data used in the CGC data section, we will calculate a weighted average over all value categories to get a single tax rate for a State in a given year. Whereby the weights are the value category total property values for a given year.

A visual presentation of these calculated annual rates is presented in Figure 34. Compared to the equivalent stamp duty graph in the previous chapter, we do not observe an increase in the average land tax rate over the 24-year period. Instead, most States and Territories had a very stable land tax rate over this long period. The tax rate over all value ranges is around 0.7 percent. For this reason, not much bracket creep is present for land tax despite the strong increase in property prices over the last decade. This is mainly due to states adjusting the thresholds and rates of land tax to keep up with the increasing unimproved property values.

Figure 34. Weighted average general land tax rate by States and Territories, 1993-2016



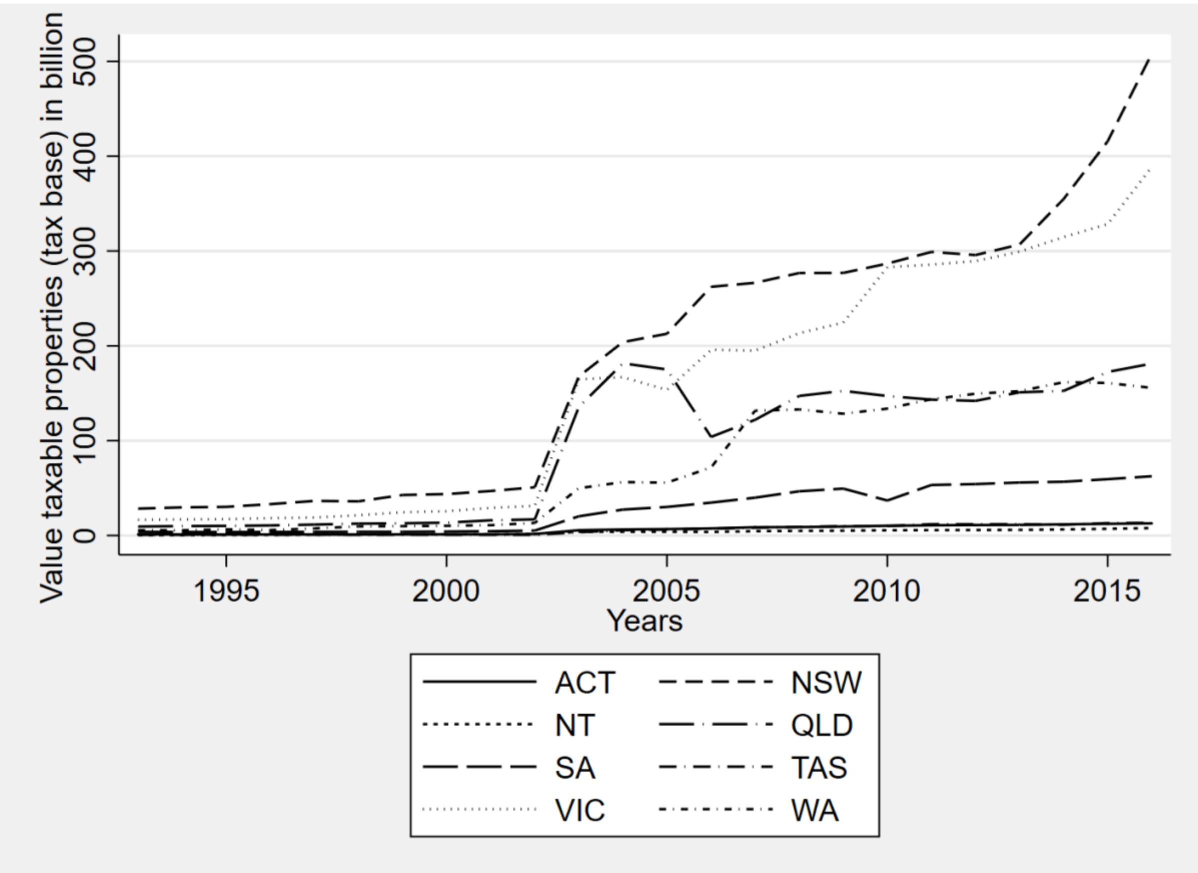
6.3.2 CGC assessment data

The CGC data for land tax is obtained from State Revenue Offices for both the tax base and revenue. The tax base for land tax is based on the total unimproved/site value of all properties that fall under land tax (i.e. that are not exempt from it). The CGC obtains the data disaggregated by 15 value ranges, going in steps of $100,000 up to $1 million and then in steps of $500,000 up to a value of $3 million. The 15 categories of value range were introduced with the 2010 Review; previously the CGC collected data for nine ranges of property value categories which were much broader going up to $100 million. This was due a second change before 2010 CGC collected land tax data on commercial and industrial land but not residential land. With the change in collection, data is now collected on both, and revenue is collected as tax dollars, rather than, as before, in the number of properties in each category.

Given the five-year rolling window of data collected by the CGC, we have data for the 16 categories from the 2003-04 Financial Year onwards. Given the stark difference in collection before and after the year 2003-04 we will cut the sample for the analysis.[56] This leave us with a panel data set containing 112 State-year observations for the aggregate annual regression models and 1,680 State-value range-year observations in the disaggregated value range regression analysis.

Figure 35 through Figure 38 provide an overview of the data. Figure 35 shows the development of the unimproved property value subject to land tax in States and Territories between 1993 and 2016. The big jump is due to the inclusion of residential land in the data from 2003 onwards. We see an increase in the tax base (total unimproved value of taxable land) for NSW, Victoria and WA over the sample period. While other states show smaller or no increases after 2003. For example, in NSW the site value of taxable properties rose from around 168 billion dollars in 2003-04 to about 508 billion dollars in the Financial Year 2016-17. As discussed in the introduction the Northern Territory does not levy a land tax.

Figure 35. Unimproved value of taxable properties (tax base) in billions of dollars by State and Territory, 1993-2016



[56] The entire data with the longer time series are visible in the graphs below.

Figure 36 shows the number of taxable commercial and industrial properties as a measure of the tax base for land tax from 1993-2002 and reveals a very constant pattern with a slight upwards trend. Figure 37 presents the tax revenue from 2003 onwards and shows an upward trend for a number of states over the sample period. In particular, WA, NSW, Victoria and Queensland each show more than a doubling of revenue, in real terms, over the 14 years.

Figure 36. Number of taxable (commercial) properties by State and Territory, 1993 - 2002

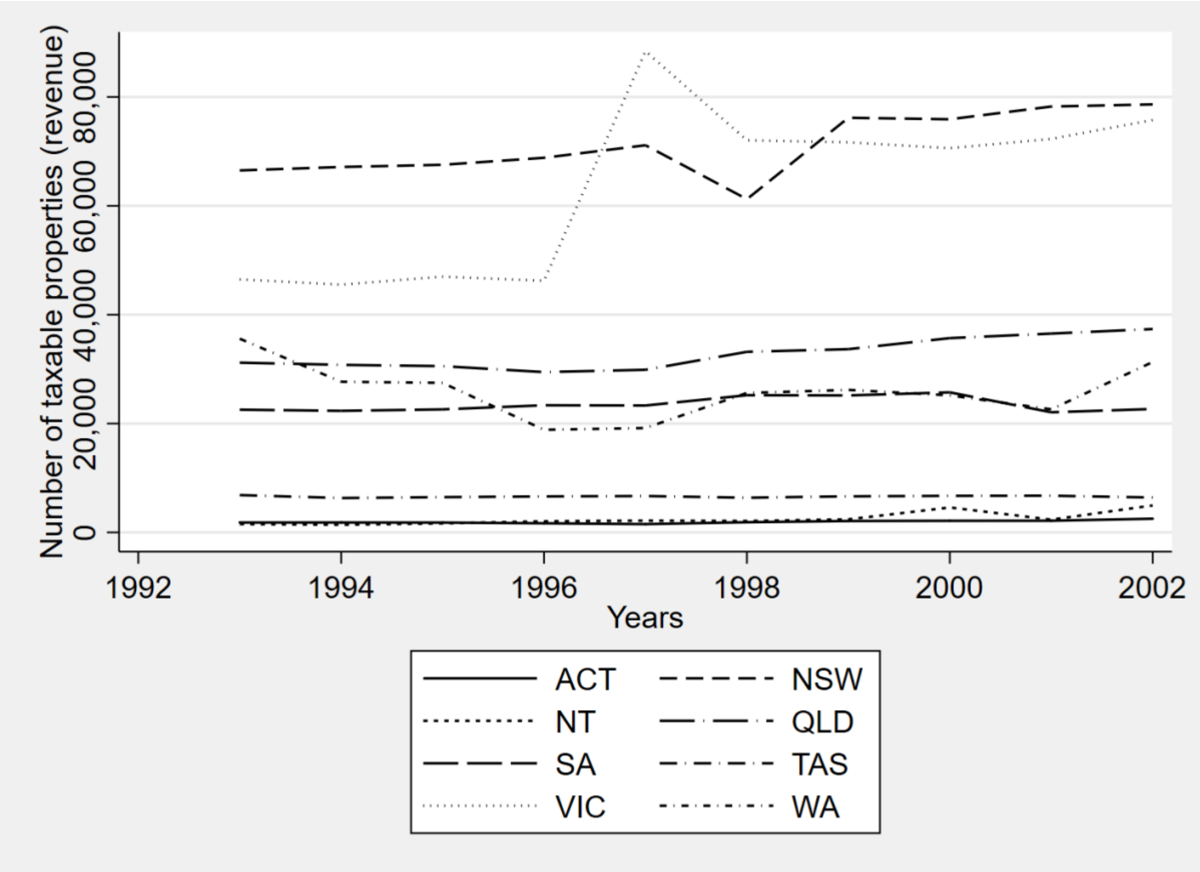
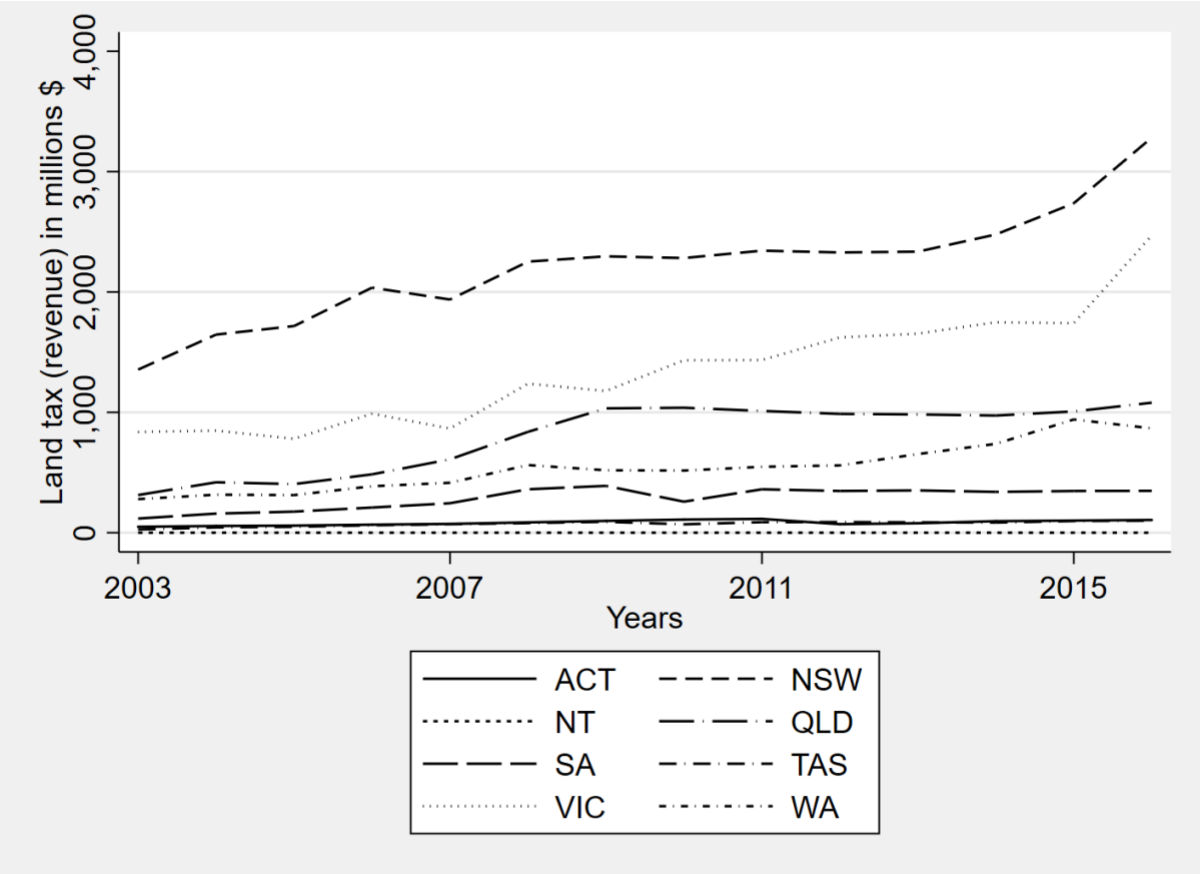


Figure 37. Land tax (tax revenue) in millions of dollars by State and Territory, 2003 - 2016



We use the specification of Equation 9 for annual State level data and extend it to the value range dimension in the data. This adds an extra index in the equation for the specific value ranges. We will use a more conservative dummy specification by including State by value range dummies. The other control variables we employ vary on the State level basis. These changes result in the following model specification:

Equation 10

$$\log(UCV)_{s,t,v} = \beta_1 \log(tax)_{s,t} + \beta_2 \log(tax)_{s,t-1} + \cdots + a_{s,v} + b_t + X_{s,t}\delta + \gamma \log(UCV)_{s,t-1,v} + \varepsilon_{s,t,v}$$

We assume that the effect of the tax rate is constant across all value ranges *v*, hence it has no extra index *v*. We use disposable income and population data from the ABS[57] as time varying controls in X_{st}.

The advantage of the CGC data is that we observe actual annual tax revenue as well as the actual tax base for each State. As a result, it is possible to calculate an effective tax rate that includes all exemptions. This is near impossible to compute with most

[57] The disposable income and population data come from ABS Tables 65230 and 3101, respectively, and represent annual income and population estimates by State.

individual sales datasets, since it is usually unknown whether a house is an owner's residence or a capital investment which will be rented and incur land tax. In addition, there are many other rules and special cases in the State tax regulation, which are usually never observed in sales data. With the data from the States, we calculate the effective tax rate by dividing State revenues by total State premiums. The derived effective tax rate is a much more precise measure of taxation, and includes more information compared to the statutory tax rates that can be found on the States' websites. However, this derived measure could potentially also introduce endogeneity.

The following theoretical example tries to make the argument for potential endogeneity of the effective tax rate. Say we have an external shock that affects demand for housing in some States but not (or less so) in others. For example, an economic upturn in a foreign country leads to an increase of investment into housing in Australia, but only in investment properties in some States. Let's also assume that they invest in properties at the lower end of the market, which are in most states exempt from land tax, and in any case, given the progressive property of land tax, have a lower tax rate. Under this scenario we would see an increase in the tax base in the States where the foreign investors turn properties into investment properties due to the exogenous asymmetric shock, but at the same time we would see an overall effective tax rate which goes down as they invest in the properties that incur zero or only low land tax rates. As a result, this would imply a negative correlation between the effective tax rate and the tax base, even though this is only a result of the asymmetric shock and tax rates will not have changed.

This example makes two important points. First that endogeneity is a potential problem and we will include an instrumental variable estimation as robustness check, where we instrument the effective tax rate with the weighted statutory tax rate in a two stage least squares regression in order to address this potential endogeneity.[58] Secondly this example also holds true for aggregated data. When we have disaggregation with respect to value range and can control for value range effects this will be less of a problem.

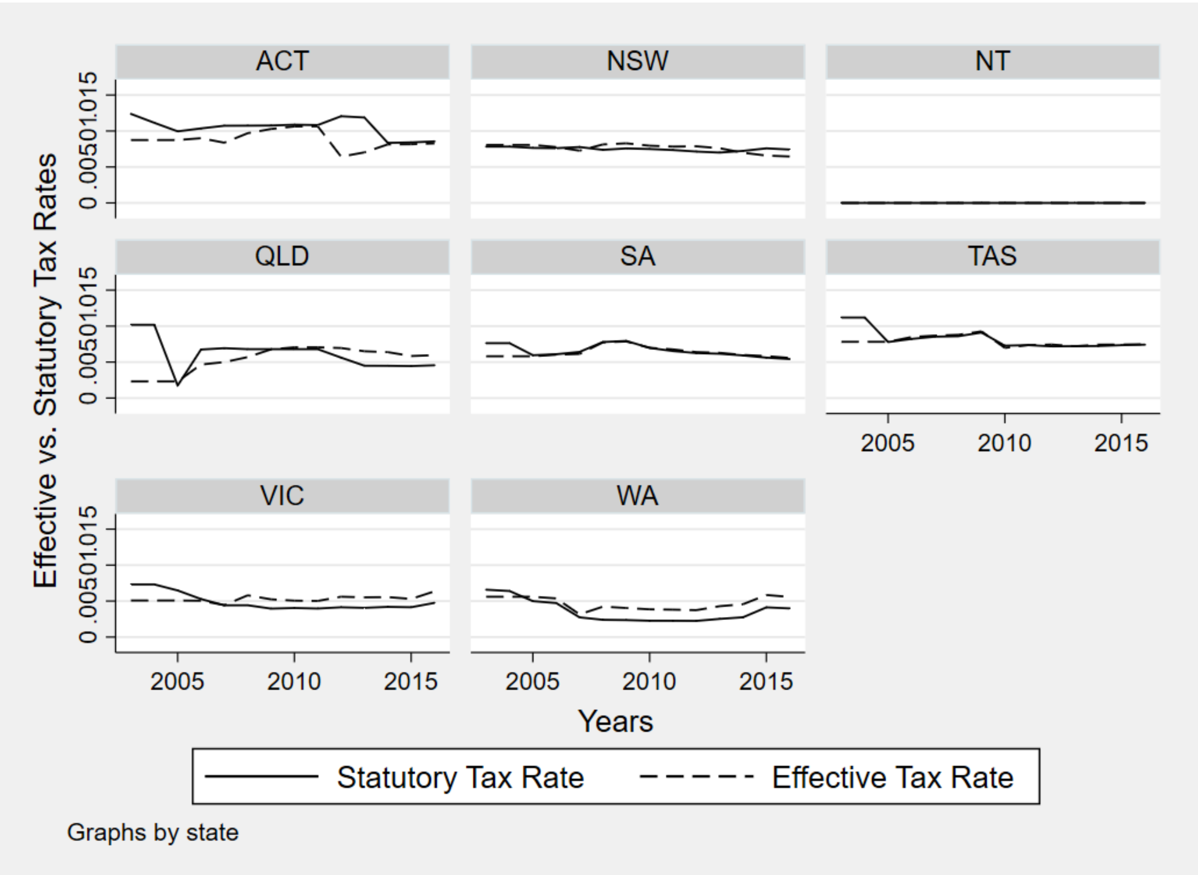
Figure 38 shows the effective and statutory tax rates for each State and Territory over time. As observed, for most States and Territories, the effective tax rate follows the

[58] A two state least squares regression is the common approach in the land tax literature, see literature overview of Sirmans, Gatzlaff and Macpherson (2008)

variations in the statutory tax rate, but the effective rate picks up other fluctuations in revenue (or the tax base) that are not due to tax rate changes. Moreover, in some cases, sizeable changes in the statutory tax rate are not reflected in the effective rate.

The Cragg-Donald Wald F-Statistics of the first stage regression measures the strength of the instrument. Throughout the different specifications presented in the IV regressions results section, the value of the test statistic is very high in the disaggregated case, suggesting that our instrumental variable is strong, but too small in the aggregated analysis where we can't exclude the possibility that the instrument is weak. The regression results with all relevant statistics are presented in Section 6.4.1

Figure 38. Comparison of effective and statutory tax rates over the sample period 2003-2016



6.3.3 Other data sources

Directly estimating the tax elasticity on the tax base, as we can do with the data from the States and Territories, is ideal for the purpose of finding this specific elasticity. This is not directly possible with any non-administrative data, such as individual sales data. With sales data, as commonly done in the literature, we could at best analyse the effect of land tax on house prices with the understanding that there is then some delayed mechanical effect on unimproved/site value. This however will not result in an elasticity that we could use for the purpose of integrating it into the CGC's equalizations formula. At best it can give us a rough idea of the effects of land taxes on the tax base, since changes in prices only carry through in part to unimproved/site values changes. More importantly though, higher land taxes, result in greater revenue, and potentially better quality public goods that push the value of properties upward. Analysing the effect of land tax on property prices in order to assess the elasticity, in isolation from the effect of the quality of public services, is challenging. Another challenge with individual property data, as discussed in Section 6.3.2, is the lack of observation of any exceptions, like the common tax exceptions for primary residences. We typically don't know which properties are affected and the overall average effect is washed out and much harder to identify.

We discuss the evidence from the existing literature which only considers the link between land tax and property prices (as opposed to the tax base directly). Generally, the evidence is more mixed than with stamp duty, but overall studies find a significant effect on prices. The most common finding is that changes in land taxes are partially capitalized into property prices. This suggests that there could be a secondary effect of land tax on the tax base.

An alternative approach would be to look at a reduced form relationship between land tax and unimproved/site value at the individual property level, akin to the aggregate CGC data analysis we carry out below. This analysis, after accounting for all other effects of the individual property, including public services which might impact the unimproved value, would in theory result in a direct estimation of the tax elasticity in question.

Unfortunately, however, we were unable to access data for unimproved/site values, other than for the ACT, since the national Corelogic data to which we have access does not include unimproved values. Such a reduced form analysis might also be possible at the suburb level. It is however difficult to account for all changes in public services across suburbs, but this might be more feasible using suburb level statistics than with individual property data. At this stage, we only have access to South Australian suburb level unimproved value data. This data is not suitable for an analysis without the cross-state variation in land tax changes over time. The analysis of a suburb level nationwide unimproved/site value dataset would be the most promising future direction for research to estimate a direct reduced form elasticity of the impact of land tax on the tax base.

6.4 Elasticity estimation

6.4.1 Results: CGC assessment data

Table 28 and Table 29 present results for the estimation using the CGC assessment data in aggregate annual form. Table 30 and Table 31 present results for the disaggregated data using value ranges.

All models presented in Table 28 and

Table 29 include time and State fixed effects.[59] Model specifications become richer and more complex as we move in the table from left to right and, given the possible delayed effect of land tax on unimproved value, we include results for lagged tax rate specifications models. Column 1 and 2 in all tables in this section analyse the contemporaneous effect. Column 3 analyses the effect of including an extra lag of the log of the land tax rate and Column 4 shows the results of the same model with 2 lags. While

Table 29 presents results using an instrument for the tax rate, we start with Table 28, which analyses the connection between sale value and the effective tax rate.

The results of the most basic elasticity specification can be found in Column 1 of Table 28, which shows the estimated effective tax rate elasticity without any controls. The estimate suggests a significantly negative relationship with an elasticity of -0.34. As we go from Column 1 to Column 2, we add more controls to address concerns about autocorrelation and to account for differences in States' trends in disposable income and population over the 14-year period of the sample. We add a lagged dependent variable to the model to control for serial correlation in the data, and a control for State-specific population and disposable income growth. Controlling for all three variables in Column 2 lowers the tax elasticity to -0.22. In Column 3 we include one extra tax rate lag which diminishes the elasticity estimate (the sum of the two tax rate coefficients) slightly, and with two lags in Column 4 reduces the elasticity ever so slightly again to

[59] Due to space considerations and in favour of clarity we omit results for the time fixed effect coefficients from the results table.

-0.19. This suggests that when the land tax increases by 10 percent the total value of sales will decline by 1.9 percent.

Table 28. Elasticity of land tax – effective rates estimation in logs with leads in the dependent variable

VARIABLES	(1) Effective Tax Rate	(2) Effective Tax Rate	(3) Effective Tax Rate	(4) Effective Tax Rate
Log(Tax Rate) [β_1]	-0.335***	-0.223***	-0.260***	-0.257***
	[0.033]	[0.042]	[0.079]	[0.077]
Lagged Log(Tax Rate) [β_2]			0.059	-0.003
			[0.070]	[0.068]
Lagged_2 Log(Tax Rate) [β_3]				0.070*
				[0.036]
Log(Tax Base)		0.471***	0.519***	0.514***
		[0.093]	[0.077]	[0.075]
Log(Income)		0.622**	0.569**	0.349*
		[0.250]	[0.246]	[0.198]
Log(Population)		0.567***	0.514***	0.523***
		[0.217]	[0.196]	[0.201]
Long-Run Tax Effect $\sum\beta i$			-0.201***	-0.191***
			[0.028]	[0.029]
Observations	178	170	170	162
R-squared	0.987	0.994	0.994	0.994
Number of state	8	8	8	8

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

While the results presented in the later columns of Table 28 include more controls and lagged effects, endogeneity may still be present since the effective tax rate is calculated on the basis of tax income and sale values.[60] Therefore, we present regression results based on an IV approach in

Table 29. We instrument the effective tax rate with the weighted average statutory land tax rate.[61] An IV approach is applied to all models in

Table 29. Otherwise, the table is constructed in the same way as Table 28. Column 1 shows that the simple relationship between the tax rate IV and the tax base is strongly negative. By including all controls in Column 2, the result remains negative but is much smaller and no longer significant. Lagging all explanatory variables leaves the elasticity estimate insignificant. Columns 2 through 4, with all the controls and different lags of the tax rate variable, consistently suggest there is no measurable effect.[62] The F-statistic for the Cragg-Donald weak identification test are between 5 and 9 for the first stage, suggesting that the instrument might be too weak in these models.

[60] As discussed in the data section the IV approach is particularly important for the disaggregated estimations.
[61] See details about the construction of the variable in the data section 6.3.2
[62] Note that the overall effect of the tax rate is the sum of the tax rate and lagged tax rate coefficient estimates, so in Column 2 that is -0.931+0.963. These results with the resulting standard errors are reported at the bottom of the tables. Different signs on the lags are typical among lagged values due to multicollinearity and may be particularly severe in a small datasets.

Table 29. Elasticity of land tax – IV estimation in logs with leads in the dependent variable

	(1)	(2)	(3)	(4)
VARIABLES	IV Tax Rate	IV Tax Rate	IV Tax Rate	IV Tax Rate
Log(Tax Rate) [β_1]	-0.732***	-0.244	-0.931***	-0.925***
	[0.117]	[0.166]	[0.242]	[0.237]
Lagged Log(Tax Rate) [β_2]			0.963**	1.374*
			[0.380]	[0.823]
Lagged$_2$ Log(Tax Rate) [β_3]				-0.366
				[0.329]
Log(Tax Base)		0.465**	1.066**	1.161
		[0.209]	[0.440]	[0.745]
Log(Income)		0.447*	0.386	0.122
		[0.272]	[0.457]	[0.795]
Log(Population)		0.448	-0.009	-0.223
		[0.435]	[0.698]	[1.285]
Long-Run Tax Effect $\sum\beta i$			0.032	0.083
			[0.272]	[0.471]
Observations	129	126	122	115
R-squared	0.975	0.990	0.978	0.965
Number of state	7	7	7	7
Cragg-Donald F-Stat	9	8	4	1

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

We next turn to the more disaggregated CGC data where we have value ranges as an extra dimension, *v*. Instead of seven State fixed effects as in the models above, there are now 153 State-value-range dummies, as each State's value range has its own fixed effect, and similarly many more observations. The Tables are built in the same way as above. First, Table 30 presents the results without any instruments followed by IV regression results in Table 31.

The results of the basic elasticity specification can be found in Column 1 of Table 30 with the estimated effective tax rate elasticity, without any controls, being significant at -0.12. As we go from Column 1 to Column 2, we add all controls to address the aforementioned concerns. We observe that when adding controls, the estimate reduces to -0.06, but stays significant. When checking for different lagged effects in Columns 3 and 4, there is a smaller, but still significant effect, with an elasticity of -0.04. A similar result emerges for the tax rate elasticity with two lags, but second lag is not significant. The contemporaneous effect of Column 2 implies that when the land tax increases by 10 percent the total value of sales declines by 0.6 percent.

Table 30. Elasticity of land tax – effective tax rate estimations at value range level with leads in the dependent variable

VARIABLES	(1) Effective Tax Rate	(2) Effective Tax Rate	(3) Effective Tax Rate	(4) Effective Tax Rate
Log(Tax Rate) [β_1]	-0.116**	-0.062**	-0.126***	-0.114***
	[0.051]	[0.025]	[0.041]	[0.039]
Lagged Log(Tax Rate) [β_2]			0.090***	0.071***
			[0.028]	[0.023]
Lagged_2 Log(Tax Rate) [β_3]				0.012
				[0.013]
Log(Tax Base)		0.593***	0.612***	0.583***
		[0.063]	[0.064]	[0.077]
Log(Income)		0.688***	0.664***	0.422**
		[0.204]	[0.187]	[0.206]
Log(Population)		0.315	0.470**	0.183
		[0.218]	[0.219]	[0.228]
Long-Run Tax Effect $\sum\beta i$			-0.036*	-0.031
			[0.019]	[0.019]
Observations	1,878	1,723	1,722	1,567
R-squared	0.677	0.785	0.789	0.740
Number of state-ranges	153	152	152	151

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Finally, we present regression results based on an IV approach at the value range level in Table 31. We instrument the effective tax rate with the statutory tax rate applicable to the average value range. The IV approach is applied to all models in Table 31. The results of Column 1, without any controls, give a bare correlation of -0.25. When adding the controls in Column 2 we get an elasticity estimate of -0.05. When using other lag lengths for the explanatory variables in Columns 3 and 4 the elasticity estimate becomes smaller with a similar error term and as a result insignificant. The results from Column 2 are very close to the contemporaneous effect found in Table 30. The F-statistic for the Cragg-Donald weak identification test are between 14 and 335 for the first stage, suggesting that the instrument is not weak.

Table 31. Elasticity of land tax – IV estimations at value range with leads in the dependent variable

	(1)	(2)	(3)	(4)
VARIABLES	Tax Rate IV	Tax Rate IV	Tax Rate IV	Tax Rate IV
Log(Tax Rate) [β_1]	-0.254***	-0.054**	-0.216***	-0.165**
	[0.067]	[0.025]	[0.062]	[0.078]
Lagged Log(Tax Rate) [β_2]			0.184***	0.023
			[0.053]	[0.119]
Lagged_2 Log(Tax Rate) [β_3]				0.116*
				[0.069]
Log(Tax Base)		0.618***	0.655***	0.661***
		[0.032]	[0.035]	[0.031]
Log(Income)		0.856***	0.757***	0.605***
		[0.228]	[0.195]	[0.190]
Log(Population)		0.160	0.510**	0.320
		[0.209]	[0.218]	[0.224]
Long-Run Tax Effect $\sum\beta i$			-0.031	-0.026
			[0.027]	[0.032]
Observations	1,429	1,313	1,312	1,196
R-squared	0.738	0.864	0.858	0.818
Number of state-ranges	114	112	112	109
Cragg-Donald F-Stat	335	256	68	14

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

6.5 Literature review: Domestic and international evidence

Only a few studies examine the effects of land taxes in Australia. Land taxes are highly recommended in those studies since the marginal excess burden (the additional deadweight loss or efficiency loss associated with raising an extra dollar of tax revenue) of a land tax is close to zero (Gabbitas and Eldridge (1998), Freebairn 2002).

However, the administrative costs of collecting land taxes may be quite high and have to be taken into account. An analysis on New South Wales State taxes by Gabbitas and Eldridge (1998) indicates that the land tax is the most expensive tax to administer due to the need for periodic independent valuation. In spite of such costs, Edwards (1984) finds that obtaining more revenues from land values, would significantly raise the average value of housing as well as the value of the housing stock. Figure 39 presents the statistically significant elasticities calculated for Australia using CGC data.

Figure 39. Change in the value of properties sold in response to a 1 percent increase in land tax, Australia

Source: Authors' calculations.

Turning to the international literature, studies on property tax are quite diverse. The definition, application, jurisdiction responsible for levying "property tax" and focus of the studies vary across the international literature. While some studies consider the economic incidence of property taxes (Lin 1986; Zodrow 2014; Oates 1969; Mieszkowski, 1972) , others examine the impact of property prices on tax revenue (Lutz et al. 2011; Doerner and Ihlanfeldt 2011; Alm et al. 2011), some analyse the impact of property taxes on property prices (see below), and others consider how public services or other characteristics are capitalised into property prices (see Hilber 2015 for a review) .

The availability of separate studies that consider the impact of property prices on property tax revenue and the impact of property taxes on property prices highlight the challenges associated with identifying a causal impact between the variables. Higher property taxes, result in greater revenue, and potentially better quality public goods that push the value of properties upward. Isolating the effect of property tax on property prices from the effect of the quality of public services is challenging. In addition, local areas with higher property values can set a lower tax rate to achieve a specified revenue, compared to local areas with lower property values, potentially confounding the direction of causation between tax rates and property values.

Among the literature considered, none of the studies identified explicitly considered the impact of an increase in land taxes on the tax base. For this reason, a general overview of the impact of property taxes, more generally, on property prices is considered. Among the studies that explicitly consider the impact of property taxes on property prices, there is broad consensus that property taxes are capitalized into property prices. The capitalization of property taxes suggests, as previously mentioned, that changes in tax rates could have implications for the size of the overall tax base via changes to property prices.

This academic literature diverges however, regarding the extent to which capitalization occurs. Full capitalization occurs when, after taking into account differences in housing characteristics (i.e. neighbourhood, size, public services), "…differences in housing prices exactly equal the present value of variations in expected tax liabilities" (Palmon and Smith, 1998). It also implies that the current owners bear the complete incidence of the introduction of the property tax and it is not shared with future owners.

In a review of 27 academic studies, Sirmans et. al (2008) found 10 studies which identified partial capitalisation, nine studies where there was full capitalisation, one study with overcapitalisation and seven studies without any statistically significant capitalisation of property taxes in property values. Among some of the studies considered in Sirmans et. al (2008) which found evidence of partial capitalization, Oates (1969) found evidence of two-thirds capitalization of property prices. Edal and Sclar (1974) found partial capitalization at about 50 per cent. In the late 1970s in San Francisco, Rosen (1982) found that each dollar decrease in relative property taxes increased relative property values by seven dollars.

Looking at more recent studies outside of the 2008 review by Sirmans et al., Hoj et al. (2018) study the impact of a change in land tax on property prices in Denmark. In Denmark, while the valuation of land is assessed using the same methods nationally, land tax rates are set at the municipal level and vary significantly. In 2007, the number of municipalities was reduced from 270 to 98, requiring a reconfiguration of the municipality borders of all but 33 municipalities. Exploiting the exogenous change to municipal land tax rates, they assess whether an increase in the effective land tax rate – defined as the fraction of the total property value paid in land tax – increased or decreased house prices. They conclude that changes in land tax are fully capitalised into the price of the land. Single-family homes located in municipalities where taxes increased (decreased), showed a decline (increase) in average prices.

Borge and Rattso (2014) also consider the impact of property taxes in Norway, where they are optional, on housing prices. They also reach similar conclusions regarding the full capitalisation of property tax into housing prices. By contrast, in Sweden, Elinder and Persson (2017) consider the impact of a national property tax cut and found no effect on the majority of property prices and a small effect on the prices of the most expensive homes. They hypothesize that the limited supply (i.e. geographic scarcity) of the most expensive homes, the disproportionately larger size of the tax cut those home owners' received, and the financial literacy of these particular owners likely explained the partial capitalization observed in this particular segment of the property market.

6.6 Conclusion

Land tax is a State tax that is payable on an annual basis with a number of exceptions on commercial and industrial properties and residential properties which are not the prime residence of the owner. Across the States and Territories, the statutory tax rates applicable follow different schedules with varying value ranges and tax rates. Land tax is currently not the most important State tax but is recognized as one of the most stable and arguable the least intrusive taxes at States disposal. It is plausible therefore in future other states decide to implement tax reforms similar to that currently undertaken in the ACT and as a result land tax gains in importance.

This chapter assessed the change in land tax base (total unimproved/site value of taxable properties) in response to a change in land tax rate. The analysis utilises aggregated revenue and tax base data provided by States and Territories to the CGC. Our analysis of the CGC data suggests a 10 percent increase in the tax rate will reduce the overall unimproved value of taxable properties by about 0.6 percent. This behavioural effect is contemporaneous and therefore likely due to changes in the quantity of properties that fall under land tax, the extensive margin. We find no evidence of lagged effects, the intensive margin - where changes in unimproved values of properties result from a delayed effect of property price changes.

The existing international and domestic literature does not provide a clear comparison as the only effect that is studied, which is somewhat similar to the estimates calculated using CGC data, are the effects of property taxation on property prices. Nevertheless, our low estimate for the elasticity of about -0.06, using the administrative data, represents a plausible and conservative first estimate of the behavioural effect of the tax rate on the tax base. As argued above, this should not reflect an upper limit on the actual elasticity, as the effect of extra provision of public services, from increased property tax revenue, can have the opposite effect (i.e. better quality or more public services can actually increase property values).

7. Mining royalties

7.1 Introduction

The State governments collect mineral royalties either under the Mining Act 1978 or under various State Agreement Acts that have been negotiated for major resource projects. Royalties are the price paid by a mining company for a mineral resource. Although royalties are payable on all minerals, the definition of minerals excludes limestone, rock or gravel shale (other than oil shale), sand (other than mineral sands), silica sand or garnet sand and clay (other than kaolin, bentonite, attapulgite, or montmorillonite), when they occur on private land (Government of Western Australia 2017).

The revenue base of mining royalty is the value of mining production. Revenue from this source comprised about 15 percent of State revenues in 2013-14. Due to substantial differences in endowments of minerals like coal, iron ore, gold, alumina, and nickel, some States are more reliant on mining royalties than others. For example, the contribution of mining royalties to state revenues in Western Australia is about 21 percent, compared to 0.01 percent in Victoria (Departments of Mining and Petroleum 2015). To maximise revenues, States employ a range of royalty rates in combination with different royalty collection methods. Royalty rates on iron ore and royalty collection methods of the States and Territories are presented in Table 32.[63]

[63] An interstate comparison of royalty rates and collection methods for important minerals, including iron ore, gold, nickel, bauxite, diamonds, mineral sands, copper, lead and zinc can be found in Government of Western Australia (2017).

Table 32. Interstate comparison of iron ore royalty rates

	WA	NSW	VIC	QLD	SA	TAS	ACT	NT
Royalty Rate	Beneficiated: 5.0% Fines: 7.5% Lump: 7.5%	4.0% of the ex-mine value (value less allowable deductions)	2.75% of net market value	$1.25 per tonne plus 2.5% of value above $100 per tonne(a)	5.0% of net market value(b)	1.9% on net sales plus profit royalty up to maximum of 5.35% of net sales(c)	n.a.	20.0% of net value of mine's production value(d)
Royalty System	Ad valorem	Ad valorem	Ad valorem	Hybrid	Ad valorem	Hybrid		Ad valorem

Note: *(a) A discount of 20% is available if the mineral is processed in Queensland and the metal produced is at least 95% iron ore.*

(b) New mines may qualify for a concessional rate of 2.0% for the first five years. A rate of 1.5% may apply to mines that were operating prior to 1 July 2011, for a period of up to five years.

(c) A 20% rebate is available for the production of the metal in Tasmania.

(d) The first $50,000 of net value is exempt. Where the net value exceeds $50,000, the royalty otherwise payable is reduced by $10,000.

Source: *Government of Western Australia (2016).*

In contrast to other taxes covered in this report, it is extremely challenging to empirically assess the effect of mining royalty rates on the demand for minerals in Australia for various reasons. Consequently, this chapter provides a brief overview of the economic theory underlying the taxation of natural resources and discusses the particular data and methodological challenges associated with computing an elasticity estimate for the mining sector (Sections 1.2 and 1.3). Moreover, a brief overview of the academic literature in Australia is provided in Section 7.5. A review of the international literature on mining taxes is not included because the results are not comparable with the Australian context.

7.2 Theoretical background

According to economic theory, the mining sector is a sector where location-specific rents pervade. Location-specific rents can allow companies to generate profits that exceed the normal, risk-adjusted rate of return, and which are immobile. Economic theory suggests that the taxation of location-specific economic rents is non-distortionary since, even in the presence of a higher tax rate, these firms can be no more profitable. In addition, as capital mobility has increased over time, foreign ownership of the domestic capital stock in Australia has also increased. Taxation of profits in sectors where there are location-specific rents and where high levels of foreign ownership exist, present a lucrative opportunity to shift the tax burden abroad (Mirrlees 2011). The form that such a minerals or rent tax should take however, is debated in the literature and depends on context. Some of the proposals and evidence are presented in Section 7.5.

7.3 Data availability

Due to severe data limitations and considerable methodological challenges, it appears unlikely that the effects of mining royalties can be quantified. Historical mining royalties, tax revenues and production figures are very limited. In particular, the regular collection of relevant statistics, such as resource and energy statistics of the Department of Industry, Innovation and Science, has been discontinued. Moreover, some information is only available on a piecemeal basis, reducing its usefulness in an empirical analysis.

Quantifying the effects of mining royalties would also be challenging, even in the presence of a comprehensive and consistent database, because of the large heterogeneity in the stock of mineral resources across States and Territories. Most of the mining royalties received by States originate from a single commodity. For example, iron ore in Western Australia and coal in New South Wales and Queensland contributed to about 80-90 percent of the respective State royalty revenue in 2013-14 (Departments of Mining and Petroleum 2015). Interstate comparisons are further complicated by differences in the quality of minerals across States.

7.4 Elasticity results

We use historical iron ore royalty rates to illustrate the challenges associated with quantifying the effects of mining royalties. Table 33 shows variation in production and collection of mining royalties across States and Territories. An instrumental variable strategy similar to that discussed in other chapters cannot be applied in the context of mining royalties because this strategy would require data at a small-scale regional level. Moreover, despite the availability of annual data at a State level, a difference-in-difference approach cannot be used to determine the effects of mining taxes because such an approach would require that ‘treatment’ and ‘control’ States would have followed the same trend in the absence of changes in mining taxes. It is unlikely that this requirement is met because State characteristics, including Government policies, type of minerals, rules and regulations may have differential effects on the production of minerals across States. At the same time, Australia is a global leader in the production of some minerals and therefore domestic decisions can affect international prices, which makes the estimation more complex. Finally, mines are concentrated in certain regions and minerals, including their quality, differ across mines.

Table 33. Historical iron ore royalty rates of the States and Territories

	WA	NSW	VIC	QLD	SA	TAS	ACT	NT
2011-12	Beneficiated: 5.0% Fines: 5.625% Lump: 7.5%	4.0% of the ex-mine value (value less allowable deductions)	2.75% of net market value	$1.25 per tonne plus 2.5% of value above $100 per tonne(a)	5.0% of net market value(b)	1.6% on net sales plus profit royalty up to maximum of 5.00% of net sales(c)	n.a.	20.0% of net value of mine's production value(d)
2012-13	Beneficiated: 5.0% Fines: 6.5% Lump: 7.5%	4.0% of the ex-mine value (value less allowable deductions)	2.75% of net market value	$1.25 per tonne plus 2.5% of value above $100 per tonne(a)	5.0% of net market value(b)	1.9% on net sales plus profit royalty up to maximum of 5.35% of net sales(c)	n.a.	20.0% of net value of mine's production value(d)
2013-14 2014-15 2015-16 2016-17	Beneficiated: 5.0% Fines: 7.5% Lump: 7.5%	4.0% of the ex-mine value (value less allowable deductions)	2.75% of net market value	$1.25 per tonne plus 2.5% of value above $100 per tonne(a)	5.0% of net market value(b)	1.9% on net sales plus profit royalty up to maximum of 5.35% of net sales(c)	n.a.	20.0% of net value of mine's production value(d)

Source: Government of Western Australia (2012, 2013 2014, 2015, 2016, 2017).

7.5 Domestic and international literature review

Freebairn (2015) justifies the importance of mineral taxation for several reasons. First, taxation of minerals is a "…charge for, or income in exchange for, the transfer of community owned natural resource deposits for use by private sector investors." He also argues that since about 80 percent of the Australian mining industry is owned by nonresident shareholders, taxation of mineral rents is principally a transfer to Australia from non-residents.

The form that such a minerals tax should take in Australia varies across the literature. For example, Freebairn and Quiggin (2010) argue that an economic rent tax base would cause smaller tax distortions than quantity-based royalties. A higher level of taxation of immobile factors, including mining resources, would allow lower taxation of internationally mobile capital, which may have positive effects on economic growth and after-tax returns to labour in Australia. These claims seem substantiated by analyses by KPMG (2010) that estimate that the combined marginal excess burden of royalties and crude oil excise is 70 cents per dollar of tax revenue, which was the highest of all taxes and royalties in Australia, with the exception of taxes on gambling. The Henry Tax Review (2010a) also recommended replacing royalties with a resource rent tax.

By contrast, using a partial equilibrium model, Ergas and Pincus (2014) find that royalties are beneficial to Australia because they increase both economic welfare and government revenue. Their argument is based on the fact that a major part of the economic incidence of mining royalties falls on foreign investors. The large net gain from mining royalties is not captured in the long-run comparative static framework of KPMG (2010). In a partial reversal of the 2010 paper, Freebairn (2015) argues that taking into account additional factors, there is a “less clear-cut superiority of the resource rent tax relative to the royalty than recommended by some, including Henry et al. (2010).”

7.6 Conclusion

Economic theory suggests that sectors with location-specific rents produce rents in excess of the normal, risk-adjusted rate of return; theory also suggests that their taxation is also non-distortionary. In practice, how these rents should be taxed in Australia is debated in the literature (Freebairn and Quiggin (2010); Henry Tax Review (2010a); Ergas and Pincus (2014); KPMG (2010); Freebairn (2015). Moreover, the geographic distribution of different minerals, as well as their quality and subsequent value, coupled with limited data, preclude the calculation of a robust elasticity capturing the demand for minerals in Australia in response to changes in mining royalty rates.

8. Summary and conclusions

This report empirically estimated the elasticity of various state tax bases, in response to changes tax rates. It focused on the following State taxes: payroll tax, insurance tax, motor tax, stamp duty, land tax, and mining royalties. As the main empirical strategy, a difference-in-difference estimation approach is applied by exploiting the variation in tax rates (and thresholds) across States and Territories and changes over time as ‘natural experiments’ to identify the effects of tax rate changes on revenue bases. Particular attention is paid to potential endogeneity problems and the use of instrumental variables to correct possible specification problems.

Using data from from the newly available Business Longitudinal Analysis Data Environment (BLADE), the report finds no evidence in favour of the hypothesis that workers and firms share the burden of payroll taxes in Australia. The effects of increases in payroll tax thresholds on the firm payroll range from -1% to 1%, with most effects being insignificant. We observe a similar pattern for the effects of threshold increases on employment, which range from -1.4% to 1.6% and are mostly insignificant. These findings are consistent with empirical findings generated in other developed economies, but inconsistent with the largely theory-driven work produced in the Australian context.

Turning to insurance tax, both the decision to purchase insurance and the amount of insurance purchased are sensitive to tax rates. The degree of sensitivity however, depends on the type of insurance. For example, in some cases where insurance is compulsory (like compulsory third party or mortgage insurance in some cases), the estimates are less elastic. Across all insurance types, using CGC data, a one percentage point increase in the tax rate reduces expenditure on total premiums by 0.6 percent. To the extent that the trends observed for the price sensitivity of the demand for insurance observed in the international literature also apply to changes in taxation (which is likely), then the international and domestic findings on the tax base elasticity to changes in insurance taxes are consistent.

In the case of motor vehicle taxes, these can apply upon the *transfer* of ownership or initial purchase of a new vehicle, on *vehicle ownership* or through *vehicle use*. This chapter assessed the demand for motor vehicles only in response to a change in licence fees (*taxes on vehicle ownership*) and found that the demand for motor vehicles is relatively inelastic. According to estimates based on HILDA, a ten percent increase in licence fees will decrease car ownership of light motor vehicles by about 0.35 percent. Using data from the CGC, the elasticity implies a 0.6 percent reduction in vehicle ownership as response to a 10 percent increase in licence fees. Internationally, motor vehicle taxes serve different purposes and can be designed and implemented in distinct ways. These differences also explain the range in elasticity estimates observed across different countries. Bearing this in mind, the findings in this chapter are consistent with each other and the international literature, while being at the lower end of the range found within in the literature.

Regarding stamp duty on property transactions, using CGC data, the results show that a 10 percent percent increase in the tax rate reduces the overall value of sold properties by 3-4 percent. This is a relatively large effect for a tax which is on average about 4-5 percent of the sales price of the house but note that this includes the extensive as well as intensive margin, that is, both changes in prices and in the quantity of houses sold. The results are also comparable to the literature which calculates results of a similar magnitude for price changes (see Figure 31). Using Corelogic sales data, the effects range from 0.1 - 3 percent of the value of sold properties for a 10 percent tax change, depending on the specification chosen. More research is needed to better understand the properties of this particular sales data set.

Using CGC data, the analysis on land tax suggests that a 10 percent increase in the tax rate will reduce the overall unimproved value of taxable properties by about 0.6 percent. This behavioural effect is contemporaneous and likely due to changes in the quantity of properties that fall under land tax, the extensive margin. We find no evidence of lagged effects, the intensive margin - where changes in unimproved values of properties result from a delayed effect of property price changes. The existing international and domestic literature does not provide a clear comparison as the only effect that is studied, which is somewhat similar to the estimates calculated using CGC data, are the effects of property taxation on property prices. Nevertheless, our low estimate for the elasticity of about -0.06, using the administrative data, represents a plausible and conservative first estimate of the behavioural effect of the tax rate on the tax base.

Finally, in the case of mining, the geographic distribution of different minerals, as well as their quality and subsequent value, coupled with limited data, preclude the calculation of a robust elasticity capturing the demand for minerals in Australia in response to changes in mining royalty rates.[64]

Table 34. Summary of selected elasticities by state tax

Tax	Elasticity	Interpretation
Payroll	Largely statistically insignificant	Not applicable
Insurance	-0.057 (CGC)	A 1 **percentage point** increase in the tax rate reduces expenditure on total premiums by 0.6 percent (equivalent to about a 10 percent increase).
Motor	-0.056 (CGC) -0.035 (HILDA)	A **10 percent** increase in licence fees reduces vehicle ownership by 0.6 percent. A **10 percent** increase in licence fees reduces car ownership by 0.35 percent.
Stamp duty	-0.29 to -0.43 (CGC) -0.01 to -0.37 (Corelogic)	A **10 percent** percent increase in the tax rate reduces the overall value of sold properties by 3-4 percent. A **10 percent** increase in the tax rate reduces the value of sold properties by 0.1 to 3.7 percent, depending on the specification chosen.
Land	-0.054 to -0.062 (CGC)	A **10 percent** increase in the tax rate will reduce the overall unimproved value of taxable properties by about 0.6 percent.
Mining	Not applicable	

[64]The elasticity estimates discussed in this study can be used to perform revenue calculations. We outline a theoretical approach that takes elasticities into account when comparing hypothetical revenues before an after a tax rate change. A brief illustration of revenue calculations is provided in the appendix.

References

AACL (2015) Modernising Australia's tax system, Commissioned Report submitted to the Property Council of Australia, ACIL Allen Consulting, Sydney, NSW, Available from: http://www.acilallen.com.au/projects/17/construction-and-property-industry/159/modernising-australias-tax-system [Accessed: 13/10/2017].

Abelson, P. (2011) Estimating the Revenue-Raising Capacities of the States and Territories and the Implications for the Equitable Distribution of GST Revenue. Economic Papers: A journal of applied economics and policy, 30(4): 443-454.

AEPL (2008) Analysis of state tax reform. Access Economics Private Limited, report prepared for the Financial Industry Council of Australia.

Alberini, A. and M. Bareit (2017) The effect of registration taxes on new car sales and emissions: Evidence from Switzerland. Resource and Energy Economics. Available at: https://doi.org/10.1016/j.reseneeco.2017.03.005 [Accessed: 24/12/2018]

Albon, R. (1997) The efficiency of state taxes. Australian Economic Review, 30(3): 273-287.

Albouy, D. (2012) Evaluating the efficiency and equity of federal fiscal equalization. Journal of Public Economics, 96(9): 824-839.

Alm, J., R. Buschman, and D. Sjoquist (2011) Rethinking local government reliance on the property tax. Regional Science and Urban Economics, (41)4: 320-331.

Alm, J. and H. López-Castaño (2005) Payroll taxes in Colombia. Andrew Young School of Policy Studies Working Paper 06-36, Georgia State University, Atlanta, USA.

AlphaBeta (2018) Do company tax cuts boost jobs, wages and investment? Evidence from the 2015 Australian tax cuts for businesses with turnover below $2 million, AlphaBeta, Sydney, Australia, available from: https://www.alphabeta.com/wp-content/uploads/2018/05/Xero-SBI-AlphaBeta-Tax-Report_May-2018.pdf [Accessed: 2 January 2019]

Arnott, R., and Petrova, P. (2006) The property tax as a tax on value: Deadweight loss. International Tax and Public Finance, 13(2-3): 241-266.

Atreya A., Ferreira S., Michel-Kerjan E. (2015) What drives households to buy flood insurance? New evidence from Georgia. Ecological Economics, 117: 153–161.

ABS (2017) Taxation Revenue, Australia, 2015-16 (Table 10), The Australian Bureau of Statistics, Catalogue Number - 5506.0, Available from: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5506.02015-16?OpenDocument [Accessed: 09/10/2017].

Barker, G., and Tooth, R. (2008). Insurance Law and Economics: An Analysis of the Demand for House and Contents Insurance in Australia. ANU Centre for Law and Economics Working Paper 1, The Australian National University.

Bennmarker, H., E. Mellander and B. Öckert (2009) Do regional payroll tax reductions boost employment? Labour Economics, 16(5): 480-489.

Bérard, G., and Trannoy, A. (2017) The Impact of a Rise in the Real Estate Transfer Taxes on the French Housing Market, WP 2017 – 32, AMSE working papers, School of Economics, Aix-Marseille University, France.

Besley, T., N. Meads and P. Surico (2014) The incidence of transaction taxes: Evidence from a stamp duty holiday. Journal of Public Economics, 119: 61–70.

Best, M. and H. J. Kleven (2013) Property Transaction Taxes and the Housing Market: Evidence from Notches and Housing Stimulus in the UK, London School of Economics and Political Science.

Borge, L. and J. Rattso (2013) Capitalization of property taxes in Norway. Public Finance Review, 42(5): 635-661.

Brandt, C., J. Anable, M. Tran (2013) Accelerating the transformation to a low carbon passenger transport system: The role of car purchase taxes, feebates, road taxes and scrappage incentives in the UK, Transportation Research Part A, 49: 132-48.

Brandt, N. (2014) Greening the Property Tax, OECD Working Papers on Fiscal Federalism, No. 17, OECD Publishing. Available from: http://dx.doi.org/10.1787/5jz5pzw9mwzn-en [Accessed: 1 September 2017].

Brown, R., R. Brown, I. O'Connor, G. Schwann and C. Scott (2011) The other side of housing affordability: The user cost of housing in Australia, Economic Record, 87(279): 558–574.

Browne, M. J., & Kim, K. (1993). An international analysis of life insurance demand. Journal of Risk and Insurance (1986-1998), 60(4), 616. Retrieved from https://search-proquest-com.virtual.anu.edu.au/docview/235880005?accountid=8330

Browne, M. J., Chung, J., and Frees, E. W. (2000) International property-liability insurance consumption. Journal of Risk and Insurance, 73-90.

Browne, M. J., and Hoyt, R. E. (2000) The demand for flood insurance: empirical evidence. Journal of risk and uncertainty, 20(3): 291-306.

Buettner, T. (2003) Tax base effects and fiscal externalities of local capital taxation: evidence from a panel of German jurisdictions, Journal of Urban Economics, 54(1), pp.110-128. Retrieved from: https://doi.org/10.1016/S0094-1190(03)00039-1

Buettner, T. (2017) Welfare Cost of the Real Estate Transfer Tax, CESifo Working Paper, No. 6321, CESifo, Germany.

Cao, L., A. Hosking, M. Kouparitsas, D. Mullaly, X. Rimmer, Q. Shi, W. Stark, and S. Wende, (2015) Understanding the economy-wide efficiency and incidence of major Australian taxes. Treasury WP 2015-01, Macroeconomic Modelling and Policy Division, The Treasury, Commonwealth of Australia.

Carling, R., and Pope, J. (2011) The economic costs of taxation: An assessment of the Henry Tax Review. Australian Tax Forum, 26(3): 3-29.

Ciccone, A. (2014) Is it all about CO2 emissions? The environmental effects of a tax reform in Norway, Memorandum, No. 19/2014, University of Oslo, Department of Economics, Oslo. Available at: http://hdl.handle.net/10419/102057 [Accessed: 24 December 2018]

CGC (2017) Introduction to Fiscal Equalisation in Australia, Commonwealth Grants Commission. Available from: https://cgc.gov.au/index.php?option=com_content&view=article&id=258&Itemid=536 [Accessed: 13 October 2017].

Cox, R. H., and Zwinkels, R. C. (2017) Mortgage Insurance Adoption in the Netherlands. Real Estate Economics. Forthcoming.

Creighton, A. (2012) The Henry Tax Review: A Liberal Critique. Centre for Independent Studies, Issue 130, The Centre for Independent Studies, Sydney.

Dachis, B., G. Duranton and M. A. Turner (2012) The effects of land transfer taxes on real estate markets: evidence from a natural experiment in Toronto. Journal of Economic Geography, 12(2): 327-354.

Dahlby, B. and L. S. Wilson (2003) Vertical fiscal externalities in a Federation. Journal of Public Economics, 87(5): 917-930.

Davidoff, I. and A. Leigh (2013) How do stamp duties affect the housing market? Economic Record, 89(286): 396-410.

Departments of Mining and Petroleum (2015) Mineral Royalty Rate Analysis, Final Report, Government of Western Australia.

Dixon, P. B., M. R. Picton and M. T. Rimmer (2004) Payroll taxes: Thresholds, firm sizes, dead-weight losses and Commonwealth Grants Commission funding. Economic Record, 80(250): 289-301.

Doerner, W., K. Ihlanfeldt (2011) House prices and city revenues. Regional Science and Urban Economics, (41)4: 332-342.

Driessen, P. and Evans, A. (2015) Demand, competition and price sensitivity in the NSW CTP market: What's driving the drivers? Actuaries Institute 2015 Injury Schemes Seminar. Available from: https://www.actuaries.asn.au/Library/Events/ACS/2015/DriessenEvansCTP.pdf [Accessed: 1 November 2018].

Eccleston, R. and H. Smith (2015) Fixing Funding in the Australian Federation: Issues and Options for State Tax Reform. Australian Journal of Public Administration, 74(4): 435-447.

Edwards, M. E. (1984) Site Value Taxation on Australia. American Journal of Economics and Sociology, 43(4): 481-495.

Egebark, J. and N. Kaunitz (2013) Do payroll tax cuts raise youth employment? IFAU Working Paper No. 27, Institute for Evaluation of Labour Market and Education, Uppsala, Sweden.

Egebark, J. and N. Kaunitz (2014) Payroll taxes and youth labor demand. IFN Working Paper No. 1001, Research Institute of Industrial Economics, Stockholm, Sweden.

Egebark, J. and N. Kaunitz (2017) Payroll taxes and firm performance. IFN Working Paper No. 1175, Research Institute of Industrial Economics, Stockholm, Sweden.

Elinder, M. and L. Persson (2017) House price responses to a national property tax reform. Journal of Economic Behavior and Organization, 144: 18-39.

Ergas, H., and J. Pincus (2014) Have mining royalties been beneficial to Australia? Economic Papers: A journal of applied economics and policy, 33(1): 13-28.

Freebairn, J. (1997) Taxation reform: Some economic issues. Australian Economic Review, 30(1): 57-70.

Freebairn, J. (1999) Tax reform proposals and housing. Economic Papers: A journal of applied economics and policy, 18(3): 73-84.

Freebairn, J. (2002) Opportunities to reform State taxes. Australian Economic Review, 35(4): 405-422.

Freebairn, J. (2009) Environmental taxation and its possible application in Australia. In Conference on Australia's Future Tax System, Melbourne, pp. 18-19.

Freebairn, J., and J. Quiggin (2010) Special taxation of the mining industry. Economic Papers: A journal of applied economics and policy, 29(4): 384-396.

Freebairn, J. (2011) A better and larger GST? The Economic and Labour Relations Review, 22(3): 85–100.

Freebairn, J. (2015) Reconsidering royalty and resource rent taxes for Australian Mining. Agricultural and Resource Economics, 59(4): 586-601.

Freebairn, J. (2016) Taxation of housing. Australian Economic Review, 49(3): 307-316.

Fritzsche, C. and L. Vandrei (2018) The German real estate transfer tax: Evidence for single-family home transactions. Regional Science and Urban Economics, Forthcoming: https://doi-org.virtual.anu.edu.au/10.1016/j.regsciurbeco.2018.08.005

Gabbitas, O. and Eldridge, D. (1998) Directions for State Tax Reform, Productivity Commission Staff Research Paper, AusInfo, Canberra.

Grace, M. F., R. W. Klein, and P.R. Kleindorfer (2004) Homeowners insurance with bundled catastrophe coverage. Journal of Risk and Insurance, 71(3): 351-379.

The Greens in the European Parliament (2018) Loss of revenues in passenger car taxation due to incorrect CO2 values in 11 EU States. Available from: http://www.foes.de/pdf/2018-03-10_FOES_Taxation_loss_due_incorrect_CO2_values.pdf [Accessed: 24 December 2018]

Government of Western Australia (2018) Overview of State taxes and royalties 2017-18, Department of Treasury, Perth, Australia, available from: https://www.treasury.wa.gov.au/uploadedFiles/_Treasury/Publications/Overview_of_State_Taxes_and_Royalties2017-18.pdf [Accessed: 2 January 2019].

Government of Western Australia (2016) Overview of State taxes and royalties 2016-17, Department of Treasury, Perth, WA, Available from: https://www.treasury.wa.gov.au/uploadedFiles/Treasury/Publications/Overview_of_State_Taxes_and_Royalties_2016-17.pdf [Accessed: 2 August 2017].

Gruber, J. (1997) The incidence of payroll taxation: evidence from Chile. Journal of labor economics, 15(S3): S72-S101.

Hasan, S., and M. Sinning (2017) GST Reform in Australia: Implications of Estimating Price Elasticities of Demand for Food. Crawford School Working Paper 1705, The Australian National University, Canberra.

Hennessy, H. and R.S.J Tol (2011) The impact of tax reform on new car purchases in Ireland, Energy Policy, 39(11): 7059-7067.

Henry Tax Review (2008a) Australia's future tax system Architecture of Australia's tax and transfer system, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Henry Tax Review (2008b) Australia's future tax system Retirement income Consultation paper, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Henry Tax Review (2008c) Australia's future tax system Consultation paper, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Henry Tax Review (2009) Australia's future tax system, Final report: Part 2 Detailed analysis – Volume 1, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Henry Tax Review (2010a) Australia's future tax system, Final report: Part 1 - Overview, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Henry Tax Review (2010b) Australia's future tax system, Final report: Part 2 Detailed analysis – Volume 1, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Henry Tax Review (2010c) Australia's future tax system, Final report: Part 2 Detailed analysis – Volume 2, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Hilber, C. (2015) The economic implications of house price capitalization: A synthesis. Real Estate Economics, 45(2): 301-339.

Hilber, C. A. and T. Lyytikainen (2017) The effect of the UK stamp duty land tax on household mobility. Journal of Urban Economics, 101: 57–73.

Hoj, A., M. Rahbek Jorgensen, and P. Schou (2018) Land tax changes and full capitalisation. Institute for Fiscal Studies, 39(2): 365-380.

Hoyt, W. H. (1991) Competitive jurisdictions, congestion, and the Henry George theorem: When should property be taxed instead of land? Regional Science and Urban Economics, 21(3): 351-370.

Hui, E. C., and C. Liang (2015) The spatial clustering investment behaviour in housing markets. Land Use Policy, 42: 7-16.

Immervoll, H. (2007) Minimum wages, minimum labour costs and the tax treatment of low-wage employment. IZA Discussion Paper No. 2555, IZA, Bonn, Germany.

Industry Commission (1993) Taxation and Financial Policy Impacts on Urban Settlement, Volume I: Report no 30, Australian Treasury, Commonwealth of Australia, Canberra, Australia.

Ingles, D. (2016) Taxes on Land Rent. TTPI Working Paper 6/2016, Tax and Transfer Policy Institute, Crawford School of Public Policy, ANU, Canberra, Australia.

ICA (2015) Submission in Response to the Australian Government's Tax Discussion Paper, Insurance Council of Australia, Sydney NSW 2000, Australia, Available from: http://www.insurancecouncil.com.au/assets/submission/2015/May%202015/2015_05_29_%20Commonwealth%20Tax%20Review%20Submission.pdf [Accessed: 10 October 2017].

IPART (2008) Review of State taxation: Report to the Treasurer, Independent Pricing and Regulatory Tribunal NSW, NSW Treasury, Sydney, Australia.

Klier, T. and J. Linn (2015) Using taxes to reduce carbon dioxide emissions rates of new passenger vehicles: Evidence from France, Germany, and Sweden. American Economic Journal: Economic Policy, 7(1): 212-242.

KPMG (2010) CGE Analysis of the Current Australian Tax System, KPMG Econtech, Available from: http://taxreview.treasury.gov.au/Content/html/commissioned_work/downloads/KPMG_Econtech_Efficiency%20of%20Taxes_Final_Report.pdf [Accessed 09/10/2017]

Korkeamäki, O. (2011) The Finnish payroll tax cut experiment revisited, or where did the money go? Paper presented at the 51st Congress of the European Regional Science Association: New Challenges for European Regions and Urban Areas in a Globalised World, 30 August - 3 September, 2011, Barcelona, Spain.

Kopczuk, W. and D. Munroe (2015) Mansion tax: The effect of transfer taxes on the residential real estate market. American Economic Journal. Economic Policy, 7(2): 214-257.

Kriesel, W. and C. Landry (2004) Participation in the national flood insurance program: an empirical analysis for coastal properties. Journal of Risk and Insurance, 71(3): 405–420.

Kunreuther, H. and E. Michel-Kerjan (2009) At war with the weather: managing large-scale risks in a new era of catastrophes. MIT Press, Cambridge.

Kugler, A. and M. Kugler. (2002) Effects of payroll taxes on employment and wages: Evidence from the Colombian social security reform. Center for Research on Economic Development and Policy Reform Working Paper No. 134, Stanford University, CA, USA.

Kugler, A. and M. Kugler (2009) Labor market effects of payroll taxes in developing countries: Evidence from Colombia. Economic development and cultural change, 57(2): 335-358.

Kugler, A., M. Kugler and L. O. H. Prada (2017) Do payroll tax breaks stimulate formality? Evidence from Colombia's reform, NBER Working Paper 23308, National Bureau of Economic Research, Cambridge, USA.

Landry, C. and M. Jahan-Parvar (2011) Flood insurance coverage in the coastal zone. Journal of Risk and Insurance, 78(2): 361–388.

Lin, C. (1986) A general equilibrium analysis of property tax incidence. Journal of Public Economics, 29(1): 113 – 132.

Lignier, P. (2011) The role of taxation in addressing the externalities of road transport: a critical analysis of Australian tax policy. Australian Tax Forum, 26: 137-171.

Lundborg, P. and P. Skedinger (1999) Transaction taxes in a search model of the housing market. Journal of Urban Economics, 45(2): 385-399.

Lutz, B., R. Molloy, and H. Shan (2011) The housing crisis and state and local government tax revenue: Five channels. Regional Science and Urban Economics, (41)4: 306-319.

Mangioni, V. J. (2014) Land value taxation and the valuation of land in Australia. Nordic Journal of Surveying and Real Estate Research, 10(2): 82–98

Mangioni, V.J. (2015) Land Tax in Australia: Fiscal reform of sub-national government, Routledge.

Melbourne Institute (2017) HILDA Survey, Melbourne Institute, University of Melbourne, Victoria, Available from: http://melbourneinstitute.unimelb.edu.au/hilda [Accessed 09/10/2017]

Melguizo, A., and González-Páramo, J. M. (2013) Who bears labour taxes and social contributions? A meta-analysis approach. SERIEs, 4(3), 247-271.

Mieskzkowski, P. (1972) The property tax: An excise or a profits tax? Journal of Public Economics, (1)1: 73-96.

Mirrlees, J., S. Adam, T. Besley, R. Blundell, S. Bond, R. Chote, M. Gammie, P. Johnson, G. Myles, and J. Poterba (ed.) (2011) Tax by Design - The Mirrlees Review, Oxford 2011.

Needham, B. (2000) Land taxation, development charges, and the effects on land-use. Journal of Property Research, 17(3): 241-257.

Nickell, S. (1997) Unemployment and labor market rigidities: Europe versus North America. The Journal of Economic Perspectives, 11(3): 55-74.

Nordvik, V. (2001) Moving costs and the dynamics of housing demand. Urban Studies, 38(3): 519–533.

Oates, W. E. (1969) The effect of property taxes and local public spending on property values: An empirical study of tax capitalization and the tiebout hypothesis. Journal of Political Economy, 77(6): 957-971.

Oates, W. E., and Schwab, R. M. (1997) The impact of urban land taxation: The Pittsburgh experience. National Tax Journal, 1-21.

OECD (2016) Revenue Statistics 2016, OECD Publishing, Paris. Available from: http://dx.doi.org/10.1787/rev_stats-2016-en-fr [Accessed 13/10/2017].

Ommeren, J. V. and M. Leuvensteijn, (2005) New evidence of the effect of transaction costs on residential mobility. Journal of Regional Science, 45(4): 681–702.

O'Sullivan, A, T. Sedon and S.M. Sheffin (1995) Property taxes, mobility and homeownership. Journal of Urban Economics, 37: 107–129.

Palmon, O. and B. Smith (1998) New evidence on property tax capitalization. Journal of Political Economy, 106(5): 1099-1111.

Pearce, P. (2012). Using tax and regulatory measures to reform choice and usage of motor vehicles for personal transportation in Australia for the sustainability of oil, Doctoral dissertation, School of Business Law and Taxation, Curtin University, Perth Available from: https://espace.curtin.edu.au/handle/20.500.11937/1823 [Accessed 13/10/2017].

Pollock, R. L., and D.C. Shoup (1977) The effect of shifting the property tax base from improvement value to land value: an empirical estimate. Land Economics, 53(1), 67-77.

Productivity Commission (2017) Realising the Productive Potential of Land, Shifting the Dial: 5 year Productivity Review, Supporting Paper No. 10, Canberra.

Ralston, B. (2018) Does payroll tax affect firm behavior? Treasury Working Paper 2018-02. The Treasury, Commonwealth of Australia, Canberra, Australia.

Ryan, L., Ferreira, S. and Convery F. (2009) The impact of fiscal and other measures on new passenger car sales and CO2 emissions intensity: evidence from Europe, Energy Economics 31(3): 365-374.

Scutella, R. (1999) The final incidence of Australian indirect taxes. Australian Economic Review, 32(4): 349-368.

Sinning, M. (2015) Australian tax reform: Do we know what needs to be done? Austaxpolicy: Tax and Transfer Policy Blog, 16 December 2015, Available from: http://www.austaxpolicy.com/australiantaxreformdoweknowwhatneedstobedone/ [Accessed 09/10/2017].

Sinning, M. and O. Majeed (forthcoming) Payroll taxes in Australia: Do workers and firms share the tax burden? Unpublished manuscript, Tax and Transfer Policy Institute, Crawford School of Public Policy, ANU, Canberra, Australia.

Sirmans, S., D. Gatzlaff, and D. Macpherson (2008) Review articles: The history of property tax capitalization in real estate. Journal of Real Estate Literature, 16(3): 327-343.

Slemrod, J. B., C. Weber, and H. Shan, (2017) The behavioural response to housing transfer taxes: Evidence from a notched change in D.C. policy, Journal of Urban Economics 100: 137-153.

Stewart, M., A. Moore, P. Whiteford and R. Q. Grafton (2015) A stocktake of the tax system and directions for reform: Five years after the Henry Review, Tax and Transfer Policy Institute, Crawford School of Public Policy, ANU, Canberra, Australia.

Tooth, R. and Barker, G. (2007) The Non-insured: Who, Why and Trends into non-insurance, Commissioned Study, The Insurance Council of Australia, Available from: http://www.insurancecouncil.com.au/issues-submissions/reports/non-insurance [Accessed 09/10/2017]

Tooth, R. (2012) Australian Household Insurance: Understanding and Affordability, Commissioned Study, The Insurance Council of Australia, Available from: http://www.srgexpert.com/wp-content/uploads/2015/08/Sapere-IAG-Consumer-Survey-Report-vPublic.pdf [Accessed 09/10/2017]

Tooth, R. (2015) Analysis of demand for home and contents insurance, Commissioned Study, The Insurance Council of Australia, Available from: http://www.insurancecouncil.com.au/assets/report/27082015%20-%20Analysis_of_demand_for_home_and_contents%20(1).pdf [Accessed 09/10/2017]

Wang, D., R. Davidson, J. Trainor, L. Nozick and J. Kruse. (2017) Homeowner purchase of insurance for hurricane-induced wind and flood damage. Natural Hazards, 88(1): 221-245.

Warren, N. (1998). Tax facts and tax reform. Australian Tax Research Foundation Research Studies, 147.

Whelan, S. and S. Parkinson (2017) Housing tenure, mobility and labour market behaviour, AHURI Final Report No. 280, Australian Housing and Urban Research Institute, Melbourne.

White, S., Sarac, K., Bubna-Litic, K., Samson, J., and Reidy, C. (2001) State and local taxes in Australia: Towards sustainability, Australian Tax Research Foundation, Sydney.

Wood, G., R. Ong, M. Cigdem and E. Taylor (2012) The spatial and distributional impacts of the Henry Review recommendations on stamp duty and land tax, AHURI Final Report No.182. Australian Housing and Urban Research Institute, Melbourne.

Wood, G., R. Ong, and M. Cigdem (2016) Housing tax reform: Is there a way forward? Economic Papers: A journal of applied economics and policy, 35(4): 332-346.

Yan, S.and G. Eskeland (2018) Greening the vehicle fleet: Norway's CO2-differentiated registration tax. Journal of Environmental Economics, 91: 247-262.

Zodrow, G. (2014) Interjurisdictional capitalization and the incidence of the property tax. Regional Science and Urban Economics, 45: 57 – 66.

Appendix 1: Revenue calculations

Payroll tax

We propose a simple procedure to calculate payroll tax revenues resulting from a change in the payroll tax rate. It is useful to introduce some notation first. Before the change in the payroll tax rate, let n_f be the number of employees of firm f $(f = 1, \ldots, F)$ and let $\bar{w}_f$ be the average wage rate of firm f. Then the total payroll before the change in the tax rate may be written as $\sum_{f=1}^{F} n_f \bar{w}_f$. Given the tax rate τ and the tax threshold T, the total tax revenue before the tax rate change is $R = \tau \Pr(n_f \bar{w}_f > T) \sum_{f=1}^{F} n_f \bar{w}_f$, where $\Pr(n_f \bar{w}_f > T)$ is the fraction of firms above the payroll tax threshold. Now let η_n denote the elasticity of the number of employees with respect to the tax and let η_w be the elasticity of wages with respect to the tax. Then the change in the number of jobs resulting from a Δx change in the payroll tax is $(1 + \Delta x \eta_n) n_f$. The corresponding change in the average wage rate is $(1 + \Delta x \eta_w) \bar{w}_f$. The total payroll after the change in the tax rate is given by $\sum_{f=1}^{F} (1 + \Delta x \eta_n) n_f (1 + \Delta x \eta_w) \bar{w}_f$. Then the total revenue after the change in the tax is

$$\tau \Pr(n_f \bar{w}_f > T) \sum_{f=1}^{F} (1 + \Delta x \eta_n) n_f (1 + \Delta x \eta_w) \bar{w}_f$$

$$= (1 + \Delta x \eta_n)(1 + \Delta x \eta_w)(1 + \Delta x) \tau \Pr(n_f \bar{w}_f > T) \sum_{f=1}^{F} n_f \bar{w}_f$$

$$= (1 + \Delta x \eta_n)\,(1 + \Delta x \eta_w)\,(1 + \Delta x) \times R.$$

Consequently, the additional revenue resulting from the change is

$$\big((1 + \Delta x \eta_n)\,(1 + \Delta x \eta_w)\,(1 + \Delta x) - 1\big) \times R.$$

Land tax

Let n_s be the number of blocks of land in suburb s $(s = 1, \ldots, S)$ before the change in the land tax. The average unimproved land value in suburb s is $\bar{p}_s$. The total value of unimproved land (before the change in the land tax) is $\sum_{s=1}^{S} n_s \bar{p}_s$. The total revenue before the tax change is $R = \tau \Pr(IP = 1) \sum_{s=1}^{S} n_s \bar{p}_s$, where τ is the land tax rate and $\Pr(IP = 1)$ is the fraction of investment properties. The elasticity of the number of blocks of land with respect to the tax is η_n. The elasticity of the average unimproved land value with respect to land tax is η_p. Similar to the payroll tax, the additional revenue resulting from a Δx change in the land tax may be written as $\big((1 + \Delta x \eta_n)\,(1 + \Delta x \eta_p)\,(1 + \Delta x) - 1\big) \times R$.

Stamp duty on properties

Let n_S be the number of properties sold in suburb s $(s = 1, \dots, S)$ before the tax change. The average price in suburb s is $\bar{p}_S$. Given the stamp duty rate τ, the total value of property sales before the change in stamp duty is $\sum_{s=1}^{S} n_s \bar{p}_S$. The total tax revenue before the policy change is $R = \tau \Pr(NE = 1) \sum_{s=1}^{S} n_s \bar{p}_s$, where $\Pr(NE = 1)$ is the fraction of non-exempt properties. Let η_n and η_p be the elasticities of the number of property sales and the average property price with respect to a stamp duty change, respectively. Then a Δx stamp duty increase will raise tax revenues by $\left((1 + \Delta x \eta_n)\left(1 + \Delta x \eta_p\right)(1 + \Delta x) - 1\right) \times R$.

Insurance tax

Let c_h denote expenditures on insurances of household $h\,(h = 1, \dots, H)$. The total tax revenue before the change in insurance tax is $R = \tau \sum_{h=1}^{H} c_h$. Given the elasticity of expenditures on insurance with respect to the tax, η, the additional revenue resulting from a Δx increase in insurance stamp duty is $[(1 + \Delta x \eta)\,(1 + \Delta x) - 1] \times R$.

Motor vehicle taxes

Let n_s be the number of vehicles sold in state s $(s = 1, \dots, S)$ and let $\bar{p}_s$ be the average vehicle price in state s before the change in motor taxes. The total volume of sales is given by $\sum_{s=1}^{S} n_s \bar{p}_S$. Let τ be the motor vehicle tax rate. Then the total revenue before the change in motor vehicle taxes is $R = \tau \sum_{s=1}^{S} n_s \bar{p}_s$. Given the respective elasticities of the number of sales and the vehicle price with respect to the tax, η_n and η_p, a Δx increase in motor taxes leads to an increase in tax revenues by $\left[(1 + \Delta x \eta_n)\left(1 + \Delta x \eta_p\right)(1 + \Delta x) - 1\right] \times R$.

Appendix 2: Responses to queries about report received from CGC Commissioners, States and Territories

General Concerns

1. **A small sample can often limit the validity of empirical work: in this case 8 states and a small number of time series observations. What are the sample sizes used in the analysis?**

   We have samples sizes ranging from 152 observations with the APRA insurance data to 3.8 million observations with the BLADE data. The individual samples size of each data source employed are described in the data sources section of each chapter. Each results table also reports the number of observations used in the corresponding regression model. As a general overview of the sample size of the data sources used:

   - HILDA had 45,000 observations for car ownership.
   - The Household Expenditure Survey had 33,000 observations over the four waves employed.
   - The CGC assessment data typically had 192 state level observations over a 17-year period. In the case of value-range disaggregations (as for stamp duty and land tax) there were 2,000 – 2,500 observations with the CGC data.
   - CoreLogic data had 600,000 observations.

2. **It would be useful to know if co-integration is an issue in these difference-in-difference models since a pooled (panel) approach is applied which has a time series aspect.**

   Co-integration is not an issue in the context of difference-in-difference estimation because the approach does not involve time series. The main concern of the approach is that standard errors need to be clustered to account for within-state correlations, which we have done. We have also tested how the use of state-time clusters affects our estimates and we find that the standard errors do not change much when we consider state-time clustering. While co-integration is not an issue, it is possible that treatment status is serially correlated, which may affect the size of the standard errors.

Specifically, in the case of the payroll tax, we will attempt to address serial correlation when preparing more detailed results for our working paper. However, it is important to note that our economic conclusions (specific to the payroll tax) will not be affected by the exact size of the standard errors because we observe both positive and negative treatment effects (that do not appear to be significant).

3. **Why were state-specific or capital city elasticity estimates excluded?**
Estimating state or region-specific tax elasticity estimates was not the objective of this report. Moreover, it is not possible to estimate state specific taxes and still control for time varying influences (like a changing economy). We identify the elasticity estimates presented in the report by exploiting changes that occurred in some states but not others, such that the other states represent the counterfactual employed.

4. **Another issue that is not considered is how a change in one tax may impact the revenue base of another tax.**
This is a valid concern but was outside the scope of this report. Generally, we would expect the elasticities across taxes to be very small. It is hard to see how a change in motor vehicle registration fees would have a significant influence on the outcomes of the property market or how changes in stamp duty might affect firms' payroll. These effects might be negligible, if indeed they exist. However, property taxes are one area where we would expect a more sizable interaction. Land tax and stamp duty are closely related and an analysis of these cross-tax elasticities could be fruitful.

5. **If the HEF system is meant to be as simple as possible, how can the inclusion of an elasticity be justified?**
The real world is a complex system that cannot be perfectly reproduced by a model. However, improvements that can bring the model closer to representing reality should be considered, even if the result remains simpler than the complex and aggregated interactions of all market participants.

6. **Many state taxes involve both thresholds and tax rates. While the consultant has focused on one or the other, for completeness, they should have examined both**.
This is not entirely correct. In the case of stamp duty, land tax and motor tax both rates and thresholds were considered at the same time. By nature of the insurance tax, only rate changes were considered. The analysis of the payroll tax is done in a different way

given the data source very specific changes are used, affected firms identified and tested against a counterfactual.

7. **State taxes tend to affect the price of a good, service or asset purchased by the user or sold by the owner. For those taxes, estimating the price elasticity of demand would be a starting point for determining the impact of state taxes on the revenue bases. The consultant does not appear to have considered this approach.**
   The objective of this empirical analysis was to find the effect of tax changes on the *tax base*. Accordingly, we have analysed variables equivalent to the tax base and not components thereof. This is the most direct and cleanest way to estimate the desired elasticities defined by the scope of this project. Other suggested steps would result in different types of elasticities, which are interesting in their own right and within their own academic literatures but are outside the scope of this study.

8. **The models used by the consultant are presented in general terms and the explanatory variables included are not mentioned in the report. While the consultant is trusted to specify their models correctly, it would be interesting to know the explanatory variables used and their impact.**
   This is incorrect. Each individual regression model is described in detail in the results section. When the individual tables are discussed all included variables are explicitly mentioned. A more general model approach is presented at the beginning of most chapters, but a very detailed description of all model parameters used for the individual data is provided in the data sections.

9. **For some state taxes such as insurance tax and motor tax, using a statutory tax rate as an instrument for an effective tax rate (after all exemptions), to overcome potential endogeneity, does not satisfy the exclusion restriction, as statutory tax rates affect individuals' behaviour.**
   This is incorrect. The statutory tax rate fulfils the exclusion restriction, as it only affects the tax base through the effective tax rate in this reduced form regression. Using the 2SLS modelling approach, only the non-endogenous tax changes are used to identify changes in the tax base.

Measurement issues

10. **The elasticity measured by the consultants for insurance duty assumes that a percentage *point* change in the tax rate will result in a percentage change in the**

revenue base[65], but the other elasticities assume a percentage change in the tax rate will result in a percentage change in the revenue base. It is not clear why the relationship should differ between taxes, or why the consultants have chosen the particular relationships.

Since insurance tax is on average close to 10 percent, a one percentage *point* change will be equivalent to the otherwise stated 10 percent change. Unlike some of the other taxes presented in the report, the international literature on the elasticity of the demand for insurance focuses primarily on its responsiveness to *price*, as opposed to taxes. As a result, results from the international literature for insurance are largely presented as the effect of a percentage increase in the price of insurance on its demand (as opposed to a percentage point increase in a price on demand).

In order to facilitate the comparison between the international literature (focused on changes in prices) and the domestic estimates (focused on changes in tax rates) for the elasticity of the demand for insurance, a percentage *point* elasticity was chosen. This was done since a 1 percent increase in prices from the international literature is approximately equivalent to a 1 percentage *point* increase in the tax rate in the domestic literature.

11. **The underlying data used to produce the elasticity estimates for the various revenue bases are not consistent, especially the time periods. It would seem reasonable that any elasticity adjustment should be measured over a consistent time period.**

For each dataset we employ we used the maximum number of time periods available for the analysis in order to derive a precise elasticity estimate. More observations and a

[65] Steinhauser, R, Sinning, M, Sobeck, K. (2019) *State tax elasticities of revenue bases*, Tax and Transfer Policy Institute, The Australian National University, Canberra, page 4.

longer time series are generally desirable, but if data are only available over a shorter period, valuable information can still be gained from analysing the shorter series.

Payroll Chapter

12. **In seeking to produce an estimate of a revenue elasticity for payroll tax, the consultants examined changes in payroll tax thresholds across jurisdictions over 10 years. The payroll tax evaluation does not study the effects of changes in payroll tax rates on the basis that these changes were comparatively small. However, consider the decrease in the legislated payroll tax rate in Victoria in 2011 from 4.95% to 4.90%. If a Victorian firm had a payroll of $1 million, the total tax saved from the change was $225, which is the equivalent of increasing the payroll tax threshold by $4,545. However, for a $5 million firm, the payroll tax saving is $2,225, the equivalent of increasing the payroll tax threshold by $44,949. This could be seen as significant.**

    Direct access to BLADE data would have allowed us to examine the data in more sophisticated ways. However, our results clearly show that reducing the payroll tax burden for small firms by a substantial amount does not lead to an increase in wages or employment. Therefore, we have no reason to expect that the effect of reducing the payroll tax burden for large firms by a relatively small amount (relatively to their size) would be very different. Changes in payroll tax thresholds were up to $100,000 and affected small firms. The fraction of large firms in Australia is very small and it appears unlikely that wage or employment effects resulting from tax rate changes are big enough to shift the average (despite the enormous size of some large firms). Our results are closer to the average (and therefore more likely to be representative) because we focus on small firms.

13. **In 2017-18 there were around 4,000 entities registered for payroll tax operating within Western Australia that have an annualised, Australia-wide payroll in excess of $5 million. This accounts for more than 25% of entities registered for payroll tax operating in Western Australia. The consultants appear to presume that these entities are not impacted by changes in the payroll tax threshold rather than measuring that this is the case.**

WA's payroll tax threshold was fixed at $750,000 from 2005-06 to 2013-14 and increased to $800,000 in 2014-15. The payroll tax rate of 5.5 percent did not change over our study period. We did not analyse payroll dynamics but it is highly unlikely that many firms with a payroll of more than $5 million were below the threshold of $750,000 (or $800,000 in 2014-15) at any point of the study period. Including large firms that were not affected in the analysis sample increases noise and reduces the signal. Therefore, our preferred analysis sample only includes firms with a payroll of less than $2,000,000 (the highest payroll tax threshold of observed during our study period is $1,850,000).

14. **While the discussion on payroll tax notes that both a threshold and tax rate are applied, the rationale for a threshold is not discussed. Thresholds exist so that small employers are not subject to payroll tax. If thresholds are not adjusted over time then rising wages will result in 'bracket creep', that is employers who were not intended to be subject to payroll tax can become subject due to increases in payrolls even if there is no increase in employees. Falling over the threshold gives rise to an extremely high marginal tax rate.**

    Our study did not intend to provide a rationale for a threshold. Our objective was to estimate the effect of payroll tax changes on wages and employment. We do not find an effect, suggesting that wage or employment effects cannot be used to justify a lower payroll tax burden. Other reasons, such as 'bracket creep', may be more appropriate.

15. **The model uses a dummy variable to show if there is a change in threshold. However, the absolute change varies across states and this may have different impacts on employment. The consultant could further investigate the impact if there is a 10 or 20 per cent increase in the threshold.**

    As mentioned earlier, limited access to the data did not allow us to study the data in more sophisticated ways. However, regardless of whether or not we study the treatment intensity, the evidence in favour of a "zero effect" is overwhelming because it can be seen directly in the raw data. A more detailed discussion of this issue will be included in our working paper.

16. **As payroll tax affects the cost of labour to employers, changes to payroll tax thresholds and rates should have the same impact as changes in the pre-tax wages of employees. That is the impact on employment of changes in payroll tax will be determined by the wage elasticity of employment. However, it is likely to be**

asymmetric in wage elasticities caused by wage increase or wage decreases. In the period considered by the consultant pre-tax wages have been decreasing while payroll tax incidence has been decreasing.

Although we refer to wages when interpreting our results, the measure used as a dependent variable in our analysis is the payroll as defined in the BLADE data. We assume that this measure is accurate. BLADE does not contain wages of individual workers.

17. **It is not clear that the model used to estimate the effect of changes in the effective rate of payroll tax on FTE number also includes the pre-tax wage rate. Changes in pre-tax wage rates will have an impact on FTE numbers and if they are not included in the model then the impact of changes in effective rates of payroll taxes may be overstated.**

    We did not control for wage or payroll effects in our FTE regressions. We will try to address this issue in our working paper. However, since our “zero effects” result can be seen directly in the raw data, it is unlikely that controlling for additional covariates will make a big difference.

18. **The consultant appears to have not considered the impact of dynamics in the operation of the labour market. If there is a decrease in the effective payroll tax, then the impact on FTE may not be immediate. It would depend on the extent to which labour can be substituted for capital and the extent to which the lower cost on production is passed on. The consultant could further identify the mechanisms by which payroll tax influences FTE.**

    Our discussion paper will also include estimates of the effects of payroll taxation on capital expenditure. The effects are insignificant.

19. **In light of these considerations, Victoria supports the conclusion of the consultant that the elasticity of the payroll tax base with respect to payroll tax should be regarded as being insignificant. However, neither the study nor some of the cited studies (Ralston, 2018) appear to adequately account for exempt businesses or grouping provisions. The latter would be difficult to observe using the Business Longitudinal Analysis Data Environment (BLADE) data, but ANZSIC codes could be used to exclude exempt businesses.**

That is correct. Researchers with adequate access to BLADE could analyse this issue in greater detail. We will discuss the limitations of our analysis in the working paper and point out directions for future research.

Insurance Taxes

20. **An important determination of the insurance premium paid (apart from compulsory third-party insurance) is the value of the asset insured. The only asset values included are the value of the dwelling and of the motor vehicles in the household (for one of the models for non-compulsory motor vehicle insurance). It is unclear whether the value of the dwelling affects the insurance decisions of renters. Also, the location of the asset could have an impact on risk (rate per dollar insured). The model may have been improved by including the location risk of the household. Since data relating to the value of assets insured or the rate of insurance are missing. This casts doubt on whether any meaningful estimates of elasticity can be obtained.**

We have used the value of the assets wherever the data permitted, that is for the value of the contents in case of content insurance (see robustness results reported in the text page 36) as well as for the car value in the case of comprehensive car insurance. The location data in the HES beyond the state is very limited and only available in the last wave of 2015.

21. **Some other factors within the data also should ideally be taken into account. Behavioural differences may be present within the data but these differences cannot be observed. For example, insurance duty for general insurance is levied on the value of the premium paid by the person or entity taking out the insurance. The value of the premium paid for the same insurance contract can differ based on the individual's/entity's excess preference. By increasing the value of the excess, the insurance premium can be reduced and the value the insurance duty is also reduced. It does not appear that such preferences or behavioural responses to increasing premiums have been accounted for or, if they are, they are assumed to be identical across all jurisdictions.**

This is a misperception. If a person buys no insurance, buys full insurance without excess, or chooses a larger than usual excess, they are all different levels of insurance people purchase according to their preferences. The reduced insurance premium paid by people with an excess represents, very accurately, the lower level of insurance individuals or entities prefer to purchase.

22. **Since the reports finds differences in the elasticities for different types of insurance, how can we apply one elasticity over the entire insurance tax base?** The individual insurance type elasticity estimates are due to data restrictions as some data sets only report spending on certain type of insurances. We use these findings as a robustness check and to determine a potential range of elasticities given the different types. The results confirm the expected differences in elasticities according to insurance, depending on whether it is more or less compulsory, and as such confirms the methodology and regression models as sensible estimates. In the end we are interested in estimating an average elasticity over all types of insurances, which can then also be applied over the entire insurance tax base.

Motor Vehicle Taxes

23. **Why has transfer duty on motor vehicle transfers been excluded from any elasticity assessment?**
    The CGC treats this tax according to the summary of revenue bases as a transfer tax similar to stamp duty. Within that category, the transfer tax on motor vehicles is of lesser importance. Moreover, the tax was not included in the scope of this report, which was defined by the CGC.

24. **License fees applying to a Holden Commodore by state and territory are shown in Figure 14 of the Report. The value of license fees in 2014 has the following order in terms of magnitude: NSW > ACT > QLD > WA > VIC > SA > Tas > NT. Figure 16 of the Report shows the average household vehicle ownership by state and territory and it has the following order: NT > Tas > WA > QLD > SA > VIC > NSW > ACT. Since Figure 16 does not follow a reverse order in comparison to Figure 14 as can be expected intuitively, it indicates some other factor is at play.**

We consider that the other factor at play could be remoteness measured by ABS remoteness classifications, or proportion of population outside the Greater Capital City Area. We are unclear whether remoteness has been controlled for in the state fixed effect variable, as but even if that is the case, we suggest that the regression for calculation of motor tax elasticity be re-executed by replacing the population variable with proportion of population outside the Greater Capital City Area.

Remoteness is controlled for in the states' fixed effect, but only to the extent that it is constant over time. The suggested measure of population living in more remote areas is a sensible measure to control for some of the changes in remoteness over time.

25. **We note that a differences-in-differences identification strategy has been followed in order to determine a causal impact of change in the tax rate on the tax base in multiple scenarios. However, the states considered in the treatment group and the control group have not been mentioned explicitly.**

    As noted in the report we run a difference-in-difference style approach. This means we take every change in taxes in a given state as the treatment and compare it with all other states where this change has not occurred as the control group. This is done for all changes in the sample. As such, the approach is not the textbook diff-in-diff specification, with a single change as the treatment, but it relies on the same identification strategy and is best described as a difference-in-difference approach.

26. **The Household, Income and Labour Dynamics in Australia (HILDA) provides a comprehensive data set for analysis. It would be interesting to know whether the consultant considered a Tobit model in this case. There may be households that do not own a light vehicle for reasons not related to registration fees, such as availability of public transport, concern about the environment and so on. Estimating the probability of a household owning a car given its particular circumstances could be the first step of the analysis.**

    A Tobit regression approach, as used in the HES data for the insurance tax, is often biased and commonly used in a (repeated) cross section where other methods like the diff-in-diff approach in panel data do not work. Since HILDA has panel data that we can use, we employ the difference-in-difference style methodology as best suited to find the tax elasticity. As such, we can control for other household circumstances, such as those mentioned above, in the cleanest, non-parametric way, with a fixed effect.

27. **Cited Australian studies identified very high consumption elasticity of motor taxes (higher than personal income tax), and motor taxes were identified as one of the most inefficient State taxes, with a deadweight loss of 37 cents for every dollar raised. This seems incompatible with the consultant's finding that the motor vehicle elasticity was quite small in Australia. It would be helpful if this is clarified**.
The objective of the literature review was to provide an overview of literature available on a specific tax, not all of which was directly comparable or plentiful. While the estimation techniques applied to the study mentioned above do not seem readily available in the publication, it seems like the authors only considered the impact of stamp duty on motor vehicles. Since stamp duty on motor vehicles was excluded from scope of analysis for the CGC in the submitted report, the estimates cannot be directly compared. Subsequently, it can only be inferred that differences in coverage explain the difference identified.

Stamp duty

28. **We note that since tax elasticity is being captured through the regression coefficient of Log(Stamp Duty) and multicollinearity *can* have a severe impact on regression coefficients, the latter needs to be given strong consideration in order to arrive at reliable estimates of the former. Hence, we suggest the authors to check whether the variance inflation factors (VIFs). We also suggest that it would be better to use either a 6-month or a 12-month lag (i.e. t-6 or t-12) in the regression equation for monthly panel data instead of a lag length of one.**
We have to distinguish between lagged dependent variables and lags of explanatory variables. The latter give less concern for issues of multicollinearity. The former indeed has potential for concern. Especially in the case of monthly data, the persistence of the dependent variables could lead to problems of the nature described. We therefore agree that the last two columns of Tables 21 and 22 be considered with care.

Regarding the second part of the question regarding lags, we do this with the monthly data (see footnote 50 on page 103) and this makes sense for the lags of the explanatory variable. This is not quite the same for the lagged dependent variable that helps to address autocorrelation. The partial adjustment model could also be using higher order lags that could be considered in further robustness analyses.

29. **In a buoyant property market with a high demand for property, the incidence of stamp duty is likely to fall on buyers. In other words, sellers will not have to adjust their selling prices to compensate for stamp duty. However, in a depressed property market with low demand, sellers will have to reduce their selling prices so that prices after the imposition of stamp duty remain attractive to purchasers. This suggests that there may not be one elasticity for stamp duty, but rather that the elasticity depends on the property market.**

    In the context of this report, the economic incidence of stamp duty is of less concern. As described, the tax could influence a house price by, at maximum, the size of the conveyance duty (i.e. 5%). The tax, however, is just one element in the negotiations of the market outcome/price, alongside all other price considerations. In this way, any price outcome, or quantity sold, will just reflect the overall market outcome. This also means that whether a change in stamp duty elicits a stronger market reaction when first introduced in a booming vs. depressed property market is irrelevant, since the equilibrium of the market outcome would be the same at the given point in time with the tax in place even if it was already introduced a year earlier in an economically very different property market equilibrium.

30. **Although a time-specific effect has been added in the regression model to reflect external shocks such as business cycle or political regulation, the price elasticity of demand is likely to be affected by the state of the economy—interest rates and the availability of finance.**

    These are all time varying factors that the time-specific effect controls for.

31. **While the CoreLogic sales data provides a wealth of information about property sales, it needs to be supplemented with variables relating to the states of the economy and socio-economic status of the suburbs. Although the assessment system data includes data on stamp duty paid for both residential and commercial properties, the model omits variables relating to the economy and property market.**

    This is not the case. Since the analysis is undertaken at the suburb level with CoreLogic data and includes suburb level and time fixed effects, the model does not require the extra variables suggested. The CGC assessment data is similarly analysed, controlling for any changes in the Australian property market and the economy.

32. **The consultant's estimation method does not consider the different segments of the market. The price/quantity dynamics of units can differ quite significantly from that of a detached house and so this should be controlled for in the regression. Other factors to consider would be that the elasticities can vary depending on the value of the home. As we have seen in other types of analysis, high-value homes are more sensitive to changes in market conditions (including that of the tax rate structure). The analysis also only considers residential property values. Although residential properties make up approximately 80 per cent of Victoria's LTD (Land Transfer Duty) revenue, commercial/industrial makes up the other 20 per cent and this segment of the property market could behave quite differently to residential.**
Indeed, there are many factors that influence the behavioural reaction to a change in taxes. The scope of this report, however, was to estimate an overall average elasticity, which could then in turn be applied to the entire tax base.

33. **It is unclear from the report whether the consultants have looked at residential properties only or both residential and non-residential properties. The residential and non-residential property markets are distinct markets and may be subject to different tax elasticity impacts. Both markets should be considered if an elasticity adjustment is ultimately undertaken.**
This depends on the data set. The Corelogic data only includes residential properties. The CGC data includes both types of properties.

Land Tax

34. **The model based on the assessment system data needs to be augmented by more data that influences the land tax base. For example, an increase in the proportion of residential properties that are rental properties will increase the land tax base. As the majority of the land tax base relates to commercial, rather than residential land, variables that are associated with the state of the economy would also be appropriate. Also omitted from the analysis is the impact of government actions that lead to increased values of land. The omission of some key explanatory variables from the models suggests that the estimated elasticities may be biased.**
This is not the case. We have controlled for the state of the economy in these regression models by including a time fixed effect. It is also misleading to think that we need to

control for the proportion of rental properties when in fact the behavioural forces at play are the main driver in this context. Rather than increased sales, as in the case of stamp duty, the main reaction that market participants can choose is to stay, enter or exit the rental market with their property. As such, this is exactly what we are trying to capture with the tax variable in this reduced form regression. Any other government action will be included in the effective tax rate.

35. **The consultant did not take into account the different tax rates for trusts versus general taxpayers. Depending on which way the value ranges are constructed, the analysis may not take into account aggregation i.e. whether the land tax value is the total of site values for all properties held by one taxpayer, or whether it is the land tax value for each property in Victoria.**

    As these value range data are provided by the individual states to the CGC for the purpose of identifying the applicable tax base and revenue, the data should not have any such problems.