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Jason Nassios, John Madden,
James Giesecke, Janine Dixon,
Nhi Tran, Peter Dixon,
Maureen Rimmer and Philip Adams
Centre of Policy Studies,
Victoria University
And
John Freebairn
Ritchie Chair of Economics, University of Melbourne

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The Centre of Policy Studies (CoPS), incorporating the IMPACT project, is a research centre at Victoria University devoted to quantitative analysis of issues relevant to economic policy.
Address: Centre of Policy Studies, Victoria University, PO Box 14428, Melbourne, Victoria, 8001
home page: www.vu.edu.au/CoPS/ email: copsinfo@vu.edu.au Telephone +61 3 9919 1877

The Economic Impact and Efficiency of State and Federal Taxes in Australia

J Nassios[1], JR Madden[2], JA Giesecke[2,3], JM Dixon[4], NH Tran[1], PB Dixon[2],

MT Rimmer[2], PD Adams[2], JW Freebairn[5]

[1]Senior Research Fellow (CoPS), [2]Professor (CoPS), [3]Director (CoPS), [4]Associate Professor (CoPS), [5]Ritchie Professor (University of Melbourne).

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Centre of Policy Studies
Victoria University
Level 14, 300 Flinders St
Melbourne Victoria 3000

Telephone: +61 3 9919 1480
E-mail: Jason.Nassios@vu.edu.au

www.vu.edu.au/centre-of-policy-studies-cops

Abstract

The Henry Review of Australia's Future Tax System (2009), made several recommendations to promote resilience, fairness, and prosperity via tax reform. Some of the key reforms suggested include a reduction in Australia's federally-imposed corporate income tax rate from 30 to 25 per cent; and the removal of property transfer duties levied by state governments. The review by Henry *et al*. (2009) utilised a long-run, comparative static computable general equilibrium (CGE) model of the Australian economy to study the tax system. Implicit within this framework is a single layer of government.

In reality, Australia's state government levied tax rates differ across the eight states and territories; some, such as state land tax, health insurance and life insurance levies, are applied in a subset of states and territories only. A general lack of interstate coordination is evident in setting, developing and

reforming Australian tax policy. In this paper, we present a meticulous and detailed analysis of Australia's state and federal tax system, using a bottom-up multi-regional CGE model of Australia's states and territories, called VURMTAX. The general framework underlying VURMTAX is similar to the Monash multi-regional forecasting (MMRF) model and its successor VURM; see Adams *et al.* (2015). A state/local government agent therefore operates within each region, with an overarching federal government agent operating across all state and territories.

VURMTAX differs from MMRF/VURM in several ways. For example, we include new theory to model the interaction between Australia's corporate and personal tax system via full dividend imputation. This involves the introduction of two types of investment agents: foreign and local investors. In VURMTAX, the tax rate levied on corporate profits accruing to these two classes of investor differ, because only the domestic investor can claim franking credits. We also give careful consideration to industry-specific foreign capital ownership shares. This means the mining sector, for example, has a larger foreign capital ownership share than the economy-wide average in VURMTAX.

We also modify the standard Klein-Rubin utility function that governs the consumption choices facing region-specific representative households in MMRF/VURM, to take account of important distortions in consumer choice caused by Australia's tax system. More specifically, we model the impact of housing tenure choice distortions introduced by owner-occupied housing exemptions in state land taxes and personal income tax, using a nested CES framework. The elasticity of substitution between rented and owner-occupied housing is then calibrated based on findings from an appropriately specified discrete choice model of housing tenure choice. We also alter the standard household decision theory to properly account for the impact of property transfer duties on the demand for the bundle of goods typically consumed by households or businesses when moving house or factory/office. We call this bundle of goods moving services. These services include real estate services contracted to sell a house/buy a property, legal services contracted to prepare necessary transfer forms, and public administration services that are demanded to formally update title office documents. We also account for the impact of motor vehicle taxes on transport modal choice by households. As such, when the motor vehicle registration duty is increased in VURMTAX, we allow for direct modal substitution between, e.g, road passenger transport (taxis), and private transport.

Among other theoretical developments, we account for the impact of jurisdiction-specific payroll tax thresholds in Australia on the output levels of monopolistically competitive firms, which yields insights into whether a reduction in payroll tax rates or a rise in payroll tax thresholds are more

effective means of stimulating a regional economy. We also embed within VURMTAX a detailed equation system to account for Australia's goods and services tax (GST).

We apply this new theory to quantify: (i) the relative economic efficiency of *unilateral* state tax policy reforms in a single Australian state, New South Wales (NSW); (ii) the excess burden of Australia's three main federally-imposed taxes; and (iii) the broader macroeconomic, state and industry impacts of federal tax policy, and unilateral state tax policy, reforms. Our assessment of the relative efficiency of NSW state and Australian federal taxes yields a set of marginal and average excess burdens, which are summarised and discussed. In total, we calculate excess burdens for nineteen major Australian taxes, of which sixteen are levied at the state/local government level. In addition to our study of the allocative efficiency impacts of the various state and federal taxes, detailed long-run (21 years post-reform) results are provided and described, to quantify the economic and industry effects of Australian tax policy reforms.

With regard to state taxes, we find residential property transfer duties to be the most damaging of the state government levied taxes. More specifically, we derive a marginal excess burden for residential property transfer duties that exceeds 100 cents per dollar of revenue raised. Contrary to many past studies of Australia's tax system, we also derive a negative marginal excess burden for company tax in Australia. We compare and contrast this result to past studies, and elucidate some key differences in parameter assumptions and modelling methodology that drive this result.

JEL Classification: C68; E20; E62; H2.

Keywords: Taxation policy; CGE modelling; Dynamics; Excess burden.

Contents

1 Introduction

This paper summarises key findings from the Centre of Policy Studies' simulation-based assessment of Australia's state and federal tax system. All simulation outputs are generated using a multi-regional computable general equilibrium (CGE) model of Australia's states and territories, called VURMTAX (Victoria University Regional Model with Tax Detail). We use a two-region aggregation of the core eight-region VURMTAX database. Results are therefore reported for one state of focus (New South Wales, NSW), along with a set of aggregate results for Australia's remaining seven states and territories (Rest of Australia, RoA), and the national economy. NSW was chosen as our state of focus, because the NSW state government levies a number of taxes, e.g., the health insurance levy, that are not levied by other Australian jurisdictions.

Our analysis surveys both the relative efficiency and economic impact of the tax system. With regard to relative efficiency, our assessment of NSW state and Australian federal taxes yields a set of marginal and average excess burdens at the national level, which we summarise and discuss in section 2. In total, we derive excess burdens for eleven major taxes, of which eight are levied at the state and local government level, while three are national taxes. Many of the eight state taxes require multiple simulations, however, and as such we report excess burdens for nineteen taxes in aggregate. For example, our study of NSW insurance taxes involved ten distinct simulations, allowing us to contrast how disaggregating insurance duties/levies into their five major components affects our understanding of the efficiency of insurance duties and levies. Similarly, we explore the relative impact of payroll tax rate and threshold adjustments (and derive excess burdens for each), and also contrast the relative efficiency of the various motor vehicle taxes levied in NSW. In addition to the national excess burdens, we also report summary measures for the economic damage caused by changes in all NSW state government taxes we study. These state economic damage indicators (SEDIs) are based on the impact of state tax policy changes on real GSP. We define both the SEDIs and excess burdens in section 3.5.

With regard to the macroeconomic and industry impacts of each tax, we provide detailed analyses of the long-run results of our tax policy experiments. Because VURMTAX is dynamic, the long-run results are reported twenty-one years after delivering a tax policy shock. With all tax policy shocks delivered in 2019, we therefore report NSW state and economy-wide macroeconomic and industry results in the year 2040. Our analysis covers both the impacts of marginal changes in tax rates/thresholds, or abolition of each of the taxes studied in this paper. It is hoped that the comprehensive analysis and results presented herein help inform Australia's ongoing tax reform debate [Freebairn (2018a)].

The paper is structured as follows. In section 2, we provide a summary of the marginal and average excess burdens for each of the taxes studied. Section 3 describes key features and elasticities in VURMTAX. Detailed tax-specific reports are provided in later sections, which also discuss state and national macroeconomic and industry impacts.

2 Summary

Our paper covers the following eight classes of Australian state and local government taxes:

(i) payroll tax, with separate studies of both rate and threshold adjustment;

(ii) land tax;

(iii) conveyancing duty, with separate analyses of business and residential duties;

(iv) insurance taxes, with separate account of the economic impact of general insurance duties, life insurance duties, and the health insurance levy. For comparison purposes, we study how these disaggregated results compare to treating all insurance taxes as a composite;

(v) fire service levy (FSL), modelled as a tax on insurance in line with the current system in place in NSW;

(vi) motor vehicle taxes, with separate modelling for used car stamp duty/transfer fees, vehicle registration and weight taxes, and duties/taxes on new car purchases;

(vii) gambling taxes; and,

(viii) council rates, modelled under the current system in NSW whereby rates are levied on unimproved land values.

The national taxes we assess are:

(i) personal income tax;

(ii) corporate income tax; and,

(iii) GST.

For each tax type, assessments are made of the marginal and average excess burdens at the national level. In addition, we report state economic damage indicators (SEDIs) at the state level. These can differ due to interstate competitive effects and factor mobility. In the case of national excess burdens, the excess burdens we report summarise the national welfare loss (measured in cents) incurred by raising a dollar of net revenue via each tax. The average excess burden is computed by dividing the total welfare cost of a tax by the net change in government revenue which arises when the tax is removed. In the case of marginal excess burden, it is the additional welfare cost incurred in seeking a marginal increase in tax-specific revenue. For all federal and local government taxes studied herein, and all but two of the state taxes we consider[1], the marginal excess burden is calculated by raising an additional A$100m in tax-specific revenue in 2019.

We describe the model closure in section 3.4, and provide a summary in what follows. For all tax policy simulations, we keep both federal and state government operating budgets fixed relative to our baseline forecast, via the endogenous determination of a lump sum transfer payment to households. In general, this transfer payment is broadly in line with the value of additional (foregone) tax revenue, which results from changes in national or state-specific tax rates/thresholds. In this way, any revenue generated (lost) from, for example, a tax rate rise (reduction) at the national (state) level, is distributed (offset) via a lump sum transfer (tax) to Australian (state-specific) households. The excess burden is defined as the ratio of the change in real welfare (leisure-adjusted gross national income (GNI) at the national level) or output (leisure-adjusted gross state product (GSP) at the state level,) to the change in real government lump sum transfers to households.

The results for the estimates of marginal and average excess burden for each tax are summarised in Table 2.1 (NSW taxes) and Table 2.2 (national taxes), with all values reported in cents per dollar. Because VURMTAX is a dynamic model, excess burdens are calculated for each year over the simulation period (2019 – 2040), which is twenty-one years. All excess burdens reported herein are based on welfare and tax collection deviations from forecast in the final year of the simulation period, i.e., twenty-one years post the tax policy shock. In the case of NSW tax policy shocks, we report both the SEDI (for NSW only) and the national excess burden.

The results in Table 2.1 and Table 2.2 can be interpreted in the following way. FWith regard to state tax outputs in Table 2.1, our analysis shows that raising an additional $1 of payroll tax revenue in NSW via an increase in the payroll tax rate generates a national welfare loss of 22c (comprising lost national income and leisure). The damage done to the NSW state economy from raising an additional $1 of payroll tax revenue via the same mechanism is 90c (comprising lost GSP and leisure). With regard to national taxes in Table 2.2, the revenue raised from company taxes in Australia imposes an average welfare *gain* (hence the negative sign) at the

[1] The two exceptions are life insurance duties and the health insurance levy, which we derive excess burdens for by simulating rate rises that are sufficient to increase tax-specific state government revenues by a smaller amount, equal to A$10m. This is because aggregate state government revenues from these taxes are small (less than A$200m in 2015/16 in each case), and A$100m increases in tax-specific revenues would have required tax rate rises that are too large to derive suitable estimates of the marginal excess burden or SEDI.

national level of 32c per dollar raised. This contrasts markedly with other national taxes, the personal income tax (PIT) and the GST, for which the average welfare loss per dollar of revenue raised is (respectively) 34c and 15c.

Table 2-1: Marginal and average excess burdens and state economic damage indicators (SEDIs) for unilateral NSW state tax reform, measured in cents per dollar.

	Marginal	**Average**
	Payroll tax *Rate adjustment*	
SEDI	90	103
Excess burden	22	35
	Payroll Tax *Threshold adjustment*	
SEDI	77	56
Excess burden	3	-17
	Land Tax	
SEDI	3	-4
Excess burden	8	4
	Land Tax on Dwellings only	
SEDI	25	14
Excess burden	17	10
	Transfer duty *Business*	
SEDI	86	64
Excess burden	63	47
	Transfer duty *Residential*	
SEDI	307	194
Excess burden	107	42
	Insurance as a single commodity[2]	
SEDI	97	89
Excess burden	37	29
	General Insurance	
SEDI	81	78
Excess burden	36	29
	Health Insurance	
SEDI	130	114
Excess burden	31	24
	Life Insurance	

[2] Includes third party insurance taxes, in addition to general, health, life and fire service levies/taxes.

	Marginal	Average
SEDI	128	117
Excess burden	27	22
Fire service levy[3]		
SEDI	88	62
Excess burden	43	32
Motor Vehicles *New cars*		
SEDI	184	184
Excess burden	97	96
Motor Vehicles *Registration and weight taxes*		
SEDI	42	40
Excess burden	25	24
Motor Vehicles *Used car duty*		
SEDI	176	157
Excess burden	24	14
Gambling *Production tax*		
SEDI	140	125
Excess burden	46	34
Council rates, UIV basis		
SEDI	-32	-34
Excess burden	-9	-11

Table 2-2: Marginal and average excess burdens for federal government taxes, measured in cents per dollar.

	Marginal	Average
Company tax		
Excess burden	-27	-32
GST		
Excess burden	15	15
Personal income tax		
Excess burden	39	34

[3] We model the current scheme. The proposed amendments to the scheme would drive excess burdens similar to those reported for council rates.

2.1 Summary of key results

2.1.1 Payroll taxes

Payroll tax in Australia is levied and collected by the states and territories. Previous studies by Murphy (1999) and Dixon *et al.* (2004) identify two distorting aspects of Australia's payroll tax system:

(a) Different rates apply to firms depending on their location and the size of their payroll. Potentially this could distort the allocation of resources between industries and regions.

(b) In all states, payroll taxes apply with a threshold, e.g. in NSW no tax was payable in 2015/16 until a firm had a payroll (or wage bill) of $0.75 million. A threshold of this type causes a downward bias in the size of NSW firms. The downward bias in the size of NSW firms causes an inefficient use of resources.

Herein, we use VURMTAX to study the NSW payroll tax system. The size of the resource-usage inefficiency or dead weight loss generated by the NSW payroll tax threshold is accommodated by modelling the firm-size distribution for each Australian state/territory, in line with the approach for the Victorian economy by Dixon *et al.* (2004). This firm-size distribution model is run in conjunction with VURMTAX, and is solved using the GEMPACK economic modelling software package [Harrison and Pearson (1999)]. Our approach alters previous conclusions regarding the excess burden of payroll tax. Specifically, we explain how the following three key findings materialise via an interplay between threshold-induced firm size biases, and rate-induced payroll tax dead weight losses (DWLs):

1. The marginal excess burden (MEB) of a payroll tax rate rise is smaller than the corresponding average excess burden (AEB);
2. The MEB of a threshold reduction (with the payroll tax rate exogenous) is lower than the MEB of a payroll tax rate rise (at the current threshold);
3. By removing the threshold and recovering the DWLs caused by its imposition, national welfare improves, leading to a negative national average excess burden of the payroll tax threshold in NSW.

2.1.2 Land tax

An important exemption in the current system of land tax in NSW is owner versus renter occupied dwellings; importantly, while the former is land-tax exempt, renter occupied dwellings are not. VURMTAX reflects the fact that land tax on dwellings is paid by renters but not by owner-occupiers. This introduces an allocative efficiency distortion in dwelling tenure choice, which we quantify using a discrete choice model of housing tenure choice. Using a neoclassical analogue with an appropriate substitution elasticity across tenure choice, we establish that the marginal SEDI of the current NSW land tax system (i.e., including exemptions on agriculture, education, residential care and owner-occupied dwellings) causes a leisure-adjusted GSP loss of 3 cents per dollar of net tax revenue raised in NSW. Our approach therefore establishes that the gain arising from part of the land tax incidence falling on foreign and interstate landowners is insufficient to offset the owner-dwelling distortion introduced by the exemption of owner-occupied housing.

2.1.3 Transfer duties on property

Stamp duty on conveyancing or property transfers in Australia are taxes that apply to the transfer of ownership of most properties. While the duty base is the sale value of the property purchased, the resources used in transferring property ownership is usually only a fraction of the value of the property transferred. To model transfer duties on residential property ownership in this way, we introduce a new bundle of goods into the household decision problem in VURMTAX, called *Moving Services*. This bundle consists of goods produced by the Real Estate Services, Other Business Services and Public Administration industries, and represent the real estate agent, legal and public administration goods demanded by households when transferring property. A similar approach is adopted to model commercial property transfers. We assume the burden of commercial property transfers falls entirely on industries (for example, commercial property transfers are incurred when businesses purchase new offices or factories within which they operate). Using ABS data on ownership transfer costs, we found the tax rate on property transfers to be very high, at around 300 per cent. This in turn leads to high excess burdens for both commercial and residential property transfers.

2.1.4 Insurance duties/levies

Taxation of insurance is an indirect tax levied in addition to the Australia's GST, on a subset of services: insurance to reduce the costs of uncertain events. There is no market failure argument for additional taxation of insurance services relative to other goods and services [Henry *et al.* (2009)]. In this paper, we derive tax rates on the provision of insurance services due to three NSW insurance duties/levies: (i) General insurance duties; (ii) Health insurance levies; and (iii) Life insurance duties. To provide a point of comparison to past studies that have not distinguished individual insurance taxes at the state-level, we also provide marginal and average excess burdens and SEDIs where we treat all insurance taxes as a collective indirect tax on a single, aggregate commodity called insurance.

Using VURMTAX, we simulate small (unilateral) increases in NSW insurance tax rates to calculate their marginal excess burdens and SEDIs. We also simulate removal of NSW general insurance duties, life insurance duties, and the health insurance levy, so as to evaluate the average excess burden and SEDIs of these taxes. The marginal SEDI of the NSW health insurance levy exceeds other insurance taxes studied here, and is closely trailed by the NSW life insurance duty marginal SEDI. No other Australian state imposes a levy on health insurance. The tax base for each of these taxes is narrow, because they are levied upon a commodity consumed only by households. Despite carrying an effective rate that is similar to the health insurance levy, general insurance duties are levied on a broader base (both households and industry consume type A – C general insurance), which mutes the marginal SEDI of general insurance taxes relative to the other insurance taxes studied herein.

2.1.5 The current fire service levy (FSL) on insurers

NSW imposes a fire services levy [FSL] on NSW insurance funds, with most other states (except Tasmania) having shifted this hypothecated tax to a property tax. Herein, we derive a conservative estimate of the effective tax rate on the provision of insurance services due to the NSW FSL, and use VURMTAX to derive its marginal and average excess burden.

In NSW, the FSL is levied upon insurance companies in order to fund metropolitan and rural fire brigades and the State Emergency Service (SES). Under the system currently operating in NSW, each financial year the NSW Government notifies insurers of their statutory FSL contribution for that year. As discussed by the Insurance Council of Australia (2017), insurance companies typically pass on this expense to their household and commercial insurance clients. Using data from the APRA Quarterly Performance Statistics for General Insurers and a conservative estimate of the tax rate on insurance premiums caused by the FSL, we found that the tax rate on the provision of insurance services due to the NSW FSL was 68 per cent. The marginal excess burden of the NSW FSL is therefore much larger than the marginal excess burden of the other NSW insurance taxes, duties and levies. This approach to funding emergency services therefore imposes far greater welfare losses on NSW households, compared to the systems in place across other jurisdictions, i.e., via a levy on council rates.

2.1.6 Motor vehicle taxes

Motor vehicle taxes can affect two types of decisions: (i) whether to purchase a motor vehicle (or the extensive margin); and (ii) how much, when and where to use the vehicle (or the intensive margin). We modelled three major NSW taxes on motor vehicles: (i) the weight tax and registration fees on used cars; (ii) stamp duty on used vehicle transfers; and (iii) new car registration fees and stamp duties. Each tax operates in distinct ways; for example, new car fees are taxes on investment, while weight and registration fees are production taxes on private motor vehicle use, as well as on commercial vehicle use by industries. This causes distinct economic impacts, e.g., investment in NSW falls by more when new car taxes are raised compared to when weight and registration fees on used cars are raised. Weight taxes and registration fees, however, have a more pronounced impact on export volumes, because some industries that bear the burden of the tax, such as road freight, serve as important transport margins in Australia.

2.1.7 Gambling taxes

There are two main arguments for special taxation of gambling:

- in cases where supply is restricted by government (e.g. casinos and gaming machines), taxation of the economic rents generated by the limited supply provide a non-distorting source of revenue; and
- as a policy instrument to internalise some of the external costs of problem gambling [Freebairn *et al.* (2015)].

VURMTAX makes some provision for economic rents created by regulation in the gambling sector. In constructing the VURMTAX database, we recognise that the initial values for returns to capital in the gambling sector implied excessively high rates of return on capital. We reduced returns on capital in gambling toward more normal rates of return by reallocating some returns to capital to returns to a sector-specific fixed factor. Hence, when we raise gambling taxes, some of the tax incidence is borne by owners of the fixed factor, thus reducing the excess burden.

There is a diverse range of different special gambling taxes, and this is likely to distort the choice of gambling products. For non-problem gamblers, taxes on gambling likely impose high costs and thus involve an excess burden [Henry *et al.* (2009)]. Analysis of these complex issues is beyond the present scope. Herein, we investigate the effects of raising the production tax rate of a single gaming industry in NSW. As we discuss later, these results show moderate estimated marginal excess burdens and SEDIs. As discussed above, our modelling of these excess burdens and SEDIs account for economic rents in the gambling sector. Nevertheless, our results must be interpreted in the context that our modelling presently does not account for the possible mitigation of the external costs involved with problem gambling.

2.1.8 Council rates

Council rates in NSW are levied on unimproved land values (UIV), with little to no exemptions. Consequently, the excess burden is negative because of foreign landowner taxation. Also, because of interstate landowner taxation, the SEDI lies below the national excess burden. Unlike land tax, which exempts owner-occupied housing, council rates levied on UIV are broad-based. This removes the major distortion involved with land tax.

2.1.9 National Taxes

To benchmark our state tax analyses, we modelled three national taxes: personal income tax, corporate income tax and the goods and services tax (GST). Previous studies of these national taxes by KPMG-Econtech (2010), Cao *et al.* (2015), and Murphy (2016) find the GST to be the most efficient national tax, with a marginal excess burden below both the personal and corporate income tax. As we outline herein, to model the welfare impact of Australia's GST relative to other taxes levied in this country, we derive a new GST theory for VURMTAX to account for the full detail of Australia's GST system. As such, the GST equation system in VURMTAX accounts for the different GST status of various goods and services, the differing coverage of GST registration, and the different degrees of GST refund for tourism-related exports. In stark contrast to previous studies however, we do not find the GST to be the least distortionary of Australia's three federally imposed taxes. With a marginal excess burden of -27 cents per dollar of revenue raised, we find that the corporate income tax ranks above the GST in terms of economic efficiency. We find the personal income tax to be the most distortionary of Australia's three national taxes. In what follows, we briefly summarise our approach and findings for these national taxes.

2.1.10 Personal income tax

Because VURMTAX assumes a representative household, we modelled Australia's personal income tax as a flat-rate tax imposed on household labour and capital income. The rate of the tax is 23.9 per cent in 2015/16, in line with the average personal income tax rate in Australia and based on Parliamentary Budget Office (PBO) estimates. We distinguish between franked and unfranked household capital income, and calibrate the personal income tax system in VURMTAX to ensure that franking credits claimed by households drive a franking credit claim-back ratio (ratio of franking credits claimed to total company tax collected) equal to 33 per cent, which is in line with the rate implied in Australian Tax Office (ATO) data. We also include new theory to model the housing tenure choice distortion introduced by the exemption of imputed owner-occupied housing rents from the personal income tax base. This theory is similar in structure to that developed herein and described in section 5, which we use to accurately model the impact of the owner-occupied housing exemption from state land tax.

Using this theory of personal income taxation, we run two VURMTAX simulations where we (i) increase the personal income tax rate by a sufficient amount to raise an additional A$100m in tax-specific revenue; and (ii) eliminate the personal income tax system and replace it with a lump sum tax on households. From simulation (i), we found the national marginal excess burden of Australia's personal income tax system to be 39 cents per dollar of net revenue raised, while simulation (ii) was used to derive the national average excess burden of this tax (34 cents per dollar).

2.1.11 Company tax

In line with previous studies of the impact of a cut to the Australian company tax rate by Dixon and Nassios (2016, 2018), and in contrast to previous studies of Australia's corporate income tax system by KPMG-Econtech (2010), Cao *et al.* (2015) and Murphy (2016), we derive a negative excess burden for company tax in Australia. This benefit arises because an increase (fall) in the company tax rate increases (reduces) real gross national income (GNI). Under the recursive-dynamic simulation framework in VURMTAX, reducing company tax in Australia increases the post-tax rate of return on all foreign-owned capital. The increase in the post-tax rate of return on foreign capital causes the foreign capital income account to shift towards deficit (because the outflow of foreign capital income increases in line with an increase in post-tax capital payments to foreigners). This windfall gain or upfront transfer to foreign owners of existing domestic capital therefore drives the nation's income account towards deficit, which causes real national income to fall below the baseline forecast. Real national income remains depressed in the long-run. We study why this result differs from previous excess burden estimates, focusing specifically on the findings by Cao *et al.* (2015), who derive a positive marginal excess burden for company tax of 42 cents per dollar of net revenue, using a comparative static long-run CGE analysis. Our approach allows us to attribute 93 per cent of the difference between the two results to differences in parameter specifications, model dynamics, and assumptions regarding net foreign liability accumulation.

2.1.12 GST

For this study, we incorporated into the model the key design features of Australia's GST system. These include: (i) the different GST statuses of different goods and services (namely taxable, GST-free, input-taxed and GST-exempt); (ii) the differing coverage of GST registration, and hence differences in the degree of GST refunds for different industries; and (iii) the different degrees of GST refund for tourism-related exports. Due to the differential GST rates and the narrowing of the GST base due to exemptions and input-taxation compared to that in an ideal GST system, with only one rate and no exemptions, or just input-taxation, the excess tax burden of the current GST system is quite high.

We found that the marginal and average excess burden of the GST on the Australian economy are each 15 cents per dollar of net revenue raised (foregone in the case of calculating the average excess burden). These excess burdens are the result of the adverse impacts of the higher GST on economic activities. The immediate impact of a rise in the GST rate is the increase in the price of taxable goods and services to households, international visitors, and input-taxed industries. On the supply-side, the higher consumer price index relative to GDP price deflator causes the real producer price to rise relative to the sticky real consumer wage, and hence employment declines relative to baseline. This in turns causes the rate of return on capital to fall, causing investment, and subsequently the capital stock, to fall relative to baseline. On the demand side, the higher consumer prices cause a reduction in real final consumption and tourism-related exports. Imports decline in line with reduced domestic demands. GDP declines relative to baseline. Total tax revenue increases, but not by as much as the increase in the GST revenue, due to a decline in non-GST tax revenues.

3 Model and methodology

VURMTAX is a 76-industry model of Australia.[4] Herein, we use a two-region (NSW and the Rest of Australia) aggregation of the core eight-region database. All but six of the industries produce a single commodity. The exceptions are:

- Low-density dwellings and High-density dwellings, which each produce two commodities: *Owner-occupied* and *Rental* tenure variants of the output of their respective Low-density and High-density dwelling services;
- Insurance, which produces five commodities: *General insurance*, *Health insurance*, *Life insurance*, *Fire and emergency services*, and *Third party insurance*;
- Other Business Services, which produces two commodities: *Conveyancing business services* and *Other business services*;
- Public Administration, which produces two commodities: *Conveyancing administration services* and *Public Administration*;
- Real Estate Services, which produces two commodities: *Conveyancing real estate services* and *Real Estate services*;
- Other Services, which produces two commodities: *Used motor vehicle transfer services* and *Other services*.

In this section, we provide a short description of the overall structure of VURMTAX. This facilitates a description of the results we present and study herein.

Investment in each regional industry is assumed to be positively related to expected rates of return on capital in each regional industry. VURMTAX recognises two investor classes: local investors (i.e. domestic households and government) and foreign investors. Effective tax rates on each investor class differ, with foreign investors not liable to pay Australian personal income tax on their capital income, while they are also unable to claim back Australian franking credits. Capital creators assemble, in a cost-minimizing manner, units of industry-specific capital for each regional industry. Each region has a single representative household and a state government. The federal government operates in each region. The foreign sector is described by export demand curves for the products of each region, and by supply curves for international

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

imports to each region. Supply and demand for each regionally produced commodity is the outcome of optimising behaviour. Regional industries are assumed to use intermediate inputs, labour, capital and land in a cost-minimising way, while operating in competitive markets. Region-specific representative households purchase utility-maximising bundles of goods, subject to given prices and disposable income. Regions are linked via interregional trade, interregional migration and capital movements, and governments operate within a fiscal federal framework.

VURMTAX provides results for economic variables on a year-on-year basis. The results for a particular year are used to update the database for the commencement of the next year. More specifically, the model contains a series of equations that connect capital stocks to past-year capital stocks and net investment. Similarly, debt is linked to past and present borrowing/saving, and the regional population is related to natural growth and international and interstate migration. The model is solved with the GEMPACK economic modelling software [Harrison and Pearson (1996)].

3.1 Modelling long-run region-specific labour supply

VURMTAX does not explicitly model a consumption/leisure trade-off. Instead, we allow regional participation rates to respond to movements in regional real consumer wages. Households therefore face a labour/leisure trade-off, which we account for when calculating the welfare impacts of changes in regional or national taxes. Workers in each region increase their labour supply in response to deviations (in per cent) of region-specific post-tax real consumer wage rates from their baseline forecast, $rwage\_ct_q$, where region $q \in$ REG spans the set of VURMTAX regions, i.e., NSW and RoA, as outlined by equation (3.1):

$$l\_s_q - wpop_q = \gamma \cdot rwage\_ct_q. \quad (3.1)$$

In equation (3.1), l_s_q is the deviation (in per cent) of region-specific labour supply from its baseline forecast, while $wpop_q$ is deviation (in per cent) of the region-specific working age population from its baseline forecast. The left-hand-side of equation (3.1) is thus the deviation in the workforce participation rate (in per cent) from its baseline forecast. In VURMTAX, we set the labour supply elasticity $\gamma = 0.15$ in equation (3.1) for all regions. This choice is motivated in section 3.3.3.

A lagged-interregional-migration module, developed and documented by Giesecke and Madden (2013), has also been incorporated in VURMTAX. Under the standard closure, workers across regions migrate depending on differences in cross-regional real (CPI-deflated) consumer wages.

VURMTAX thus provides two avenues for an expansion in the long-run region-specific labour supply:

(1) via increases in region-specific participation rates, i.e., the region-specific ratio of labour supply to the working age population increases relative to the baseline forecast, according to equation (3.1) and the labour supply elasticity in section 3.3.3; and

(2) via inter-regional migration, which increases the region-specific working age population and thus labour supply at the expense of labour supply in other regions.

In the short-run, changes in tax rates may also cause changes in the unemployment rate, which impacts employment but not labour supply. In VURMTAX, households are assumed to derive no value for additional leisure hours caused by involuntary unemployment.

The labour supply theory described here introduces a labour/leisure trade-off in VURMTAX. In order to calculate the region-specific welfare impact of changes in region-specific tax policy, we must value any additional (foregone) leisure time. Herein, we value any additional labour supplied at the marginal (post-tax) value of labour in the baseline forecast, i.e., at the base-period real consumer wage. If the marginal value of leisure were higher than this, then workers would have supplied less labour under the baseline. Under this framework, the value of leisure in A$m. consumed in region q in year t of our simulation is therefore equal to:

$$VLEIS_{q,t} = RWAGE_{q,t}^{c,B} \cdot WPOP_{q,t}. \left[1 - PRT_{q,t}\right], \qquad (3.2)$$

where superscript "B" denotes a variable that takes its baseline value in both the baseline and policy simulations, $RWAGE^{c,B}{}_{q,t}$ is the baseline value of the real consumer (superscript c) wage in region q at time t, $WPOP_{q,t}$ is region q's working population at time t, and $PRT_{q,t}$ is region q's participation rate at time t. When the participation rate in region q increases in a policy simulation, i.e., $PRT_{q,t} > 0$, this materialises via an expansion in region-specific labour supply relative to the region-specific working population. From equation (3.2), this reduces the value of leisure derived by households, because some leisure time has been forsaken to increase labour supply in response to the new (higher) counterfactual simulation real post-tax consumer wage. At the national level, we compute the value of changes in leisure time by summing equation (3.2) over all $q \in REG$.

3.2 Endogenous determination of the national savings rate in VURMTAX

Implicit within our framework is a sticky adjustment mechanism for the national savings rate. This mechanism is active throughout a counterfactual simulation, and is calibrated so as to ensure stabilisation in the deviation of the net foreign debt to national income ratio from its baseline forecast level. In the case of the public sector, we assume that its propensity to contribute to national foreign liability accumulation is largely constrained by the assumption that state and federal public sector borrowing requirements do not deviate from baseline. Hence, in VURMTAX the private sector adjusts its consumption behaviour endogenously, in order to ensure that the economy-wide ratio of foreign liabilities to GNI stabilises around 15 to 20 years after the shock-year.

Importantly, this mechanism does not alter the economy's capacity to reach the new optimal capital stock following a tax policy shock. This becomes clear when we study the impact of alternative assumptions regarding the national savings rate response to changes in the corporate tax rate in section 13. Instead, our sticky savings rate mechanism alters the degree to which the investment required to achieve this optimal capital stock is financed by domestic or foreign savings.

3.3 Key Elasticities

VURMTAX is parameterised by elasticities that govern (among other things) the proclivity of economic agents to substitute between domestic and imported varieties of commodities; the demand by foreigners for Australian exports; the sensitivity of the labour force participation rate to changes in real consumer wages; and the degree to which industries can substitute between primary factor inputs to production, e.g., the labour/capital substitution elasticity. In this section, we summarise some key elasticities used to parameterise VURMTAX.

3.3.1 Labour/Capital substitution elasticity

In VURMTAX, we use a homogeneous labour/capital substitution elasticity across industries equal to 0.4. In contrast, recent studies of Australia's tax system that rely on excess burden calculations to evaluate the relative efficiency different taxes, e.g., see Cao *et al.* (2015), Kouparitsas et al (2016) and Murphy (2016, 2018), who adopt substitution elasticities that are much larger. For example, Cao *et al.* (2015) apply a labour-capital substitution elasticity equal to 0.9, which is more than two times the value adopted in VURMTAX.

In a broad survey of pertinent CGE and econometric literature, Walmsley, Lakatos and Minor (2015) find support for a great range of labour/capital substitution elasticities. However, an econometric analysis of the first-order profit maximising condition for firms by Chirinko, Fazzari and Meyer (2004) find strong evidence in support of a labour/capital substitution elasticity of 0.4. This econometric analysis is based on a panel dataset of 1 860 US firms from 1972 to 1991, with the estimates insensitive to the statistical methodology [both Ordinary Least Squares (OLS) and Instrumental Variables (IV) techniques are applied and yield similar estimates]. Contemporary studies for Germany by Kemfert (2008) and Van Der Werf (2008) also support a value of 0.4.

Most recently, Tipper (2012) used three different econometric techniques to estimate economy-wide, three-sector and 20-industry level labour-capital substitution elasticities for the New Zealand economy in the short- and long-run[5], following a similar approach to the study for the US economy by Ballistreri, McDaniel and Wong (2003). The 20-industry level elasticities derived by Tipper (2012) using an AR1 model were generally well below 0.77 in both the short- and long-run.[6] Omitting indeterminate estimates with wide standard errors, the mean (across industries) substitution elasticity in the long-run was 0.29

3.3.2 Export demand elasticity

As described by Dixon and Rimmer (2002), export demand elasticities in single-country CGE models such as VURMTAX are conceptually equivalent to trade-weighted averages of a series of country-specific import substitution elasticities, such as those that parameterise a model of global trade, e.g., the GTAP model. In VURMTAX, we follow Dixon and Rimmer (2002) and adopt a uniform trade elasticity across all commodities that is equal to -4. This choice of export demand elasticity differs significantly from the values adopted in other CGE studies of Australia's tax system, such as those by Cao *et al.* (2015), Kouparitsas *et al.* (2016) and Murphy (2016, 2018). The central case adopted by Cao *et al.* (2015), for example, is an export demand elasticity equal to -12, with the value for mining exports, as well as some agricultural, tourism-related and education exports, set to -6.

[5] The author notes that the AR1 long-run elasticities derived may not be suitable for long-run CGE analyses, because they are implicitly defined over a two-year time-period.

[6] The exception was the long-run estimate for the Electricity, Gas and Water industry, which was much higher than 1 but accompanied by very large standard errors.

Trade elasticities of smaller magnitude (such as those adopted in VURMTAX) generate larger terms of trade and thus national income effects, particularly when tax policy changes domestically stimulate the production of commodities that make up a large share of Australian exports. This point is particularly relevant when assessing the impact of a company tax cut in Australia, as we shall discuss in section. Econometric estimates of export demand elasticities using the United Nations ComTrade database (and thus takes account of changes in export intensity on a commodity-specific basis over time) support export demand elasticities for Australia that are of similar order to those adopted in VURMTAX. See for example Imbs and Méjean (2010), who estimate both export and import price elasticities implied by a Constant Elasticity of Substitution (CES) demand system for 33 countries using trade data from 1995 to 2004. They conclude that an appropriate elasticity for a small, open economy such as Australia lies between -3.1 and -2.3, depending on export intensity and trade weights.[7]

3.3.3 Labour supply elasticity

In VURMTAX we set the labour supply elasticity to 0.15. This choice is predicated on a detailed survey of CGE literature, which we summarise here. Bento and Jacobsen (2007) and Taheripour *et al*. (2008) employ an uncompensated labour supply elasticity equal to 0.15, whilst Takeda (2007) employs 0.19. Babiker *et al*. (2003) and Fischer and Fox (2007) calibrate their models to labour supply elasticities of 0.25 and 0.10, respectively. To address uncertainty over the value of the labour supply elasticity, Fraser and Waschik (2013) conduct a sensitivity analysis around the central case value of the labour supply elasticity +0.15, re-calibrating the model to a low value of 0.075 and high value equal to 0.30. In a review of the literature (specifically with regard to the U.S. labour market), Borjas (2015) finds that income effects generally dominate substitution effects for US males, driving a negative labour supply elasticity of -0.1. In contrast, substitution effects dominate for US females, driving a small positive labour supply elasticity of +0.2. Evers *et al.* (2008) also examine empirical estimates of labour supply elasticities by gender and across countries. The authors identify a median (uncompensated) labour supply elasticity for men of 0.08, while for women the figure is both higher and exhibits greater variability, with a median of 0.35. In VURMTAX, we do not distinguish labour supply

[7] Here, we refer to unconstrained estimates of the export demand elasticity for Australia reported by Imbs and Méjean (2010). By unconstrained, we mean that the elasticity is not constrained to be homogenous across sectors. As the authors note, doing so generates a heterogeneity bias and reduces the magnitude of the estimates export demand elasticities.

effects by gender or marital status, and adopt an aggregate labour supply elasticity equal to the central case examined by Fraser and Waschik (2013).

3.4 Closure

In solving VURMTAX, we undertake two parallel model runs: a baseline simulation and a policy simulation. The baseline simulation is a business-as-usual forecast for 2017-40. The policy simulation is identical to the baseline simulation in all respects, other than the addition of shocks describing the tax policy under investigation. We report results as percentage (and in some cases, A$m) deviations in the values of variables in each year of the policy simulation, away from their baseline values.[8] All policy simulations conducted herein are undertaken under the following model closure:

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

(2) Rates of inter-regional migration are sticky in the short-run, but adjust gradually in response to movements in inter-regional relativities in real post-tax per-capita income in order to ensure that such income relativities are gradually returned to baseline values;

(3) Regional participation rates adjust to deviations in region-specific real consumer wages, as previously discussed in section 3.1;

(4) National private consumption spending is the sum across regions of regional private consumption. Within each region, private consumption spending is a given proportion of regional disposable income. Regional average propensities to consume are endogenously adjusted by a uniform percentage across all regions, to ensure that the ratio of net foreign liabilities to GDP stabilizes over a seven-to-ten year time period following any given policy shock;

(5) For public consumption spending undertaken by state and local government, we assume a constant ratio of real regional government public consumption spending to real regional private consumption spending. For federal consumption spending within each region, we assume a constant ratio of region-specific federal public consumption spending to national private consumption;

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

(6) Net operating balances of regional governments and the federal government are held at baseline values via endogenous adjustment of lump sum payments to households.

3.5 Calculating the excess burden in a tax policy experiment

The term "excess burden" was coined by Harberger (1962) to describe the impact (in totality) of US corporate tax on US national income. Because VURMTAX is dynamic, it can calculate year-on-year excess burden measures using a similar principle. We use the approach adopted by Nassios *et al.* (2019) to study land tax in Australia herein. More specifically, the efficiency loss caused by a tax policy package in time-period *t* at the national (Australia-wide) level (EB^t_{Nat}) is evaluated according to:

$$EB^t_{Nat} = -100\left[\frac{\Delta GNI^t + \sum_q \Delta VLEIS^t_q}{\sum_g \Delta LST^t_g}\right], \quad (3.3)$$

where ΔGNI^t is the deviation in real gross national income (GNI) in year *t* expressed as the difference between the policy simulation and baseline simulation values for GNI in year *t*; $\Delta VLEIS^t_q$ is the deviation in the value of leisure in region *q* at time *t* calculated using equation (3.2); and ΔLST^t_g is the deviation in revenue-neutral lump sum transfer by government *g* in year *t*. Equation (3.3) is a measure of the change in real national income, adjusted for changes in the value of leisure, caused by a change to state or federal tax policy that results in a change in the government's capacity to make a budget-neutral transfer to Australian households of $\sum_g \Delta LST^t_g$. By using the value of aggregate lump sum payments to households in the denominator (rather than, say, revenue raised from the particular tax in question), we take account of general equilibrium effects, including induced changes in: revenue raised from other tax basis, the price of government spending, and government benefit payments.

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

$$SEDI^t_{NSW} = -100\left[\frac{\Delta GSP^t_{NSW} + \Delta VLEIS^t_{NSW}}{\Delta LST^t_{NSW}}\right], \quad (3.4)$$

Equation (3.4) is a measure of the change in the size of the NSW economy, adjusted for changes in the value of leisure, which are caused by a change in the NSW government's capacity to make a budget-neutral transfer to NSW households of ΔLST^t_{NSW} .

4 Payroll tax

Payroll tax in Australia is levied and collected by the states and territories. Previous studies by Murphy (1999) and Dixon *et al.* (2004) identify two distorting aspects of Australia's payroll tax system:

(a) Different rates apply to firms depending on their location and the size of their payroll. Potentially this could distort the allocation of resources between industries and regions.

(b) In all States, payroll taxes apply with a threshold, e.g. in NSW no tax is payable until a firm has a payroll (or wage bill) of $0.75 million. A threshold of this type causes two distortions:

   i. The tax base is reduced. Different firms and industries within a region therefore face different payroll tax rates, dependent upon the size of their wage bills;

   ii. It places a downward bias in the size of firms, especially those whose natural wage bill (wage bill in the absence of the threshold) is between 100 and 200 per cent of the threshold size. The downward bias in the size of firms causes an inefficient use of resources.

Our focus is exclusively on the payroll tax system in NSW. In what follows, we describe how the threshold system generates an efficiency loss using a partial equilibrium model of the NSW labour market, where firms are split into two pools: small companies (who pay no payroll tax), and large companies (who pay payroll tax). We use the findings of this analysis to motivate the development of the NSW payroll tax model, which is based on a model developed by Dixon *et al.* (2004) for Victoria. This model facilitates the development of a new baseline for VURMTAX, a computable general equilibrium model of Australia's states and territories. The new baseline in VURMTAX endogenously accounts for dead weight losses caused by firm size resource usage inefficiencies in NSW caused by the NSW payroll tax threshold. This extends previous studies of payroll tax reform in Australia, which have focused exclusively on the first of two impacts of the payroll tax threshold summarised above, i.e., they have studied point (b) i. above but have disregarded (b) ii. We therefore elucidate how changes in the threshold-induced deadweight loss interact with changes in payroll tax deadweight losses caused by the presence of the tax. This allows us to examine how these two deadweight losses impact the excess burden of payroll tax in NSW, as well as the macroeconomic and industry impacts of this tax in an environment of unilateral reform in NSW.

4.1 A partial equilibrium assessment of the current NSW payroll tax system

In this section, we present a partial equilibrium model of the NSW labour market disaggregated into small business (payroll tax exempt due to the threshold) and large business (taxed at a fixed rate of their annual wage bill). This model is used to explore the effects of a payroll tax system with a threshold, relative to a no payroll tax base-case. Our depiction in Figure 4-1 initially assumes a flexible wage and aggregate full employment labour market in a long-run comparative static assessment. The key features of Figure 4-1 are:

- Labour demand for the exempt small businesses and taxed large businesses are represented by the downward sloping curves L_S and L_D. Both can be interpreted as the derived demand for the labour input, and also the marginal value product of labour. The downward slope reflects labour-for-capital (and other intermediate input) substitution, comparative advantages and importance of economies and diseconomies of scale, and in some cases product market effects. However for the purposes of this discussion, we assume that small and large businesses produce the same output for the same product market, and the distinct labour demand curves portrayed in Figure 4-1 arise from lower labour productivity in small business relative to large business.
- For simplicity, Figure 4-1 ignores cross-wage by sector effects and assumes a high level of labour mobility at the margin across small and large businesses.
- The right-hand panel of Figure 1 depicts the aggregate labour market. The general consensus is that aggregate labour supply is relatively inelastic compared with aggregate labour demand [Dandie and Mercante (2007)]. Clearly, the disaggregated firm demand functions are more elastic than the aggregate labour demand.
- Before the introduction of a payroll tax with a threshold (or in our long-run base-case), the labour market clears at a wage W with aggregate employment of E, with E_S by small business and E_L by large business, i.e., $E = E_S + E_L$. In the absence of firm-size market failures, the base-case allocation of labour between small and large business is close to an efficient benchmark. The Reserve Bank of Australia (RBA) Conference on Small

Business Conditions and Finance[9] highlighted the absence of any rationale to argue that on average small business is the key driver of employment and innovation; rather, there are anecdotal examples from both sectors.

- Under a payroll tax system with a threshold, the payroll tax rate on large business is assumed to be equal to *T*. The tax shifts the demand curve for labour by large business down to L_D – T, with no change on small business demand, and a smaller downward shift of the aggregate labour demand curve to L'_D.
- Partial equilibrium effects of the payroll tax on large businesses are:
  - For the aggregate labour market, a drop of the market wage from *W* to *W'*, with *W* - *W'* < T, and a relatively smaller drop in aggregate employment from *E* to *E'*, because labour demand is more elastic than supply.
  - With the lower wage, employment in the small business sector increases from E_S to E_S', and employment in the large business sector contracts from E_L to E_L'.
  - Most of the employment adjustment is a reallocation from large to small business, with a (much) smaller change in aggregate employment.

Figure 4-1 facilitates a discussion of the efficiency impacts of such a payroll tax system.

- The reallocation of labour from large to small businesses incurs efficiency losses of the triangles **a** arising from expanded production in small business and area **b** arising from foregone production in large business (treating the sector labour demand curves as the derived marginal benefit functions). These areas correspond to the higher costs of production of the Dixon *et al.* (2004) model. The efficiency cost of the distorted reallocation of labour from large to small business, $E_{L\text{-}to\text{-}S}$, can be approximated as the sum of the triangles **a** and **b** of Figure 4-1.

$$E_{L-to-S} = \frac{1}{2} T_p \Delta E, \qquad (4.1)$$

where T_p is the payroll tax rate expressed as \$ per unit labour, and ΔE ($\approx E_S' - E_S$ and $E_L - E_L'$) is labour reallocated between sectors. Dividing both sides of (4.1) by the wage bill, W_E, gives the efficiency cost as a share of the wage bill, $e_{L\text{-}to\text{-}S}$,

$$e_{L-to-S} = \frac{1}{2} \frac{T_p}{W} \frac{\Delta E}{E}, \qquad (4.2)$$

[9] See http://www.rba.gov.au/publications/confs/2015/ for a catalogue of conference proceedings.

where, T_p / W is the payroll tax rate expressed as a proportion of the wage of large business, and $\Delta E / E$ is the proportion of employment reallocated from large to small business. Or, one can use the elasticities of labour demand by small and large business to derive a value for ΔE in (4.1) or for $\Delta E / E$ in (4.2).

- Since the pattern of firm sizes (and thus the aggregate average cost per unit of industry output) varies by industry, a narrow base payroll tax will cause some distortions to relative industry output prices and thus to the mix of industry products produced and consumed. These efficiency losses require a CGE assessment.
- As shown in the right-hand panel of Figure 4-1 for aggregate employment, payroll tax as an addition to the tax wedge between employer labour cost and the effective purchasing power of the employee distorts the aggregate labour market with an efficiency cost of a loss of economic surplus represented by area **c**.
- This figure assumes no additional distortions exist in the aggregate labour market, which is of course a simplification. In reality, payroll tax is an additional distortion, which compounds the impacts of national taxes such as the GST and personal income tax, together with the indirect impacts of capital taxes which reduce investment, the capital stock and thus the aggregate labour demand curve.

4.2 Reflecting key insights from the partial equilibrium assessment in a CGE model: The NSW payroll tax model

Accurately reflecting the efficiency costs of the payroll tax system identified in our partial equilibrium assessment within VURMTAX was a two-stage process. Firstly, VURMTAX was updated to reflect 2015-16 NSW payroll tax collection figures ($7.975 b[10]), on both an aggregate and by-industry basis. This process is informed by registered company count data reported by the ABS.[11] Secondly, we develop a model that is run in parallel with VURMTAX to establish baseline estimates of the deadweight loss caused by NSW's prevailing payroll tax threshold (A$0.75m). A model suited to such a task was previously developed for Victoria by Dixon *et al.* (2004). This model reflects two key findings of our partial equilibrium assessment in section 4.1:

[10] ABS Catalogue Number 5506.0 Taxation Revenue, Australia, 2015-16

[11] ABS Catalogue Number 8165.0 Counts of Australian Businesses, including Entries and Exits, June 2012 to June 2016

1. Dixon *et al.* (2004) explicitly model the impact of the payroll tax threshold on firm costs. Adjustments in this alters the shape of firm cost curves, which in turn drives a reallocation of employment across firms of different size.
2. The efficiency costs of distorted reallocation of labour from large-to-small business (defined previously as the sum of triangles **a** and **b** or $E_{L\text{-}to\text{-}S}$) is also modelled. Because the average cost curve in Dixon *et al.* (2004) is downward sloping with firm output, the re-allocation of labour from large-to-small firms causes an increase in average costs of production.

To study the NSW payroll tax system in VURMTAX, we developed a similar model to the one described in Dixon *et al.* (2004) for Victoria, and parameterise this model with NSW data.[12] This model is referred to herein as the NSW payroll tax model, and relies on data from the following sources:

- Company size data from ABS cat. no. 8165.0;
- Industry-specific employment data by company size from ABS cat. no. 8155.0;
- Average wage rates inferred from ABS cat. no. 6306.0.

4.2.1 Methodology

This section applies the theory from Dixon *et al.* (2004) to NSW. We conduct a series of computations, each stating from an initial situation where NSW is applying a 3.32 per cent payroll tax rate with a zero threshold and is collecting A$7 975m in payroll tax revenue (equal to the level of payroll tax revenue collected in 2015/16 based on ABS Cat. No. 5506.0). While the counterfactual zero-threshold situation is not the most natural starting point for computations, it is preferred because, as described by Dixon *et al.* (2004), we do not have detailed data on the existing distribution by firm size. We adopt a similar assumption to Dixon *et al.* (2004) and assume the zero-threshold employment distribution across firms is relatively smooth. This yields the employment distribution in Figure 4-2.[13] We allow for 104 different firm sizes in our discretisation of the NSW employment distribution, which is truncated for convenience in Figure 4-2 at a firm size of 48.75 employees. For each of the 104 firms we account for, we use the theory in NSW payroll tax model to study how the size of the firm adjusts to changes in the NSW payroll tax threshold.

[12] For a summary of the theory underlying the model by Dixon *et al.* (2004), we refer the reader to Appendix 4.1.

[13] For a detailed discussion of the effects of a payroll tax threshold on the distribution of employment by firm size, see Dixon *et al.* (2002).

The NSW payroll tax model is calibrated so as to allow a user to impose one of two assumptions regarding the nature of firms in NSW: (1) that firms are perfectly competitive, with prices equal to marginal costs; or (2) that firms are monopolistically competitive and face highly elastic (but not infinitely elastic) firm-specific output demand curves. In Table 4-1, we report the results of a policy simulation in which we increase the threshold from zero to A$750 000. The deadweight loss or efficiency impact of under our preferred assumption of monopolistically competitive firms is shaded in green in Table 4-1. The other results are briefly summarised below:

1. Deadweight losses (DWLs) due to firm size biases are 0.37% of the wage bill and 11% of total collections. Because firms operate on relatively steep sections of their average costs curves under monopolistic competition, the associated dead weight losses due to the payroll tax threshold are much larger than would be the case if we assumed firms to be perfectly competitive [see Dixon *et al*. (2004)];
2. The wage bill in NSW is largely invariant to the change in the threshold, which is clear when comparing the entries in columns (1) and (2) of row 5 in Table 4-1.

For a more detailed discussion of the assumptions underlying the NSW payroll tax model and a sensitivity analysis of our firm size bias DWL estimates, we refer the reader to Appendix 4.2.

4.2.2 Incorporating firm-size deadweight loss estimates into VURMTAX

We translated the firm size DWLs calculated from the NSW payroll tax model into primary factor productivity shocks in VURMTAX. To distribute the aggregate (state-wide) figure for NSW reported in Table 4-1 ($879.28m) across ANZSIC level 1 industries in NSW, we use the process described in Appendix 4.3. Finally, using a concordance between the ANSZIC level 1 industries and the 76 industries in VURMTAX, we attribute the aggregate DWL from the NSW payroll tax model across all 76 industries in VURMTAX.

The industry-specific DWLs are then delivered as primary factor productivity shocks. Changes in payroll tax rates and thresholds in the policy simulation, then lead to further productivity shocks, that either compound (when rates are raised) or reduce (when thresholds or rates are reduced) the existing baseline payroll tax threshold DWLs.

4.3 **Simulations and results**

4.3.1 Overview

Using the excess burden formulae in section 3.5, we calculated the national excess burdens and state economic damage indicators (SEDIs) for NSW payroll taxes using VURMTAX. Our results are summarised in Table 4-2.

We report two marginal SEDIs for NSW and two marginal excess burdens (MEBs), derived from the following two experiments:

1. In Table 4-2(a), on SEDI and one MEB are derived from a VURMTAX simulation where we raise the NSW payroll tax rate. This rise (8 basis points, from 5.45 per cent to 5.53 per cent) is calibrated to raise an additional A$100m in payroll tax revenue for NSW. The DWL due to the A$750 000 threshold is also adjusted under this simulation, because a rise in the payroll tax rate also raises the DWL due to the threshold by 0.34 per cent (by A$3m, from A$879m to A$882m). This rise is calculated using the NSW payroll tax model and imposed as a second shock in our simulation;

2. In Table 4-2(b), the set of MEBs relate to a reduction in the value of the NSW payroll tax threshold (from A$0.75m to A$0.701m), which is calibrated to raise A$100m in additional payroll tax revenue in NSW. This reduces the DWL due to the threshold by 1.54 per cent (by A$13m, from A$879m to A$866m), but also raises the effective payroll tax rate (total collections relative to the aggregate state wage bill) because more firms in each industry are liable to pay payroll tax. Nevertheless, the legislated payroll tax rate for firms with wage bills above the threshold is held constant at 5.45%.

We also report two average excess burdens (AEBs) and two average SEDIs for NSW, derived from the following two simulations:

3. The AEBs reported in Table 4-2(a) relate to a reduction of 95% in NSW payroll tax collections, which is achieved by endogenous determination of the payroll tax rate in NSW. The DWL due to the threshold (the level of which remains unaltered) is also eliminated under this scenario;

4. The AEBs in Table 4-2(b) reflect the elimination of the payroll tax threshold in NSW. The actual payroll tax rate (5.45 per cent in NSW) is exogenous and

unchanged in this simulation; all industries are now however required to pay this rate of payroll tax on their wage bill.

4.3.2 State economic damage indicators (SEDIs): Rate versus threshold adjustment

From Table 4-2, the MEB of raising additional NSW payroll tax revenue differs depending on whether the mechanism is: (i) a rise in the legislated tax rate of 5.45, under an exogenous threshold [see experiment (1) above], or (ii) a reduction in the threshold from A$0.75m, at an exogenous legislated payroll tax rate [see experiment (2) above]. We find that the threshold reduction causes less economic damage (77 cents in foregone leisure-adjusted real GSP per dollar of net revenue in NSW) than a rise in the tax rate at the current threshold (90 cents of foregone leisure-adjusted GSP in NSW). This is because each experiment causes a roughly equivalent change in the effective payroll tax rate in NSW, i.e., the change in payroll tax collections relative to the state-wide wage bill is very similar in each experiment. However, the legislated rate rise causes a small rise in resource misallocation due to the threshold. This increases the threshold-induced DWL by A$2.9m. In contrast, a threshold reduction reduces the resource misallocation DWL by A$13.5m. In the threshold reduction experiment, this materialises as a relative productivity gain, mitigating the impact of the effective payroll tax rate rise.

4.3.3 Marginal versus average SEDIs: payroll tax rate adjustment

The SEDI results for changes in the NSW payroll tax rate are reported in Table 4-2(a). Comparing the SEDIs, we find that the average SEDI (103 cents per dollar) exceeds the marginal SEDI (90 cents per dollar). The average excess burden (35 cents per dollar) is also larger than the marginal excess burden (22 cents per dollar). This result seems counterintuitive when considered in the context of previous studies of the excess burden of taxation, e.g., Harberger (1962), which shows that the DWL due to an ad valorem tax levied at rate T is proportional to the square of the tax rate at leading-order, i.e., T^2. The average excess burden should therefore always lie below the marginal excess burden of a tax.

The payroll tax systems in NSW and other Australian states and territories cause two economic distortions, however:

(1) As described by Harberger (1962), taxes causes distortions. A rise in the payroll tax rate drives a wedge between the real wage as seen by NSW consumers, and the real effective wage as viewed by the employer. With the real producer wage rising (a rise in

payroll taxes, ceteris paribus, raise the cost of labour to firms relative to the price they receive for their output), output begins to contract in response to rising input costs. Employment in turn falls, and the real consumer wage therefore begins to fall.

(2) The imposition of a payroll tax system with a threshold introduces a second type of distortion: it generates a firm size bias, which acts in addition to the wedge between producer costs of labour and household labour earnings. Importantly, the DWL due to the threshold does not increase with the square of the tax rate. This is evident in experiment (1), as discussed in section 4.3.1. With the NSW payroll tax threshold set at A$0.75m, if we impose a 1.5 per cent (8 basis point) change in the payroll tax rate, the threshold DWL rises by A$2.9m, or a much smaller 0.32 per cent.

(3) It is clear from this example, and from Dixon *et al.* (2004), that the threshold firm size bias DWL is positively correlated to movements in the legislated payroll tax rate.

The explanation for why threshold firm size bias DWLs adjust slowly to changes in legislated tax rates is explained by Dixon *et al.* (2004). To provide a brief summary here, we rely on Figure 4-3. In Figure 4-3, the *x*-axis is our usual set of firm size buckets for NSW, while for each value of *x*, we plot on the *y*-axis the number of employees in firms whose size was between *x* and 1.5 * *x*. Therefore, the *y*-axis value of approximately 175 000 on Figure 4-3 at *x* = 12.5 means that, in the absence of the threshold, firms in NSW that employed between 12.5 and 18.75 employees each, would have employed a total of approximately 175 000 people.

As observed by Dixon *et al.* (2004), while payroll tax thresholds cause increases in resource use per unit of output for firms, the firms that experience the most pronounced increases would have paid a wage bill (in the absence of the threshold) of anywhere from the threshold, up to approximately 1.5 times the size of the threshold. For NSW, this means the current threshold of A$0.75m causes a pronounced distortion in the resource use per unit output for firms whose wage bill would otherwise have been between approximately A$0.75m – A$1.125m. When firms are large relative to the threshold, the threshold is insignificant in the calculation of average costs and the determination of the minimum point on their average cost curve. From Figure 4-3, we see observe that employment in firms with size greater than *x* but less than or equal to 1.5*x* is close to constant, as *x* goes from approximately 5 to 17. Given the average wage in NSW, this is consistent with a firm wage bill of between A$0.31m and A$1.09m. With the threshold in NSW set at $0.75m, small changes in the legislated payroll tax rate at the current threshold therefore impose resource misallocation over an approximately constant quantity of resources. Small threshold changes within this range therefore generate an approximately constant DWL.

Large adjustments in the legislated payroll tax rate, e.g., the kind imposed when remove the tax altogether, do however drive significant responses in the magnitude of the DWL caused by the threshold. Removing the payroll tax, while removing the wedge between producer cost of labour and labour income, also removes the firm size distortion. As such, when calculate average SEDIs and excess burden estimates by removing payroll tax in NSW, the resulting SEDI and excess burdens exceed the marginal results calculated using small changes in the payroll tax rate. Our reasoning is confirmed by Table 4-3, where we compare the marginal and average SEDIs generated in two additional experiments:

(1) We conduct a simulation where we impose an 8 bps rise in the payroll tax rate in VURMTAX, but *do not adjust the threshold DWL from its baseline forecast*. We calculate a marginal SEDI for NSW from the results; and

(2) We eliminate payroll tax via rate adjustment but *do not adjust the threshold DWL from its baseline forecast*, and calculate an average SEDI for NSW using the results.

By leaving the threshold unaltered in our new experiments, we find that marginal SEDIs now exceed average SEDIs, i.e., the relativity of the marginal and average excess burdens are reversed.[14]

4.3.4 SEDI for payroll tax threshold adjustment in NSW

To study the impact of the payroll tax threshold, we calculated marginal and average SEDIs and excess burdens by simulating:

(i) a small reduction in the threshold level, which raises payroll tax revenue; and

(ii) elimination of the threshold, which also raises revenue.

Both our experiments therefore raise payroll tax revenue. The average SEDI of a threshold reduction on the NSW economy reported in Table 4-2(b) and is equal to 56. This should be interpreted as the average level of foregone GSP per dollar of revenue raised by complete removal of the payroll tax threshold.

[14] Herein, we report excess burden to the nearest cent per dollar of net tax revenue raised. The marginal excess burden therefore appears to be equal to the average, however the relativities are indeed reversed.

Interestingly, we do not observe average SEDIs and excess burdens exceeding the corresponding marginal results in Table 4-2(b), as we did for the results Table 4-2(a). This is because reducing threshold levels always *reduces* the threshold-induced DWLs, while increasing the price wedge between producer labour cost and labour income, i.e., the two DWLs caused by the payroll tax system in NSW move in countervailing fashion when reducing the threshold. Once again, as described by Dixon *et al.* (2004), small adjustment in threshold levels do little to alter the threshold DWL. Removing the threshold entirely however causes a large productivity gain, which puts downward pressure on the SEDI and excess burden. This acts to offset the distortionary effects of increasing the share of the state's wage bill that is liable for payroll tax; this is clear from Table 4-4, where the excess benefit (the negative excess burden) caused by removing the threshold DWL clearly increases in strongly non-linear fashion as we reduce the threshold.

4.3.5 The national excess burden of NSW payroll tax

National excess burdens trail state-level SEDIs of unilateral payroll tax reform in NSW. State-level impacts herein are muted at the national level, because we study unilateral tax policy change by NSW, not coordinated payroll tax change across all states and territories. When NSW increases its payroll tax rates, the RoA expand because real consumer wages fall in NSW when the payroll tax rate rises. Because labour is mobile across state borders in VURMTAX, and migrates to normalize cross-state differences in real consumer wage rates, labour supply in the rest-of-Australia expands relative to NSW, driving increases in real GSP outside NSW. This mechanism damps the national excess burdens, relative to the SEDIs for payroll tax. In a broad sense, other national-level results follow similar patterns to those identified at the state-level. For example, we observe that the marginal excess burden for a payroll tax rate adjustment [Table 4-2(a)] is smaller than the corresponding average excess burden. For brevity, we do not repeat all our previous observations here, and refer the reader to sections 4.3.2 - 4.3.4.

4.3.6 Macroeconomic impacts

In this section we study the macroeconomic effects of changes in the NSW payroll tax system. For brevity, we focus on two sets of results only: those from experiments (1) and (4) described in section 4.1. As discussed in section 4.3.2, the impact of a small rise in the payroll tax rate [experiment (1)] and a small reduction in the payroll tax threshold [experiment (2)] are similar; differences between the two arise due to the productivity improvement that accompanies a threshold reduction. With this in mind, we focus our discussion of marginal changes in either payroll tax rates or thresholds on the macroeconomic effects of experiment (1). Results for experiment (2) are summarised in Table 4-5. Rather than providing the full-time paths for all variables, i.e., the year-on-year deviations from baseline from 2019 – 2040, we provide macroeconomic results for one year only: 2040. All outputs are measured as deviations from the baseline forecast.

An interesting policy question is to explore the economic impact of abolishing the NSW payroll tax threshold. We therefore also discuss the macroeconomic impacts of experiment (4), where the removal of the payroll tax threshold drives strong productivity gains. These gains offset the impact of increases in the effective payroll tax rate at the national level, as evidenced by the negative average excess burden of the NSW payroll tax threshold [see Table 4-2(b)]. For brevity, we do not provide a detailed summary of the macroeconomic impacts for payroll tax removal [experiment (3)]. We do however report the results for readers in Table 4-6.

Table 4-5 and Table 4-6 summarise both state- and national-outputs. Table 4-5(a) and Table 4-6(a) focus on NSW state-level results, while national results are provided in Table 4-5(b) – (c) and Table 4-6(b) – (c).

We begin by studying the impact of a small rise in the payroll tax rate in NSW; see the results for experiment (1) in Table 4-5. Recall from section 3.4 that our NSW labour market is characterised by short-run stickiness in the real consumer wage. In the first year of a rise in the payroll tax rate, the real effective wage as viewed by the employer [reported as the real producer wage in Table 4-5(a)] rises relative to the business-as-usual baseline forecast, causing a negative deviation in short-run employment. In VURMTAX, region-specific real consumer wage adjustment drives the region-specific unemployment rate back to its baseline forecast in the long-run. In the long-run, region-specific employment can deviate from baseline due to inter-regional migration or changes in region-specific participation rates. We observe such long-run employment deviations in NSW, in response to a small rise in the payroll tax rate in NSW [-0.026 per cent under experiment (1) in Table 4-5(a)]. We observe similar impacts due to threshold removal, albeit of larger magnitude [-0.902 under experiment (4) Table 4-6(a)]. In each experiment, lower long-run employment is largely due to the fall in the long-run NSW participation rate, which falls because the real consumer wage in NSW lies below baseline.

These (negative) long-run employment deviations are caused by two DWLs that interact when we increase the payroll tax rate, or remove the threshold. As discussed in section 4.3.1, a small rise in the payroll tax rate drives correspondingly small (+A$2.9m) increases in the threshold-induced DWL. This diminishes NSW productivity, and reinforces the negative employment result caused by a rise in the effective payroll tax rate in NSW. In contrast, removing the threshold drives material productivity gains in NSW, which partly offset the negative impact of the higher effective tax rate.

In the absence of a change in the relative price of labour and capital, with employment lower in NSW in the long-run (row 4 of Table 4-5 and Table 4-6), we would expect a similar fall in the long-run NSW capital stock. However, we see that the fall in the NSW capital stock (row 2 of Table 4-5 and Table 4-6) is slightly smaller than the fall in NSW employment. What accounts for this rise in the NSW capital / labour ratio? The rise in the effective payroll tax rate raises the producer price of labour relative to the producer price of capital. This rise in the cost of labour relative to capital induces NSW firms to substitute towards capital. At the level of the NSW macroeconomy, this is manifested as a rise in the NSW capital / labour ratio. With both the state capital stock and long-run employment below baseline, real GSP also falls relative to the baseline in each case, by 0.023 per cent and 0.464 per cent Table 4-5(a) and Table 4-6(a), respectively. A rise in the NSW payroll tax rate, and removal of the NSW payroll tax threshold, both drive real GSP below baseline.

Shifting from the income side of the state economy to the expenditure side, with long-run employment and capital stocks below baseline, so too is real private consumption. Because regional real public consumption is tied to real private consumption in all simulations discussed herein (see section 3.3), real public consumption also lies below baseline in each case. The most noticeable impact of effective rate adjustment is however the change in state exports. Because the effective payroll tax rate in NSW rises in both experiment (1) and (4), NSW production prices rise (0.026 per cent and 0.748 per cent in row 1 of Table 4-5(a) and Table 4-6(a), respectively), and so too does the terms of trade (by 0.002 per cent and 0.041 per cent in row 26 of Table 4-5(a) and Table 4-6(b), respectively). A rise in the payroll tax rate, and removal of payroll tax threshold, are therefore expected to negatively impact import-competing sectors such as manufacturing.

Because the productivity gain that results when the NSW payroll tax threshold is removed accrues to the domestic economy, at the national level both public and private consumption are elevated relative to baseline when the threshold is removed (see rows 15 and 16 for experiment (4) in Table 4-6(b)). This materializes in our excess burden analysis via a negative national average excess burden of payroll tax threshold removal in NSW. Finally, by comparing row 13 and row 30 in Table 4-5 and Table 4-6, we see that the impact of payroll tax rate or threshold adjustment is more pronounced on NSW aggregate tax collections, than it is at the national level. For example, in experiment (1) [see Table 4-5] NSW tax collections increase by A$197m in 2040 when the payroll tax rate rises, while national collections rise by only A$87m. This is because payroll tax is largely a tax on labour; hence, an increase (decrease) in payroll tax collections in NSW drive countervailing movements in personal income tax collections at the federal level.

4.3.7 Industry impacts

Table 4-7 and Table 4-8 show the effects of payroll-tax reform on output by ANZSIC level-1 industry. As in Table 4-5 and Table 4-6:

- The columns titled experiment (1) and (2) give the impacts of a small rise in the payroll tax rate, and a small reduction in the payroll tax threshold, respectively;
- The columns titled experiment (3) and experiment (4) give the impacts of payroll tax removal and payroll tax threshold removal.

As in section 4.3.6, we focus on experiments (1) and (4) here. Interestingly, the relative impacts across industries differ whether we are increasing the rate under a fixed threshold [experiment (1)], or removing the threshold and keeping the legislated rate fixed [experiment (4)]. This is because some industries (such as Agriculture, forestry and fishing) comprise more firms whose wage bills lie below the threshold. Threshold removal sees these industries experience a large rise in their effective payroll tax rate, which reduces the wage rate they can offer workers significantly. For Agriculture, forestry and fishing, the effective payroll tax rate rises from 1.76 per cent to the statutory rate of 5.45 per cent. This increases production prices in these industries, driving long-run output below baseline by 1.29 per cent [row 1, experiment (4) in Table 4-8]. Under the current system of payroll taxes, Mining is taxed heavily (with an effective payroll tax rate of 4.93 per cent, respectively). The impact on Mining output of threshold removal (-0.79 per cent from row 2, experiment (4) in Table 4-8), is therefore muted relative to the impact on Agriculture, forestry and fishing. When the statutory payroll tax rate rises however (under a constant threshold), the pattern is reversed; in this case, the percentage change in the payroll tax rate faced by industries is uniform, and Mining [-0.07 per cent in experiment (1) of Table 4-7] is more heavily impacted than Agriculture, forestry and fishing [-0.03 per cent in experiment (1) of Table 4-7]. Other industries, such as Education and training, and Health care, are negatively impacted by the fall in state private consumption, despite being modelled as payroll tax exempt in VURMTAX.

4.4 Conclusions and Further Work

This section has focused on the payroll tax system in NSW. We began by studying the efficiency impact of that system using a partial equilibrium model. This partial equilibrium model was used to motivate the development of the NSW payroll tax model, which is based upon a model for Victoria by Dixon *et al.* (2004). We described how the NSW payroll tax model is used to model the dead weight losses caused by the current threshold (A$0.75m) in NSW, and how these dead weight loss figures are accommodated within the VURMTAX CGE model of Australia's states and territories. We then summarised four simulations that were conducted with VURMTAX, which are used to generate marginal and average SEDIs and excess burdens. The values of these economic damage indicators and welfare metrics are described, with particular attention to why the average SEDIs and excess burden of payroll taxation in NSW can exceed the corresponding marginals. We also briefly long-run macroeconomic and NSW industry impacts.

Appendix 4.1. Payroll-tax thresholds and the size of firms: Theory

Dixon *et al.* (2004) explain in detail how a payroll tax threshold affects the shape of a firm's average cost curve and thereby affects the size of the firm. In this explanation they use diagrams similar to Figure 4-4 and Figure 4-5. AA′ in Figure 4-4 is a firms average cost curve in the absence of a payroll tax. The imposition of a payroll tax without a threshold raises the average cost curve vertically to position BB′. In particular, the imposition of the payroll tax does not affect the output level corresponding to the low point on the firm's average cost curve.

Now assume that a threshold is introduced such that no payroll tax is charged on the wage bill that the firm incurs if its output is below $Q_{critical}$. In the figure, $Q_{critical}$ is a little under 40 per cent of output at efficient scale: That is, output at the low point of the AA′ or BB′ curves. We can trace out the average cost curve with the threshold in place by imagining that the firm pays payroll tax on its entire wagebill but gets a refund on payments made on the wagebill up to the threshold. Thus the average cost curve with the threshold in place follows AA′ up to $Q_{critical}$. After $Q_{critical}$, average costs are the same as on the BB′ curve minus the refund divided by output. That is

$$AC(H,T,Q) = AC(\mathbf{0},T,Q) - T*H/Q \qquad \text{for } Q > Q_{critical} \qquad (A1)$$

where H is the threshold wagebill (the wagebill at $Q_{critical}$), T is the rate of the payroll tax, Q is output and AC is average cost. Thus, AC(0,T,Q) is the average cost of output Q with a payroll tax at rate T and no threshold, that is AC(0,T,Q) is a point on the BB′ curve. AC(H,T,Q) is a point on the average cost curve with the threshold in place, curve AA″ in Figure 4-4. As Q gets larger, the AA″ curve gets closer and closer to the BB′ curve. At large values of Q the refund is insignificant.

From (A1.1) we see that

$$\frac{\partial AC(H,T,Q)}{\partial Q} = \frac{\partial AC(0,T,Q)}{\partial Q} + \frac{T*H}{Q^2} \qquad \text{for } Q > Q_{critical} \text{ .} \qquad \text{(A2)}$$

At efficient scale, the minimum point on either the AA′ or BB′ curve $\partial AC(0,T,Q)/\partial Q = 0$. Thus, at efficient scale

$$\frac{\partial AC(H,T,Q)}{\partial Q} > 0 \qquad \text{if H and T} > 0 \text{ .} \qquad \text{(A3)}$$

Consequently, the imposition of the threshold changes the shape of the average cost curve so that its minimum point occurs to the left of efficient scale, at 90 per cent of efficient scale in Figure 4-4.

If we were dealing with a purely competitive industry, where firms operate at minimum average cost, then in Figure 4-4 the imposition of the threshold causes the firm to operate at 90 per cent of efficient scale. Hence the average cost of the resources that it uses rises from EF to CD. We calculate the deadweight loss of this movement away from efficient scale as (CD-EF) per unit of output by the firm. Figure 4-5 shows how a threshold biases firm size in a monopolistically competitive industry. In such an industry, firms operate at a point on their average cost curve where the ratio of marginal to average cost equals 1 plus the reciprocal of the elasticity of demand for their product. Thus if firms perceive an elasticity of demand for their product of -5, then they operate at a point on their average cost curve where marginal cost is 80 per cent of average cost. As shown in Dixon *et al.* (2004), under reasonable assumptions concerning the shape of average cost curves, the introduction of a threshold reduces the output at which the ratio of marginal to average cost is equal to any given fraction. Thus we conclude that the introduction of a threshold biases firm sizes down not only in competitive industries but also in monopolistically competitive industries. Again, dead-weight losses can be calculated by looking at the increase in average costs on the zero-tax curve, AA′.

Appendix 4.2. Payroll-tax thresholds and the size of firms: Results from the NSW Payroll Tax model

While our preferred assumption of firm structure in NSW is monopolistic competition, we simulated a wide range of threshold values assuming both perfect competition (Table 4-9) and monopolistic competition (Table 4-10). Key findings are summarised below:

1. Because firms operate on relatively steep sections of their average costs curves under monopolistic competition (see Figure 4-4 and Figure 4-5, the associated DWLs due to the payroll tax threshold are much larger than under perfect competition [see also Dixon *et al.* (2004)];
2. The wage bill is largely invariant as the threshold is increased.

The sensitivity of our outputs under the assumption of monopolistically competitive firms was also tested, with the resulting DWLs compared in Table 4-11 at the current payroll tax threshold in NSW.[15] As we move to the right across the columns of Table 4-11, we are operating on steeper and steeper sections of the firm average cost curves (because we are reducing the elasticity of demand for firm-specific outputs). Thus the imposition of the threshold causes smaller reductions in output per firm (effect one) but greater DWLs per unit reduction in output (effect two). Initially the second effect (the extra damage per unit of output reduction) dominates and DWL rise, but eventually the first effect (less reduction in output per firm) dominates, and the DWL falls.[16]

Appendix 4.3. Payroll-tax rates and the distribution of threshold productivity losses across industries

Table 4-12 is Australian Bureau of Statistics cat. no. 8165.0 data for June 2016 on the number of businesses classified by number of employees and ANZSIC Level 1 industry in NSW. The table implies that in June 2016 there were 15 510 businesses in Agriculture, forestry and fishing that employ workers. Of these, 11 945 had between 1 and 4 employees, etc.

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[15] All simulations are performed using GEMPACK [Harrison and Pearson (1996)].

[16] For brevity, we avoid a detailed description of why deadweight losses fall uniformly as we move from row 1(current model specification) to row 2 (alternative specification), and refer the reader to Dixon *et al.* (2004) for a detailed description of the model parameters. We simply summarise the effect by stating that it is due to effect one described herein dominating effect two.

In Table 4-13, we have summarised ABS data (cat. no. 8155.0) for 2014-15 on number of workers classified by number of employees in employing business and by ANZSIC Level 1 industry. This data is not reported by state or territory however. To disaggregate the number of workers in NSW (as reported in Table 4.5 from Australian Bureau of Statistics cat. no. 6291.0, Total employed persons in NSW at February 2015 [latest available data]) by number of employees in employing business and by ANZSIC Level 1 industry, i.e., to derive a table similar to Table 4-13 for NSW, we followed the process summarised below:

1. We began by dividing each cell in Table 4-13 by aggregate employment to derive employment shares by number of employees in employing business and by ANZSIC Level 1 industry.
2. These national employment shares were then scaled using the company size data for NSW in Table 4-12. For example, ignoring companies with no employees in Australian Bureau of Statistics 8165.0, we found that a greater proportion of NSW private companies employ more than 200 people (4.79 per cent) than the corresponding share for the rest of Australia (4.23 per cent). For each ANZSIC Level 1 industry, we constructed company size shares for NSW and the rest of Australia using this approach. We then multiplied the ratio of these shares, by the national employment shares. These modified shares were then normalised (to sum to one) and multiplied by the number of workers in NSW (Australian Bureau of Statistics cat. no. 6291.0, Total employed persons in NSW at February 2015), which yields Table 4-14.

We then used national average wage rate data classified by ANZSIC level 1 industry and by firm size from Australian Bureau of Statistics 8155.0 for 2014/15 (re-scaled by the NSW average annual wage rate from Australian Bureau of Statistics cat. no. 6302.0 from November 2016) to derive a wage bill matrix for NSW, which is reported in Table 4-15. From this wage bill data, we estimated payroll tax collections by industry for NSW by assuming a payroll tax rate of 5.45% of the wage bill and a threshold of A$0.75m. Our estimated payroll tax collections (A$7 573m) via this method lies within 5% of reported payroll tax revenue for NSW in 2015/16 (A$7 975m). Taking the ratio of our derived payroll tax collections to our derived wage bills, then yielded the effective annual payroll tax rates by industry for NSW also reported in Table 4-15. Finally, we used our calculated wage bills to attribute the DWL due to firm size biases caused by the payroll tax threshold (which are derived in the NSW payroll tax model) across the various ANZSIC level 1 industries that pay payroll tax. The final attributed DWL for the baseline forecast in VURMTAX (rate 5.45 per cent, threshold A$0.75m) is shown in the final column in Table 4-15.

4.5 **Tables and Figures**

Figure 4-1: Partial equilibrium analysis of a payroll tax system with a threshold

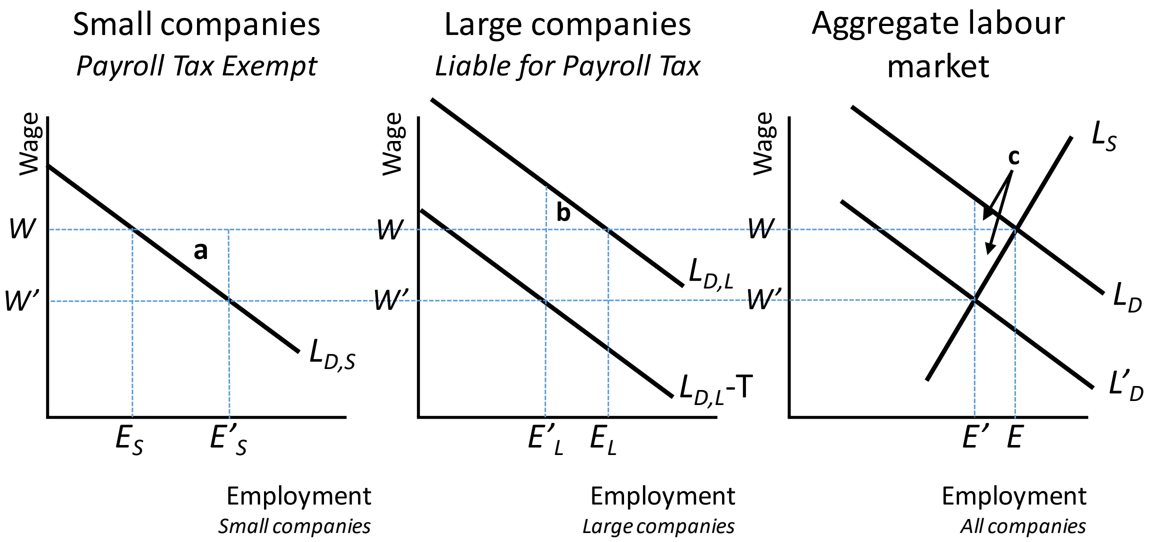
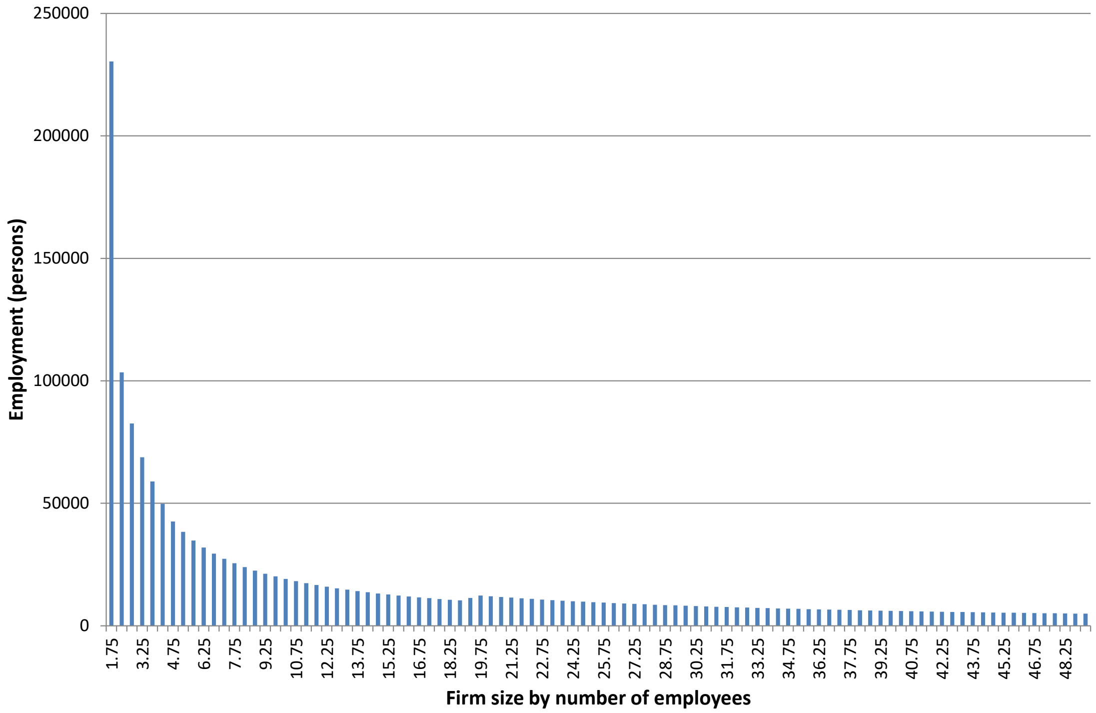


Figure 4-2: Employment by firm size in NSW



Notes: This is the base case distribution of NSW aggregate employment (in persons) by firm size, when we assume there exists no payroll tax threshold and the employment distribution is mostly smooth. The payroll tax rate in this case is uniform across firms and set equal to 3.32 per cent to match 2015/16 payroll tax collections in NSW.

Figure 4-3: Employment in firms in which the number of employees is greater than *x* but less than or equal to 1.5*x* (smoothed distribution)

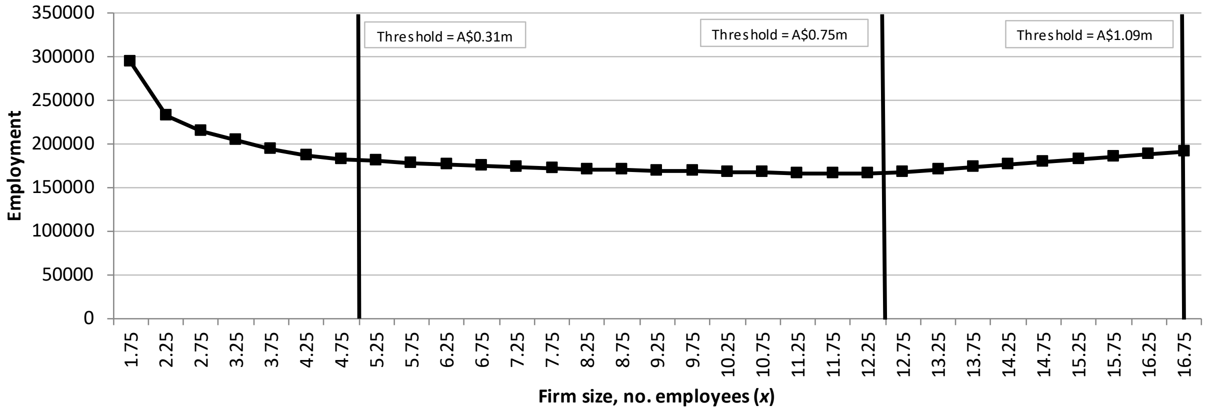
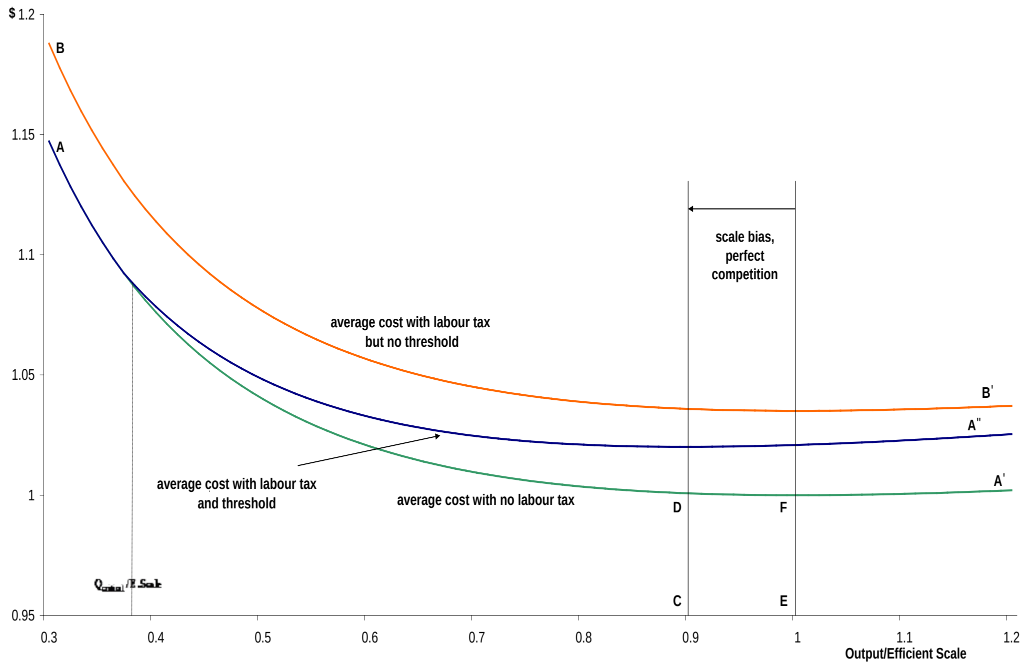
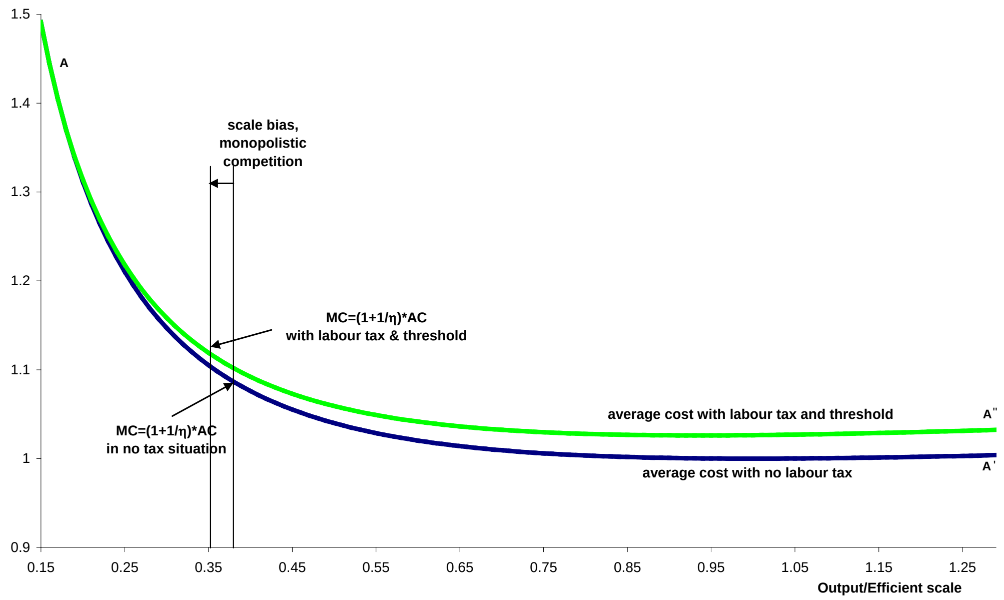


Figure 4-4: Average cost curves and scale bias under perfect competition



Notes: These curves are drawn for a firm facing a payroll tax of 5.45 per cent with a threshold that corresponds to about 40 per *cent of the firm's employment in a situation of zero tax. The curves incorporate the assumption that average costs in the no-tax situation are 4 per cent higher at 50 per cent of efficient scale than they are at efficient scale.*

Figure 4-5: Average cost curves and scale bias under monopolistic competition



Notes: In drawing this diagram we set η at –5, that is MC/AC = 0.8. The curves are drawn for a firm facing a payroll tax of 5.45 per cent with a threshold that corresponds to 60 per cent of the firm's employment in a situation of zero tax. The curves incorporate the assumption that average costs in the no-tax situation are 4 per cent higher at 50 per cent of efficient scale than they are at efficient scale.

Table 4-1: Outputs from the NSW payroll tax model.

		Base case (1)	Current NSW system (2)
1	Threshold ($m)	0	0.75
2	Payroll collections ($m)	7,975	7,975
3	Tax rate (per cent)	3.32	5.46
4	Deadweight loss (DWL, $m)	0	879.28
5	Wage bill ($m)	240,020	239,498
6	DWL / collections (per cent)	0	11.02
7	DWL / wage bill (per cent)	0	0.37
8	Employment (persons)	3,672,927	3,664,949

Notes: In column (1), we summarise the zero-threshold base case NSW payroll tax model inputs, and compare these to the situation under a threshold of A$750,000, under our preferred assumption of monopolistically competitive firms.

Table 4-2: Marginal and average excess burdens for NSW payroll tax reform, measured in cents per dollar of net revenue raised.

	Column [1] Marginal	**Column [2]** Average
(a) Due to adjustment in the NSW payroll tax rate		
SEDI (NSW)	90	103
Excess burden	22	35
(b) Due to adjustment in the NSW payroll tax threshold		
SEDI (NSW)	77	56
Excess burden	3	-17

Table 4-3: Decomposing the impact of effective payroll tax rate and threshold adjustment on the marginal and average SEDIs (in cents-per-dollar-of-tax-revenue generated) due to payroll tax rate changes in NSW

	MEBs	AEBs
NSW: Rate and Threshold adjustment	90	103
NSW: Rate adjustment only	87	86
NSW: Threshold adjustment only	3	17

Table 4-4: Decomposing the impact of effective payroll tax rate versus threshold adjustment on the marginal and average SEDIs (in cents-per-dollar-of-tax-revenue generated) due to payroll tax threshold removal in NSW

	MEBs	AEBs
NSW: Rate and Threshold adjustment	77	56
NSW: Rate adjustment only	94	90
NSW: Threshold adjustment only	-17	-34

Table 4-5: State and national level macroeconomic impacts in 2040, due to a A$100m rise in payroll tax revenue in NSW resulting from a (1) rate rise; or (2) threshold reduction.

		Experiment (1) Payroll tax rate rise Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	**Experiment (2)** Payroll tax threshold reduction Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.026	0.025
2	Capital stock (rental weights)	-0.018	-0.017
3	Real investment	-0.022	-0.020
4	Employment	-0.026	-0.027
5	Real GSP	-0.023	-0.019
6	Real private consumption	-0.013	-0.011
7	Real public (state) consumption	-0.013	-0.011
8	Imports, volume	-0.019	-0.017
9	Exports, volume	-0.086	-0.074
10	Real post-tax consumer wage	-0.015	-0.014
11	Real producer wage	0.011	0.015
12	Tax base ($m)	-86.240	3749.250
13	Aggregate tax revenue ($m)	197.120	204.450
	(b) National results		
14	Real GDP	-0.003	-0.002
15	Real private consumption	-0.003	-0.001
16	Real public (state and federal) consumption	-0.002	-0.001
17	Real investment	-0.002	-0.002
18	Real exports	-0.006	-0.005
19	Real imports	-0.004	-0.003
20	Real GNI	-0.002	-0.001
21	Capital stock (rental weights)	-0.002	-0.002
22	Employment	-0.002	-0.002
23	Capital rentals (investment-price deflated)	0.001	0.002
24	Real post-tax consumer wage	-0.014	-0.013
25	Real producer wage	-0.001	0.000
26	Terms of trade	0.002	0.002
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.001	-0.001
29	Tax base (all states and federal, $m)	-148.989	3690.212
30	Aggregate tax revenue (all states and federal, $m)	125.659	142.100
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.000

Table 4-6: State and national level macroeconomic impacts in 2040, due to removal of payroll tax in NSW or removal of the NSW payroll tax threshold

		Experiment (3) Payroll tax removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	**Experiment (4)** Payroll tax threshold removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
		(a) NSW state-level results	
1	Price deflator, GSP	-2.054	0.748
2	Capital stock (rental weights)	1.542	-0.448
3	Real investment	1.897	-0.543
4	Employment	2.099	-0.818
5	Real GSP	1.958	-0.464
6	Real private consumption	1.163	-0.242
7	Real public (state) consumption	1.163	-0.242
8	Imports, volume	1.699	-0.445
9	Exports, volume	7.324	-1.940
10	Real post-tax consumer wage	1.209	-0.408
11	Real producer wage	-0.714	0.591
12	Tax base ($m)	6817.580	126957.000
13	Aggregate tax revenue ($m)	-14799.300	6971.180
		(b) National results	
14	Real GDP	0.273	-0.004
15	Real private consumption	0.264	0.009
16	Real public (state and federal) consumption	0.231	0.019
17	Real investment	0.232	-0.020
18	Real exports	0.554	-0.111
19	Real imports	0.408	-0.065
20	Real GNI	0.250	0.004
21	Capital stock (rental weights)	0.220	-0.027
22	Employment	0.202	-0.070
23	Capital rentals (investment-price deflated)	-0.111	0.035
24	Real post-tax consumer wage	1.116	-0.387
25	Real producer wage	0.138	0.070
26	Terms of trade	-0.176	0.041
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	0.087	-0.040
29	Tax base (all states and federal, $m)	11783.540	125208.910
30	Aggregate tax revenue (all states and federal, $m)	-8950.009	5189.639
		(c) Change expressed as percent of GDP	
31	Balance of trade	-0.007	0.000

Table 4-7: NSW industry impacts of payroll tax reform in NSW in 2040, caused by a A$100m rise in payroll tax revenue via a (1) rate rise; or (2) threshold reduction

		Experiment (1) $100m rise in payroll tax via rate adjustment Effects on real industry output % deviation from baseline, 2040	**Experiment (2)** $100m rise in payroll tax collections via threshold reduction Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.03	-0.03
2	Mining	-0.07	-0.04
3	Manufacturing	-0.06	-0.06
4	Electricity, gas, water and waste services	-0.03	-0.02
5	Construction	-0.02	-0.02
6	Wholesale trade	-0.03	-0.03
7	Retail trade	-0.02	-0.02
8	Accommodation and food services	-0.03	-0.01
9	Transport, postal and warehousing	-0.05	-0.04
10	Information media and communications	-0.03	-0.03
11	Financial and insurance services	-0.01	-0.01
12	Dwelling ownership	-0.01	0.00
13	Business services	-0.02	-0.02
14	Public administration and safety	-0.01	-0.01
15	Education and training	-0.01	-0.01
16	Health care and social assistance	-0.01	-0.01
17	Other services	-0.02	-0.03

Table 4-8: NSW industry impacts of payroll tax reform in NSW in 2040, caused by removal of the tax or removal of the threshold.

		Experiment (3) Payroll tax rate removed Effects on real industry output % deviation from baseline, 2040	**Experiment (4)** Payroll tax threshold removed Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	2.57	-1.29
2	Mining	5.88	-0.79
3	Manufacturing	5.09	-1.43
4	Electricity, gas, water and waste services	2.95	-0.54
5	Construction	1.76	-0.44
6	Wholesale trade	2.74	-0.81
7	Retail trade	2.11	-0.64
8	Accommodation and food services	2.79	-0.30
9	Transport, postal and warehousing	4.62	-0.96
10	Information media and communications	2.67	-0.72
11	Financial and insurance services	1.20	-0.21
12	Dwelling ownership	0.64	-0.06
13	Business services	1.79	-0.45
14	Public administration and safety	0.76	-0.13
15	Education and training	1.03	-0.26
16	Health care and social assistance	0.85	-0.15
17	Other services	1.74	-0.55

Table 4-9: Effects of different payroll tax thresholds in NSW Perfect Competition, $MC = P$

Perfect Competition Experiment Design	1	2	3	4	5	6	7	8
Threshold ($m)	0	0.15	0.3	0.45	0.6	0.75	0.9	1.05
Payroll collections ($m)	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975
Tax rate (per cent)	3.32	4.22	4.70	5.04	5.31	5.55	5.77	5.97
Dead-weight loss ($m)	0.00	78.84	89.76	103.84	117.04	130.29	144.11	158.01
Wage bill ($m)	240,020	239,605	239,580	239,548	239,515	239,486	239,455	239,430
Dead-weight loss to collections (per cent)	0	0.99	1.13	1.30	1.47	1.63	1.81	1.98
Dead-weight loss to wage bill (per cent)	0	0.03	0.04	0.04	0.05	0.05	0.06	0.07
Employment (persons)	3,672,928	3,666,584	3,666,201	3,665,712	3,665,201	3,664,756	3,664,285	3,663,899

Table 4-10: Effect of different payroll tax thresholds in NSW Monopolistic Competition, *MC* = 0.8 x P

Monopolistic Competition Experiment Design	1	2	3	4	5	6 *Baseline Scenario*	7	8
Threshold ($m)	0	0.15	0.3	0.45	0.6	0.75	0.9	1.05
Payroll collections ($m)	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975
Tax rate (per cent)	3.32	4.18	4.65	4.97	5.24	5.46	5.66	5.84
Dead-weight loss ($m)	0.00	636.89	729.20	780.25	836.48	879.28	925.85	966.38
Wage bill ($m)	240,020	239,638	239,585	239,556	239,523	239,498	239,471	239,448
Dead-weight loss to collections (per cent)	0	7.99	9.14	9.78	10.49	11.02	11.61	12.12
Dead-weight loss to wage bill (per cent)	0	0.27	0.30	0.33	0.35	0.37	0.39	0.40
Employment (persons)	3,672,928	3,667,078	3,666,267	3,665,823	3,665,325	3,664,949	3,664,535	3,664,177

Table 4-11: Deadweight losses ($m) from a payroll tax threshold of $0.75 m

AC increase at 0.5 x Efficient Scale	Perfect Competition	MC = 0.9 X P	MC = 0.8 X P	MC = 0.7 X P	MC = 0.6 X P	MC = 0.5 X P
4%	130.293808	693.743652	879.275146	908.392944	849.077759	738.744019
8%	86.138039	459.103546	651.436096	725.524902	712.583496	630.480042

Table 4-12: Australian Bureau of Statistics 8165.0 data for the numbers of private sector businesses by employment size and ANZSIC Level 1 industry in NSW, June 2016.

	1-4 employees	5-19 employees	20-199 employees	200+ employees	*Total companies*
Agriculture, Forestry and Fishing	11945	3124	428	13	*15510*
Mining	444	151	55	31	*681*
Manufacturing	8635	4922	1612	171	*15340*
Electricity, Gas, Water and Waste Services	612	215	59	13	*899*
Construction	42878	7596	1129	53	*51656*
Wholesale Trade	9230	4547	1414	134	*15325*
Retail Trade	16604	7375	1602	117	*25698*
Accommodation and Food Services	11951	8171	2192	103	*22417*
Transport, Postal and Warehousing	12442	1883	594	74	*14993*
Information Media and Telecommunications	2659	587	322	57	*3625*
Financial and Insurance Services	11502	1533	477	101	*13613*

	1-4 employees	5-19 employees	20-199 employees	200+ employees	*Total companies*
Rental, Hiring and Real Estate Services	9360	2429	410	37	*12236*
Professional, Scientific and Technical Services	35948	6927	1759	131	*44765*
Administrative and Support Services	10055	3326	1228	175	*14784*
Public Administration and Safety	1044	343	139	12	*1538*
Education and Training	3041	1482	608	61	*5192*
Health Care and Social Assistance	13558	5512	1116	110	*20296*
Arts and Recreation Services	2346	795	239	30	*3410*
Other Services	13199	3229	355	12	*16795*
Currently Unknown	2091	387	71	8	*2557*
TOTAL	*219544*	*64534*	*15809*	*1443*	*301330*

Table 4-13: Australian Bureau of Statistics 8155.0 data on aggregate national employment of employing businesses, classified by employment size and ANZSIC Level 1 industry in Australia, 2014-15.

	Up to 19 employees	20-199 employees	200+ employees	*Aggregate employment*
Agriculture, forestry and fishing	390.00	67.00	19.00	*476.00*
Mining	17.00	23.00	133.00	*173.00*
Manufacturing	286.00	260.00	311.00	*857.00*
Electricity, gas, water and waste services	14.00	21.00	77.00	*112.00*
Construction	729.00	158.00	151.00	*1038.00*
Wholesale trade	206.00	175.00	162.00	*543.00*
Retail trade	472.00	257.00	587.00	*1316.00*
Accommodation and food services	436.00	305.00	222.00	*963.00*
Transport, postal and warehousing	233.00	95.00	246.00	*574.00*
Information media and telecommunications	38.00	28.00	105.00	*171.00*
Financial and insurance services	70.74	37.17	50.09	*158.00*
Rental, hiring and real estate services	312.00	60.00	31.00	*403.00*
Professional, scientific and technical services	498.00	269.00	197.00	*964.00*
Administrative and support services	285.00	208.00	319.00	*812.00*
Public administration and safety (private)	23.00	27.00	35.00	*85.00*
Education and training (private)	91.00	168.00	139.00	*398.00*
Health care and social assistance (private)	351.00	233.00	496.00	*1080.00*
Arts and recreation services	65.00	59.00	78.00	*202.00*
Other services	318.00	90.00	65.00	*473.00*
TOTAL	*4834.74361*	*2540.1686*	*3423.0878*	*10798*

Table 4-14: Derived NSW number of workers of employing businesses, classified by employment size and ANZSIC Level 1 industry in Australia, 2014-15.

	Up to 19 employees	20-199 employees	200+ employees	*Aggregate employment*
Agriculture, forestry and fishing	69.87	9.81	3.81	*83.49*
Mining	3.26	3.61	28.60	*35.47*
Manufacturing	94.87	70.49	115.55	*280.91*
Electricity, gas, water and waste services	5.25	6.44	32.36	*44.05*
Construction	218.51	38.70	50.69	*307.91*
Wholesale trade	49.58	34.42	43.67	*127.68*
Retail trade	132.63	59.02	184.74	*376.39*
Accommodation and food services	127.24	72.74	72.56	*272.53*
Transport, postal and warehousing	78.28	26.08	92.56	*196.92*
Information media and telecommunications	17.09	10.29	52.90	*80.28*
Financial and insurance services	82.06	35.23	65.07	*182.37*
Rental, hiring and real estate services	49.79	7.83	5.54	*63.16*
Professional, scientific and technical services	174.22	76.91	77.19	*328.32*
Administrative and support services	43.86	26.16	54.98	*125.00*
Public administration and safety (private)	54.67	52.44	93.17	*200.28*
Education and training (private)	65.21	98.38	111.55	*275.14*
Health care and social assistance (private)	148.07	80.33	234.35	*462.75*
Arts and recreation services	19.52	14.48	26.23	*60.23*
Other services	111.18	25.71	25.45	*162.35*
TOTAL	*1545.16094*	*749.07548*	*1370.9941*	*3665.2305*

Table 4-15: Derived NSW wage bills by firm size and ANZSIC Industry, effective payroll tax rate and attributed DWL

	Calculate wage bills (A$m)				
	Up to 19 employees	20-199 employees	200+ employees	Ratio of payroll tax collections to the wage bill (effective tax rate)	Attributed DWL by industry (A$m)
Agriculture, forestry and fishing	1,055	477	195	1.08%	7.52
Mining	426	650	6,053	5.23%	31.01
Manufacturing	5,108	5,826	13,540	4.13%	106.47
Electricity, gas, water and waste services	419	644	4,920	5.16%	26.03
Construction	10,484	4,151	8,991	2.95%	102.78
Wholesale trade	2,861	3,260	4,927	3.47%	48.06
Retail trade	4,746	2,917	8,047	3.36%	68.34
Accommodation and food services	3,226	2,749	2,630	2.32%	37.43
Transport, postal and warehousing	2,693	2,148	11,213	4.40%	69.84
Information media and telecommunications	879	931	7,093	4.82%	38.73
Financial and insurance services	7,364	5,786	13,208	4.40%	114.67
Rental, hiring and real estate services	1,685	721	659	1.86%	13.33
Professional, scientific and technical services	10,634	8,299	11,628	3.54%	132.95
Administrative and support services	1,633	2,025	4,549	3.67%	35.70
Public administration and safety (private)	2,626	2,708	7,679	0.00%	0.00
Education and training (private)	2,491	6,979	7,846	0.00%	0.00
Health care and social assistance (private)	6,998	4,781	14,904	0.00%	0.00
Arts and recreation services	463	670	1,394	4.02%	10.99
Other services	4,428	1,984	1,733	2.67%	35.43
TOTAL	*70,220*	*57,706*	*131,209*	*2.92%*	*879.28*

5 Land tax

5.1 Allocative efficiency impacts of land tax

The key distinction between NSW state land taxes and local council rates on UIV are exemptions. Local councils typically levy differentiated rates based on land zone types, but they carry very few exemptions [Henry Review (2009)]. In contrast, as discussed by Freebairn (2016), the NSW state land tax has two sources of inefficiency relative to a broad-based land tax:

(1) Exemptions, which include the primary producer land (PPL) and principal place of residence (PPR) exemptions [see the Land Tax (Amendment) Act (1970, 1973)], in addition to exemptions for land held by charities, municipal and public land, health centres, and residential care facilities; and

(2) Higher tax rates apply to larger land holdings.

The exemption of owner-occupied dwellings, or the PPR exemption, from land-tax represents the clearest distortion. An assessment of whether other features of the land tax system (mainly the tax-free threshold, the premium rate and the application of these by total land holdings of an owner rather than individual land parcels) generate significant distortions might be possible in future work, but would require extensive data of each landholder’s individual property values. It has been conjectured that the land tax systems in NSW and other Australian states contribute to the large proportion of rental apartments being individually rather than institutionally owned. There is some support in the literature from a small number of US studies that differences in ownership structure might affect the profitability of renting activities. Haddin III (2009) for example finds that for multifamily homes in the city of Atlanta the operating performance of properties owned by real estate investment trusts (REITs) is slightly better than that for non-REIT-owned properties. This result, however, is not readily translatable to the NSW ownership issue. Consequently, we concentrate in this study on what appears to be the major distortion in the NSW land-tax system, the exemption of owner-occupied dwellings.

5.2 Modelling land tax in VURMTAX

Nassios *et al.* (2019) describe the way land taxes are modelled in VURMTAX. Herein, we provide a short summary of their description. VURMTAX identifies four types of land tax potentially levied on land used in each industry in each region: (1) Local council rates on UIV. We denote the value of these taxes levied on land in industry *i* in region *q* as $V1LNDTXL_{(i,q)}$;

(2) State land tax ($V1LNDTXS_{(i,q)}$); (3) Other state taxes on immovable land ($V1LNDTXSO_{i,q}$); and (4) Federal land tax ($V1LNDTXF_{(i,q)}$).

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

All land tax rates in VURMTAX are expressed as tax rates on land income, $V1LND_{(i,q)}$, derived from land employed by industry *i* in region *q* rather than land values.[17] We calculate initial land tax rates on income from land used in industry *i* operating in region *q* via:

$$\mathrm{TAXLNDL}_{(i,q)} = \frac{\mathrm{V1LNDTXL}_{(i,q)}}{\mathrm{V1LND}_{(i,q)}},$$

$$\mathrm{TAXLNDS}_{(i,q)} = \frac{\mathrm{V1LNDTXS}_{(i,q)}}{\mathrm{V1LND}_{(i,q)}}.$$

In a standard business-as-usual forecast, all land tax rates in VURMTAX defined above are held exogenous at the levels implied in our initial data.[18] All tax policy simulations discussed in this section involve an event-year change in these tax rates.

The VURMTAX sectoral aggregation is based on Australian Bureau of Statistics input-output industry classifications, and as such, the starting point in VURMTAX for modelling of the residential dwelling sector is a single *Ownership of Dwellings* sector. The activities of this sector subsume all dwelling types and all tenure choices. In VURMTAX, for reasons we motivate more fully in our discussion in section 5.3 below, this sector is divided into two dwelling types (low-density dwellings and high-density dwellings), each offering two tenure choices (ownership or tenancy). The result is two industries distinguished by dwelling type (high density, and low density, hereafter *DwellingHigh* and *DwellingLow*). Each of these two industries offers two tenure choices to households. As such, the model identifies four dwelling

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

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

service commodities: high-density tenancy (*DwelHighRent*), high-density ownership (*DwelHighOwn*), low-density tenancy (*DwelLowRent*) and low-density ownership (*DwelLowOwn*).[19] We assume that each industry assigns its dwelling services output across the two tenure choices in a constrained revenue maximising way. More formally, we assume that each dwelling production sector (*DwellingHigh* and *DwellingLow*) faces a constrained transformation process (described by industry-specific constant elasticity of transformation (CET) functions) for dividing its output across the two tenure choices (respectively, *DwelHighRent* and *DwelHighOwn*, and *DwelLowRent* and *DwelLowOwn*). This establishes the supply side of the market for the four types of residential service.

We model household demand for dwelling services as a staged decision process. At the top level of the process, the household demand for *Dwellings*, undifferentiated by dwelling type or tenure choice, is one among the 79 commodities[20] that enter the household's Klein-Rubin utility function. The household's first decision problem is to choose utility maximising consumption of each of the 79 commodities (including *Dwellings*), taking both prices and the available consumption budget as given. Having determined demand for *Dwellings* in this way, the household's second problem is to minimise the cost of acquiring these services by choosing, in a constrained optimising fashion, across alternative dwelling types. More formally, we assume that the household views *Dwellings* as a constant elasticity of substitution (CES) combination

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

[20] The household sets their demand for dwellings, moving services and transport services as per the standard LES framework in MMRF/VURM. Having set demand for dwelling services, they subsequently make their density and tenancy consumption choices. Having set demand for moving services, they subsequently set their demand for conveyancing legal, real estate and administration services. Having set demand for transport services, they subsequently set their demand for private transport or road transport, i.e., taxis, services.

of high- and low-density dwellings. The second stage of the household's decision problem therefore requires the household to minimise the cost of acquiring the utility maximising level of *Dwellings* by choosing across two types of dwellings, *DwellingLow and DwellingHigh*, subject to the CES function and given prices. We assume the elasticity of substitution in this second decision to be relatively low and equal to 0.5. In the final stage of the housing decision problem, households minimise the cost of acquiring the utility maximising level of *DwellingLow and DwellingHigh* via a tenure choice decision, i.e., given the utility maximising level of *DwellingLow* consumption, households minimise costs via a choice between *DwelLowRent* and *DwelLowOwn*.[21] For reasons we shall discuss in section 5.3, the elasticity of substitution in the tenure choice decision facing households is set equal to 4. This establishes the demand side of the market for the four types of residential service (comprising two dwelling types cross-classified by two tenure possibilities). These four markets clear via endogenous movements in prices. As discussed below, for purchases of low- and high-density rental services, these prices include land taxes.

5.2.1 Mathematical description and data

In VURMTAX we ensure, via appropriate initial entries in the array of state taxes on consumption ($V3TAX_{(c,s,q)}$) that land tax paid by, say, the high density dwelling sector (*DwellingHigh*), is paid by renters (i.e. consumers of *DwelHighRent*) and not owners (i.e. users of *DwelHighOwn*). In simulations in which we change land tax rates, we ensure that changes in land tax collections affect renters, but not owners. The allocation formula recognises that the initial assignment of land taxes in the input-output database is on the production side of the *DwellingHigh* and *DwellingLow* industries. Hence, the starting point for the incidence of these taxes, without intervention via entries in $V3TAX_{(c,s,q)}$, is on both owner occupiers and renters of each type of dwelling. In both the initial database and in simulation, we ensure that the land tax is paid by renters but not owners via:

$$V3TAX_{(DwelHighOwn,NSW,NSW)} = -SHROWN_{(DwellingHigh,NSW)} \times V1LNDTAXS_{(DwellingHigh,NSW)}$$

$$V3TAX_{(DwelHighRent,NSW,NSW)} = +SHROWN_{(DwellingHigh,NSW)} \times V1LNDTAXS_{(DwellingHigh,NSW)}$$

$$V3TAX_{(DwelLowOwn,NSW,NSW)} = -SHROWN_{(DwellingLow,NSW)} \times V1LNDTAXS_{(DwellingLow,NSW)}$$

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[21] Equivalently, given the utility maximising level of *DwellingHigh* consumption, households minimise costs via a choice between *DwelHighRent* and *DwelHighOwn*.

$$V3TAX_{(DwelLowRent,NSW,NSW)} = +SHROWN_{(DwellingLow,NSW)} \times V1LNDTAXS_{(DwellingLow,NSW)}$$

where

$V1LNDTAXS_{(t,NSW)}$ is land tax paid on land used in the production of NSW dwelling type t.

$SHROWN_{(t,NSW)}$ is the share of sales of dwelling type *t* accounted for by owner occupancy, calculated via:

$$SHROWN_{(DwellingHigh,NSW)} = \frac{MAKE_{(DwelHighOwn,DwellingHigh,NSW)}}{MAKE_{(DwelHighOwn,DwellingHigh,NSW)} + MAKE_{(DwelHighRent,DwellingHigh,NSW)}}$$

$$SHROWN_{(DwellingLow,NSW)} = \frac{MAKE_{(DwelLowOwn,DwellingLow,NSW)}}{MAKE_{(DwelLowOwn,DwellingLow,NSW)} + MAKE_{(DwelLowRent,DwellingLow,NSW)}}$$

$MAKE_{(c,j,r)}$ is the value of commodity *c* produced by industry *j* in region *r*.

$V3TAX_{(k,NSW,NSW)}$ is a consumption tax or subsidy paid by NSW households on dwelling service type k. For purchasers of the owner tenure variety, the value for V3TAX will be a subsidy sufficient to eliminate the V1LNDTAXS carried in the basic price of the relevant dwelling type. For purchasers of the renter tenure variety, the value for V3TAX will be a tax sufficient to ensure that the purchaser’s price reflects all land tax payable on the relevant dwelling type.

5.3 The deadweight loss from owner-occupied housing exemptions in land tax

The aim of this section is to provide a framework for understanding the excess burden of land tax calculated using VURMTAX. As described previously herein and discussed by Freebairn (2018b), an important distinction between land tax and council rates is the PPR exemption. As we shall discuss and highlight via VURMTAX simulation outputs in later sections, the deadweight loss from state land tax on unimproved property values arises largely from the exemption of owner-occupied housing land from land taxes. This exemption biases the choice between owning and renting towards owning, which we account for in VURMTAX using the framework summarised in section 5.1.

5.3.1 Own or rent? A discrete choice model

A major distorting feature of land tax in NSW and other Australian jurisdictions is the exemption for land used in owner-occupied dwellings.

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

$$U(j) = D(j) * U\left(\frac{X_1(j)}{A_1(j)}, Z(j)\right) + (1 - D(j)) * U\left(\frac{X_2(j)}{A_2(j)}, Z(j)\right) \quad (5.1)$$

where

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

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

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

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

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

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

$$P_1 = P * (1 + T_1) \quad (5.2)$$

$$P_2 = P * (1 + T_2) \quad (5.3)$$

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

From (5.1), (5.2) and (5.3) we conclude that:

Market condition

j will be a renter if $$A_1(j) \geq \frac{(1+T_2)}{(1+T_1)} * A_2(j) \quad (5.4)$$

j will be an owner if $$A_1(j) < \frac{(1+T_2)}{(1+T_1)} * A_2(j) \quad (5.5)$$

Assume that land is homogeneous. Then for an optimal distribution of land between owning and renting:

Efficiency condition

j must be a renter if $A_1(j) \geq A_2(j)$ (5.6)

j must be an owner if $A_1(j) < A_2(j)$ (5.7)

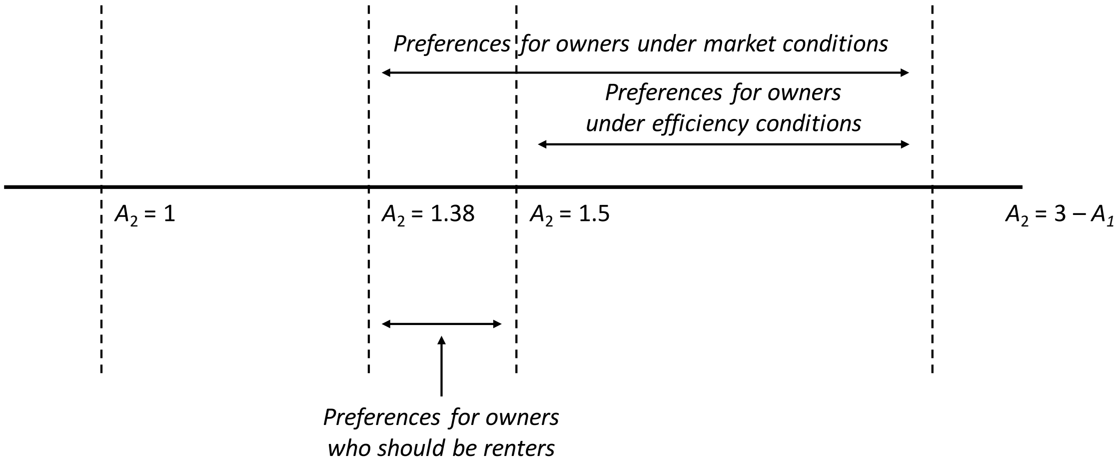
Why is this the efficiency condition? As can be seen from (5.1), if *j* is an owner and was given $[A_2(j)/A_1(j)]*X_1(j)$ units of rented land in exchange for $X_1(j)$ units of owned land then there would be no change in *j*'s utility. Now assume $A_1(j) > A_2(j)$, then we would have some land left over (a welfare gain). Hence, if there is an owner with $A_1(j) > A_2(j)$, then the situation is not optimal.

Comparing (5.4) and (5.5) with (5.6) and (5.7) we see that the market will produce an optimal outcome if and only if T_1 is equal to T_2. In NSW it is reasonable to think of T_1 as zero as T_2 as 0.17.[22] With these tax rates, we see that there is likely to be an under-use of land for renting and an over-use for owning.

In Figure 5.1, we assume that all family units have A_1 and A_2 values that sum to 3 and that both A_1 and A_2 lie between 1 and 2. With $(1+T_1)/(1+ T_2) = 1/1.17$, in the market outcome all households *j* whose A_2 value is greater than 1.38 will be owners. As indicated in the figure, family units whose A_2 value is between 1.38 and 1.5 will be owners under market conditions whereas optimality requires that they should be renting.

[22] This is based on the idea of an approximately 3.2 per cent interest rate and a 1.6 per cent tax rate applied to the value of land, weighted by an appropriate share of land-to-capital costs incurred in delivering a unit of dwellings services in Australia, i.e., 0.5 by 0.33 yields our assumed relative tax rate of 0.17.

Figure 5-1: Own-or-rent decision in a discrete choice model of housing tenure.



To work out the dead-weight loss imposed by the land tax we need to decide how much land is used be people whose A_2 value is between 1.38 and 1.5.

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

$$X_2^{market} = \int_1^{1.38} A * dA = 0.46 \qquad (5.8)$$

The amount of land being used by owners who should be renters is

$$X_1^{misallocated} = \int_{1.5}^{1.62} A * dA = 0.18 \qquad (5.9)$$

The amount of land being used by owners who should be owners is

$$X_1^{optimal} = \int_1^{1.5} A * dA = 0.625 \qquad (5.10)$$

The total amount of land used by owners under market conditions is

$$X_1^{market} = X_1^{misallocated} + X_1^{optimal} = 0.81 \qquad (5.11)$$

The total amount of land used by owners and renters in the market solution is

$$X^{market} = X_1^{market} + X_2^{market} = 1.26 \qquad (5.12)$$

The total amount of land used in an optimal solution

$$X^{optimal} = 2 * X_1^{optimal} = 1.25 \quad (5.13)$$

The excess burden associated with tax-related misallocation of land calculated as excess land use is

$$X^{market} - X^{optimal} = 0.0135 \quad (5.14)$$

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

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

$$\text{collection} = 0.17 * 0.46 = 0.077 \quad (5.15)$$

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

$$AEB = \frac{0.0135}{0.077} = 17.6\% \quad (5.16)$$

5.3.2 A neoclassical representation

According to the discrete-choice analysis in section 5.3.1, removing land tax on rented housing increases the X_2 / X_1 ratio from 0.45 / 0.81 to 0.625 / 0.625, i.e. from 0.567 to 1. This is caused by a change in relative prices from 1.17/1 to 1. These observations are consistent with a representative agent utility-maximizing model in which the utility function guiding owner-renter choice is given by:

$$UR = \left(X_1^{\sigma-1/\sigma} + X_2^{\sigma-1/\sigma}\right)^{\sigma-1/\sigma}, \quad (5.17)$$

if we set σ, the elasticity of substitution between owning and renting, equal to 3.66.[23] This motivates the tenure choice substitution elasticity we use in VURMTAX.

To illustrate this, as in the discrete-choice model, we assume (X_2, X_1) = (0.46, 0.81) in the prevailing market situation; i.e., with the 17 per cent land tax in place so that $P_2/P_1 = 1.17$. Thus, as shown in Figure 5-2, total land use in this distorted situation is 1.26 (=0.46+0.81), yielding *UR*=1.622. Optimally distributed between owning and renting, 1.26 units of land would yield utility of *UR*=1.639. Alternatively, we could generate the initial level of utility using 1.06 per cent less land [= 100*(1-1.622/1.639)]; that is, using 1.25 units of land distributed as 0.625 for each of owning and renting.

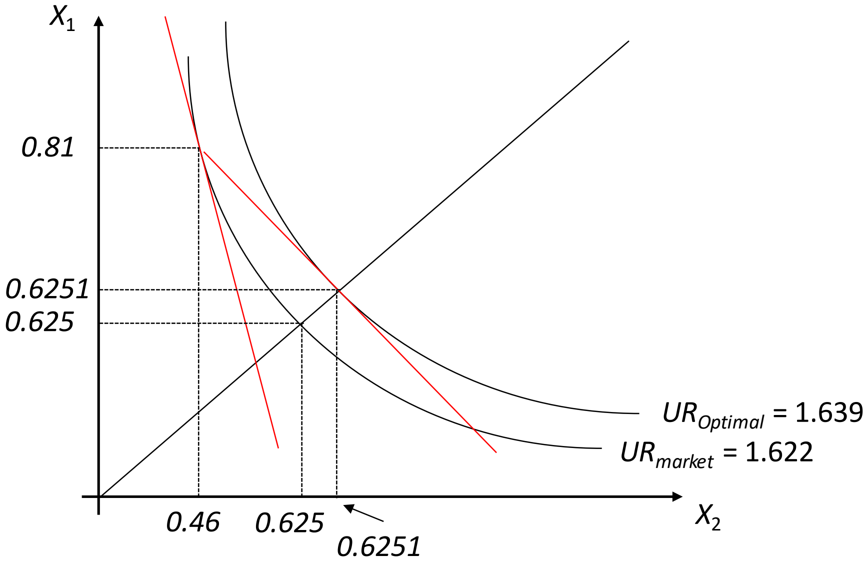
This analysis shows a deadweight loss from the distorting tax of 0.0134 units of land, close to the discrete-choice model value (0.0135). The AEB in the representative-agent model is thus:

$$\text{AEB} = \frac{0.0134}{0.077} = 17.4\%, \qquad (5.18)$$

compared with 17.6% for the discrete-choice model [see equation (5.16)]. As we shall see, the results from both the discrete choice and neoclassical models described in this article are quite similar to the values derived from our CGE model, VURMTAX, when we simulate the removal of land taxes on the NSW dwellings sector (holding all other tax rates constant).

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

Figure 5-2: Own-or-rent decision in a representative agent model of housing tenure.



5.4 Simulation design

The closure of the model at the national level is summarised in section 3.3. As outlined in section 3.5, we calculate the average excess burden of land tax by undertaking a simulation in which we reduce land tax rates by 95% of their initial levels. We calculate the marginal excess burden of land tax by simulating a $100m rise in the land tax collections.

5.4.1 Excess burden of NSW land tax

Table 5-1(i) summarises the SEDI and excess burdens of NSW land tax rate adjustments, twenty-one years after the tax policy changes. At each jurisdictional level, the average SEDI and excess burden of NSW land tax is low (the average SEDI is equal to -4, while the average excess burden is 4 at the national level). The incidence of the tax falls largely on landowners, leading to little distortion in economic behaviour and thus little in the way of allocative efficiency effects. Marginal SEDIs and excess burdens are larger, however remain relatively low compared to other taxes studied in this paper. An interesting result is that national excess burdens are higher than the corresponding SEDIs. This pattern is not evident for other taxes studied in this paper, except council rates. This is because both land tax and council rates fall on an immobile factor of production: land. Other taxes find their way into NSW production costs, reducing NSW competitiveness and thus leading to resource outflow from NSW. This interstate competitiveness effect is not at work with land tax, because the immobility of land prevents the tax passing into NSW production costs.

An important exception to the general efficiency of land tax is owner versus renter occupied dwellings, as highlighted in sections 5.1 and 5.3. As discussed earlier, we ensure that the land tax payable on land allocated to each of the two dwelling types (low and high density) is paid by renters but not by owner-occupiers. This introduces an allocative efficiency distortion in dwelling tenure choice, the impact of which is also highlighted in Table 5.1 where we report the excess burden of two additional simulations:

- Simulate a $100m rise in land tax receipts via a rise in the land tax rate on the dwellings sector, maintaining all other land tax rates at their baseline values. The outputs of this simulation yield the marginal SEDIs and excess burdens reported in Table 5-1(ii);
- Simulate removal of land tax on dwellings, the outputs of which yield the average SEDIs and excess burdens summarized in Table 5-1(ii).

The purpose of these additional simulations is to allow us to distinguish the effects of changing land tax rates in general (Table 5-1(i)) from the effects of changing land tax rates on dwellings only (Table 5-1(ii)). The difference between the two sets of results must be the effects of changing land tax rates on non-dwellings sectors.

As expected, the marginal and average SEDIs and excess burdens exceed the corresponding figures determined for changes in the overall rate of land tax in NSW. An interesting result is that the state average SEDI is very similar to the figure derived using the discrete choice and neoclassical models described in section 5.3, which therefore serve to highlight the key drivers of land tax resource misallocation captured by VURMTAX.

We describe below the state and national macroeconomic effects and NSW industry impacts of changes in the land tax rate. We focus our discussion on the effects of removal of the land tax. Because the simulation in which we raise land tax revenue by $100 m. only differs from the full removal simulation in terms of direction and magnitude, our discussion of the removal simulation is equally applicable (with appropriate allowance for sign and magnitude) to the marginal increase simulation.

5.5 Macroeconomic impacts

As we shall discuss in our analysis of NSW council rates (see section 11), an important consideration is that part of council rates are paid by foreign landowners. Hence, in the simulation where council rates are eliminated, national income and consumption fall as a result of foregone tax revenue on foreign owned land. A similar consideration is at work with land taxes, but with the additional factor that there are allocative efficiency consequences arising from tenure choice distortion that are not present under council rates.

The influence of foreign land ownership in the land tax simulation are apparent in a comparison of the excess burden measures in Table 5-1(i) and Table 5-1(ii). In the VURMTAX database, residential dwellings are modelled as overwhelmingly domestically owned. Hence, when we eliminate land tax on dwellings only (Table 5-1(ii)**)** we gain the allocative efficiency benefit from removing the tenure choice distortion, without significant loss of national income arising from taxing foreign owned land. The resulting national AEB measure, at 10, is higher than that generated by removal of land taxes on all sectors (Table 5-1(i)). This is because the latter simulation involves foregone tax revenue from foreign owned land, which damps the benefit of full land tax removal relative to the case where we confine land tax removal to the dwellings sector. These considerations are helpful in understanding the results of the land tax simulation reported in Table 5-2 and Table 5-3, because it allows us to identify starting points for thinking about the macroeconomic effects of land tax removal in terms of allocative efficiency gains from removing tenure choice distortion and national income losses from foregone taxation of foreign owned land.

The removal of the tenure choice distortion created by the imposition of land tax on rental occupied dwellings but not owner occupied dwellings raises real GDP at market prices relative to real GDP at factor cost. This allocative efficiency gain accounts for part of the rise in real GDP at market prices (row 14). The allocative efficiency gain is like a productivity increase. In the long-run, assuming the national population growth rate remains unchanged from baseline, the gains from this accrue to national fixed factors: labour and land. This accounts for the increase in the national real wage (row 24). This generates a small increase in national participation and employment (row 22). Together with the allocative efficiency gain, the rise in employment promotes a small increase in the capital stock relative to baseline (row 22). The positive deviations in both employment and capital contribute to the positive deviation in real GDP, in addition to that attributable to the removal of the tenure choice distortion.

Ceteris paribus, the increase in real GDP raises national income relative to baseline (row 20). Note however that the increase in real national income is less than the increase in real GDP, largely because the elimination of land tax involves some foregone tax revenue on foreign owned land. Because the positive deviation in national income is less than the positive deviation in real GDP, so too the positive deviations in consumption (private and public) are less than the deviation in real GDP (rows 15 and 16). This causes the real balance of trade to move towards surplus (rows 18 and 19).

We turn now to the impacts of land tax removal on NSW. As discussed above, part of the incidence of land tax on rental dwellings is passed on to tenants in higher rents. At the same time, a distortion is introduced in choice of tenure between rental and owner occupancy. Removal of land tax lowers the cost of rental occupancy and eliminates the tenancy choice distortion. Both effects lower the long-run cost to NSW households of acquiring the biggest component of their consumption bundle: dwelling services. The result is a reduction in the NSW consumer price index relative to that in other states. This causes the NSW real consumer wage to rise (row 10), which in turn generates an increase in labour force participation, and thus causes a positive deviation in long-run NSW employment (row 4). The positive deviation in NSW employment together with the allocative efficiency gain arising from removal of the tenure choice distortion causes NSW real GDP to rise relative to baseline (row 5). However, the foregoing of some land tax revenue on foreign owned land results in a net reduction in NSW income available for funding private and public consumption spending. This accounts for the negative deviations in private and public consumption (rows 6 and 7).

5.6 **Industry impacts**

Table 5-3 reports results for the output deviations of NSW industries. As discussed with reference to the national macroeconomic outcomes, the national real balance of trade moves towards surplus, and as such, the national real exchange rate depreciates relative to baseline. This encourages positive deviations in trade-exposed sectors in NSW, like manufacturing and mining (Table 5-3). The agriculture sector is exempt from state land tax, because of the primary producer land exemption. Nevertheless, it also benefits from real depreciation, and expands. The NSW transport, postal and warehousing sector is also assisted by real depreciation, because it provides transport and storage margin services to export industries. The damping of NSW private and public consumption spending relative to baseline (rows 6 and 7 of Table 5-3) causes negative deviations in the output of NSW sectors that are heavily oriented towards supplying consumption goods. This accounts for the negative deviations in the output of accommodation and food services, other services, health care and social assistance, dwelling services, and retail trade.

5.7 Conclusions

In this section, we have used VURMTAX to assess the economic impact of NSW land taxes. We have established that the marginal SEDI of the current NSW land tax system, i.e., including exemptions on agriculture, education, residential care and owner-occupied dwellings, cause a leisure-adjusted GSP loss of 3 cents for each additional dollar of net tax revenue raised via this tax in NSW. The national excess burden is slightly higher, at 8 cents of foregone leisure-adjusted real income per dollar of additional taxation revenue raised nationwide. As we show via a simulation where we alter the land tax rate on the dwelling services sector (holding all other rates exogenous and at their baseline levels), the positive marginal excess burden of land tax in NSW reported here is largely a result of the allocative distortion introduced by the land tax exemption of owner-occupied land. This establishes that the gain arising from part of the land tax incidence falling on foreign landowners, is insufficient to offset the owner-dwelling distortion caused by the NSW land tax system.

5.8 Tables

Table 5-1: State and national marginal and average excess burden of unilateral changes in NSW land tax rates, reported for the year 2040

	Marginal Column 1	**Average** Column 2
(i) State land tax in NSW		
SEDI, NSW	3	-4
Excess burden	8	4
(ii) State land tax on dwellings in NSW		
SEDI, NSW	25	14
Excess burden	17	10

Table 5-2: State and national macroeconomic impacts in 2040, due to a A$100m rise and elimination of land tax in NSW

		Land tax rate Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	Remove land tax in NSW Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.005	-0.119
2	Capital stock (rental weights)	0.002	-0.045
3	Real investment	0.002	-0.060
4	Employment	-0.001	0.003
5	Real GSP	-0.002	0.015
6	Real private consumption	0.001	-0.062
7	Real public (state) consumption	0.001	-0.062
8	Imports, volume	0.002	-0.047
9	Exports, volume	-0.012	0.256
10	Real post-tax consumer wage	-0.001	0.032
11	Real producer wage	-0.001	0.012
12	Tax base ($m)	-152.414	4340.920
13	Aggregate tax revenue ($m)	162.240	-4585.980
	(b) National results		
14	Real GDP	-0.001	0.012
15	Real private consumption	0.000	0.010
16	Real public (state and federal) consumption	0.000	0.013
17	Real investment	0.000	-0.004
18	Real exports	-0.002	0.018
19	Real imports	0.000	-0.006
20	Real GNI	-0.001	0.008
21	Capital stock (rental weights)	0.000	-0.003
22	Employment	0.000	0.005
23	Capital rentals (investment-price deflated)	0.000	0.002
24	Real post-tax consumer wage	-0.001	0.019
25	Real producer wage	-0.001	0.010
26	Terms of trade	0.000	-0.006
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.001	0.009
29	Tax base (all states and federal, $m)	-157.354	4471.040
30	Aggregate tax revenue (all states and federal, $m)	132.719	-3877.331
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.003

Table 5-3: NSW industry impacts in 2040, due to a A$100m rise and elimination of land tax in NSW

		Land tax rate Effects on real industry output % deviation from baseline, 2040	Remove land tax in NSW Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	0.00	0.10
2	Mining	-0.01	0.21
3	Manufacturing	-0.01	0.14
4	Electricity, gas, water and waste services	0.00	0.03
5	Construction	0.00	-0.06
6	Wholesale trade	0.00	0.00
7	Retail trade	0.00	-0.05
8	Accommodation and food services	0.00	-0.07
9	Transport, postal and warehousing	-0.01	0.11
10	Information media and communications	0.00	0.03
11	Financial and insurance services	0.00	-0.02
12	Dwelling ownership	0.00	-0.12
13	Business services	0.00	0.01
14	Public administration and safety	0.00	-0.02
15	Education and training	0.00	-0.03
16	Health care and social assistance	0.00	-0.05
17	Other services	0.00	-0.06

6 Transfer or conveyancing duty on property

Stamp duty on property conveyancing applies to the transfer of ownership of most properties, with the duty base being the value of the property purchased.[24] In all Australian states, a progressive rate schedule is employed. In 2015-16 for NSW, the rate of duty increases from 1.25 per cent on purchase prices up to $14,000 through 5 additional steps up to 5.5 per cent on properties sold for over a million dollars. For residential properties, a premium rate of 7 per cent applies to properties sold for over $3 million, while a surcharge of 4 per cent is payable by foreign purchasers.

While the tax base for conveyancing duty is the value of the property, the activity being taxed is the process of property transfer. The value of the resources used in transferring property ownership is usually only a fraction of the property price.

To capture this, we introduce three new commodities in VURMTAX. These commodities reflect the real estate services, legal services and public administrations services households and industries consume in order to transfer residential or commercial property. To model NSW residential conveyancing, which we assume is falls entirely on NSW households; we modify the usual linear expenditure system governing the representative households' consumption decisions in VURMTAX by introducing a new aggregate commodity called *Moving Services.* Moving services is a Leontief aggregate of the three aforementioned commodities. Industry demands for moving services stem from their demand for commercial property, e.g., offices, factories, etc. We assume industry demand for moving services to be proportional to industry output levels; they therefore serve as intermediate inputs to industry production.

Our calibration relies on estimates of the tax rate on resource usage for property transfers, which we derive using available data in section 6.1. We then perform four simulations:

1. One where we increase the rate of conveyancing duty on residential property transfers (a tax on household consumption of *Conveyancing*) by an amount sufficient to generate A$100m in tax-specific state revenue;

[24] Stamp duty on conveyancing is often referred to as transfer duty or conveyancing duty. We use these terms interchangeably.

2. One where we increase the corresponding rate on industry consumption of this commodity, which facilitates business property transfers, to raise an equivalent amount of tax-specific revenue; and
3. Two where we simulate removal of (i) residential property conveyancing duties; and (ii) business property conveyancing duties.

These simulations yield marginal and average SEDIs and excess burdens for these commercial and residential property transfer duties, and facilitate a discussion of the macroeconomic and industry impacts of these taxes, which we present in section 6.2.

6.1 Calculating the tax rate on property transfer resource usage

In 2015-16 conveyancing duties generated $8,367 million for the NSW Government (Table 2 of Australian Bureau of Statistics, 2017a). As noted above, stamp duty on conveyances is a tax on the activity of selling property. Australian Bureau of Statistics (Table 2 of 2017b) data shows ownership transfer costs for NSW as $10,248 million in 2015-16.[25] These costs include: fees paid to lawyers; fees and commissions paid to real estate agents and auctioneers; Title Office charges; local government charges; and the stamp duty.[26]

On the basis of these two numbers we can deduce that the resource costs (use of capital, labour and materials) of selling property in New South Wales in 2015-16 was $1,881 million (=10,248 – 8,367). Using the above figures, we have $8,367 million of stamp duty being levied on an activity with a resource cost of only $1,881 million. This implies a tax rate on the activity of transferring property of 445 per cent (=8367/1881).

6.1.1 How reasonable is this estimate?

For 2006-07, Dixon and Rimmer (2007) were able to show that this method of estimating the resource cost on the activity yielded a credible estimate for Australia.[27] For Australia as a

[25] Private Gross Fixed Capital Formation - Ownership Transfer Costs: Current prices (Series ID: A2336131C) shown in Table 2 (Australian Bureau of Statistics, 2017b), Expenditure, Income and Industry Components of Gross State Product, New South Wales.

[26] Also included are two fees ($136.30 each) which are payable to government (a mortgage fee and a transfer fee).

[27] Their check involved looking at data for 2002-03, the latest year for which the Australian Bureau of Statistics published catalogue 8663.0. Table 2 of 8663.0 shows income of real estate agents from property sales as $5,000.6 million. They considered that this was the bulk of the resource costs associated with property sales in 2002-03. Consequently, a reasonable check of their method of calculating resource costs associated with property sales was to see if it gave an estimate for 2002-03 a little higher than $5,000.6 million (a little higher to allow for other elements such as legal costs). Applying their method to 2002-03 gave $5,633 million, derived as the difference

whole, the implied tax rate in 2015-16 is 269 per cent, a similar rate to the 265 per cent which was the estimate for Australia for 2006-07 in Dixon and Rimmer (2007). The much higher implied tax rate computed for NSW compared to that for Australia as a whole can be explained by the Australian Bureau of Statistics data showing NSW as collecting 41 per cent of Australia's stamp duty revenue, but accounting for only 36 per cent of the nation's resource costs of transferring ownership.

In order to understand these shares, we undertook a number of further checks. The average price for NSW residential properties in 2015-16 was $786,000 (Australian Bureau of Statistics 6416.0 Table 6 Mean price of residential dwellings: New South Wales). The average price for dwellings for all of Australia was $617,800. That is, the NSW mean price was 27 per cent higher in NSW than that for Australia as a whole. Computing the stamp duty for each state, we estimated that the NSW tax rate per dollar was around 2 per cent higher for NSW than for an estimated all-state average.[28] Assuming that NSW accounts for just over a third of all property sales, these estimates are consistent with a NSW share in national conveyancing duty receipts of 41 per cent.[29] However, a NSW share of 36 per cent in national ownership transfer costs (including stamp duty) implies that NSW accounts for only a quarter of total resource costs for property transfer costs. While real estate fees per dollar of purchase price are lower in NSW than in other states, the share of resource costs in national resource costs of transfer costs is infeasible. Using information on real estate agent commission rates and fees per dollar of sale price of a residence[30], we estimate that nationally agents charge a commission of 2.24 per cent. This compares with a real estate agents' commission of 2.1 per cent for NSW.

Thus we estimate that per property sale, NSW real estate agents' charges are 19 per cent higher on a NSW property. This suggests a NSW share in national resource costs of transfers of 38.6 per cent. Even if the NSW resource cost per property were the same as that for the country as a whole (very unlikely given the higher average property price in NSW), NSW's share of the resource cost would still be 34.6 per cent. We take an average of these two percentages which

between ownership transfer costs of $14,421 million (Australian Bureau of Statistics 5220.0, 2002-03, Table 22) and stamp duty on conveyances of $8,788 million (Australian Bureau of Statistics 5506.0, 2002-03, Table 13).

[28] For Queensland and South Australia, which have much higher transfer fees than the other states, we reallocated sufficient transfer fees to conveyancing stamp duty so that the transfer fees were in line with mortgage fees, as is the situation for all other states.

[29] An implied assumption is that interstate differences in business property prices follow the same pattern as for residential prices.

[30] See http://whichrealestateagent.com.au/real-estate-agents-fees-and-commissions-nsw/.

implies a NSW resource cost of transfers of $2,803 million. This in turn implies a tax rate on conveyancing of almost 300 per cent, which is the upper bound we adopt to calibrate VURMTAX on a state-by-state basis. Therefore, for NSW we set the duty rate at 300 per cent, while for other states whose implied rate lies below this upper bound, we adopt the rate implied by the ABS data.

6.1.2 Calibrating VURMTAX to study conveyancing duties

The data on NSW conveyance duty collections we have used to deduce the tax rate applying to the transfer of properties in general cannot be readily disaggregated into business properties and residential properties. However, there is some fragmentary information. Dixon and Rimmer (2008) use information from Allen Consulting to undertake this task. We employ the business-property share of 18 per cent that they adopt to split both stamp duty revenues and resource costs. This gives a figure of $1 506 m. for stamp duty revenue on business-property transfers, with the remaining A$6 861 m. collected from residential property transfers. We assume the business and residential transfer duty rate to be identical, with residential transfer duty services consumed by households and business transfer services consumed as an intermediate input to production by industries. Under an assumed 300 per cent tax rate of property transfer services, this implies a resource cost of A$502 million for industries and A$2 287m for households.

Using this information, we create a new series of three new commodities in VURMTAX. These are:

- *Conveyancing business services*, which is produced by the Other Business Services industry. When property downturns arise, this industry can substitute production towards the more general *Other business services*;
- *Conveyancing administration services,* which is produced by the Public Administration industry together with the more general *Public Administration*;
- *Conveyancing real estate services*, which is produced by the Real Estate Services industry that also produces *Real Estate services*.

Stamp duties are then modelled as user-specific sales taxes on consumption of these three commodities by industries and households.

6.2 Simulations and results

Using VURMTAX, we then performed:

(1) Two distinct simulations, where we accommodate a marginal increase in (i) residential stamp duty rates; and (ii) business-property transfer duty rates, which increase tax-specific collections by A$100m. The results yield marginal SEDI and excess burden estimates for each tax; and
(2) Two additional simulations, where we independently decrease collections of each duty by 95 per cent to determine their average SEDI and excess burdens.

The results are summarised in
Table 6-1. As discussed above, we divide the conveyancing simulation into two parts: residential stamp duties, and commercial property transfer duties. We begin by discussing the state and national macroeconomic effects, and industry effects, of elimination of residential stamp duties, before turning to commercial property duties.

6.2.1 Macroeconomic impacts – residential transfer duties

Table 6-2 reports the state and national macroeconomic effects of removing residential stamp duties. As discussed above, stamp duties generate a substantial deadweight loss because they are imposed on a narrow base (moving services). Hence, removal of stamp duty on residential property transfers generates a sizeable allocative efficiency gain. At the level of the macro-economy, this is reflected in the increase in real GDP at market prices (row 14). At the national level, owners of fixed factors, via higher factor prices, capture the gains from this improvement to allocative efficiency. This accounts for the long-run positive deviation in the real consumer wage (row 24). The rise in the real consumer wage generates an increase in labour supply, which explains why the long-run employment deviation is positive (row 22).

Normally, we would expect a rise in national employment, together with an improvement in allocative efficiency, to generate a deviation in the national capital stock of a magnitude similar to, if not greater than, that of the increase in national employment. However, while the deviation in national capital is positive (row 21), it is low when compared with the national employment deviation. As we shall discuss in more detail later, this is due to a shift in the composition of private consumption spending, towards consumption of labour-intensive commodities (like moving services). The damped capital deviation accounts for the deviation in national investment, which is broadly in line with the baseline (row 17). Because the allocative efficiency gains accrue largely to domestic labour, the size of the national income deviation (row 20) is similar to that of the real GDP deviation (row 14). Hence, the deviations in private and public consumption (rows 15 and 16) are also similar to the deviation in real GDP. The increase in economic activity associated with the expansion in real GDP and consumption draws more imports into the economy (row 19). Because our macro closure assumption imposes a target for the ratio of foreign debt to national income, attendant on the increase in import volumes is a rise in export volumes (row 18). The positive deviation in export volumes accounts for the negative deviation in the terms of trade (row 26).

We turn now to the effects of removal of residential stamp duty for the NSW macro-economy (Table 6-2). While Table 6-2 does not present short-run results, it is helpful to begin our discussion with the short-run regional effects of removal of the substantial allocative efficiency distortion created by residential stamp duties. The VURMTAX regional migration theory carries the assumption that regional populations adjust slowly to movements in relative post-tax wage rates across regions. In the very short-run, this means the gains from the removal of the allocative efficiency costs created by residential stamp duties accrue to NSW fixed factors: labour (because inter-regional migration is slow to adjust) and land. This causes real consumer wages, and more broadly, real post tax incomes per capita, to rise in NSW relative to the rest of Australia in the short-run. This induces net inter-regional immigration to NSW, a process that continues until the ratio of per-capita post tax wages in NSW relative to RoA is returned to its baseline level. This process is largely complete by 2040. The resulting long-run expansion in the population of NSW accounts for the long-run expansion in NSW employment (row 4). The expansion in NSW employment generates a long-run inflow of capital to NSW (row 2), although this is of a smaller magnitude than the expansion in NSW employment because of a change in the composition of NSW consumption (discussed in section 6.2.3 below). The rise in NSW employment, together with both the rise in the capital stock and the efficiency gain from residential stamp duty removal, generates a positive deviation in NSW real GSP (row 5).

The increase in factor incomes in NSW allows private and public consumption spending to rise relative to baseline (rows 6 and 7). The VURMTAX capital and investment theory ensures that long-run capital growth rates by sector and industry gradually converge on their baseline values. At the level of the NSW macro-economy, this means that the positive deviation in the NSW capital stock is matched by a positive deviation in NSW investment of a similar magnitude (row 3). The long-run fall in the NSW GSP deflator (row 1) reflects a process discussed in Giesecke *et al.* (2008), namely, that under an environment in which long-run movements in primary factors act to re-equilibrate regional differentials in factor returns, removal of a regional cost (in this case, the allocative efficiency cost of residential stamp duties) will in the long-run be reflected in lower values for regional factor prices and associated regional deflators (like the GSP deflator).

6.2.2 Macroeconomic impacts – commercial property transfer duties

State and national macroeconomic results for commercial property transfer duties are provided in Table 6-3. We model commercial property stamp duties as a sales tax on use of moving service commodities as intermediate inputs to production. In the long-run, with rates of return on capital largely given, removal of a tax on intermediate input use must lower the marginal product of capital. With employment largely given, this requires the capital / labour ratio to rise in the long-run. This accounts for the positive deviation in the national capital stock (row 21). The increase in the capital / labour ratio, together with the decrease in taxation of business use of intermediate inputs, generates a long-run positive deviation in the real wage (row 24). The rise in the real wage induces a small positive deviation in labour supply, which explains the positive deviation in national employment (row 22).

Together, the positive deviations in employment and the capital stock generate a positive deviation in long-run real GDP (row 14). The rise in real national income (row 20) is less than the rise in real GDP because part of the capital stock expansion (row 21) is foreign financed, and the terms of trade decline (row 26). Because the real national income deviation is lower than the real GDP deviation, so too are the deviations in real private and public consumption (rows 15 and 16) lower than the real GDP deviation. Consistent with the capital deviation exceeding the real GDP deviation, so too the real investment deviation (row 17) exceeds the real GDP deviation. Nevertheless, the damped response of real consumption relative to real GDP is sufficient to ensure that the real GNE deviation is less than the real GDP deviation. Hence, the real balance of trade moves towards surplus (rows 18 and 19). The positive export volume deviation explains the negative terms of trade deviation (row 26), which, as noted above, dampens somewhat the deviations in the real wage and real GNI.

We turn now to a discussion of the NSW macroeconomic impacts (first panel of Table 6-3). In the short-run, with real wages sticky, removal of the indirect tax on intermediate inputs causes NSW employment to rise and creates upward pressure on NSW wages. This increases net immigration to NSW from the rest of Australia. Over time, this expands the NSW population, generating positive deviations in long-run NSW labour supply and employment (row 4). In the long-run, with rates of return on capital to the NSW economy largely given, and with movements in net inter-regional immigration driving a process of convergence in real wages across regions, there is little scope for long-run movement in the ratio of capital rental prices to wages. Hence, with the long-run regional wage / rental ratio largely given, the increase in NSW employment (row 4) is matched by an increase in the NSW capital stock (row 2). With both NSW employment and capital higher than baseline, so too is NSW real GSP (row 5). Because capital growth rates by sector converge in the long-run towards their baseline levels, the long-run positive deviation in the NSW capital stock (row 2) generates a long-run positive deviation in NSW investment (row 3). The deviation in private and (thus also public) consumption is damped relative to the GSP deviation, because business stamp duties are deductable for the purpose of calculating federal income taxes. This blunts the impact on regional post-tax incomes, and thus consumption, of the removal of business stamp duties.

6.2.3 Industry impacts – residential transfer duties

Table 6-4 reports sectoral output deviations for NSW industries. We begin by noting that the sector lowest output deviation is dwelling services, while industries that produce moving services, e.g., the Business services industry, experience a strong rise in output. Business services is the producer of two commodities, real estate and other business services for conveyancing, upon which residential stamp duties are levied. When residential stamp duties are removed, the consumer price of these services drops sharply. This induces NSW households to substitute towards higher consumption of moving services, i.e., households are more active in selling and purchasing residential property. In so doing, they engage moving services providers, and output of these commodities increases.

In substituting towards consumption of moving services, households must substitute away from other commodities. This accounts for the low output deviation rankings for consumption-intensive commodities like dwelling services, financial and insurance services, accommodation and food services, and other services. The dwelling services output deviation is particularly low for two reasons. First, the sector sells its output only to households. Hence, unlike the other consumption-oriented sectors just mentioned, it faces no scope to increase intermediate, investment or export sales when consumption sales falter. Second, consumption of dwelling services is a large share of household expenditure. It thus accommodates a large share of the expenditure-switching burden when consumption of moving services rises. VURMTAX does not contain an explicit framework for modelling the household's decision choice between moving house or adjusting their existing dwelling, e.g., by renovating. But, the sectoral results can be interpreted to some degree in these terms. When residential stamp duties are removed, households demand more of the moving services required to facilitate movements between houses. This is financed in part by a reduction in dwelling services demand, which can be interpreted as households making space occupancy decisions in keeping with their needs, rather than constrained by excessive moving costs.

6.2.4 Industry impacts – commercial property transfer duties

Table 6-5 reports long-run output deviations for NSW industries. Consistent with the damped consumption response relative to real GSP for NSW discussed above, the low-ranked sectors in terms of output deviation tend to be those with high shares of their output accounted for by sales to private and public consumption. This explains the low output deviations for dwelling services, healthcare and social assistance, public administration and safety, education and training, financial and insurance services, and other services. Sectors that sell comparatively large shares of their output to international or interstate trade, or for whom commercial stamp duties are an important input tax, are highly ranked in terms of output expansion. This explains the high output rankings of manufacturing, transport, postal and warehousing, mining, wholesale trade, and business services.

6.3 **Concluding remarks**

An interesting feature of the residential stamp duties result was the damped output deviation for dwelling services. While not an explicit element of VURMTAX's modelling, this can be interpreted as reflecting a net reduction in demand for dwelling space, when households are encouraged to make better dwelling occupancy choices via removal of excessive constraints on moving house. This result emerges from the standard household nesting structure in VURMTAX, and as such, might under-estimate the adjustment to dwelling service demand arising from removal of residential stamp duties.

An interesting avenue for future research would be to explicitly model decisions such as whether to renovate or extend an existing dwelling, or move home. This would have implications for the sectoral results of the policy change, particularly as they relate to the size of the dwelling sector, but also other sectors, like transport, storage, construction and architectural services.

6.4 Tables and Figures

Figure 6-1: Deadweight loss from stamp duties on NSW property transfers

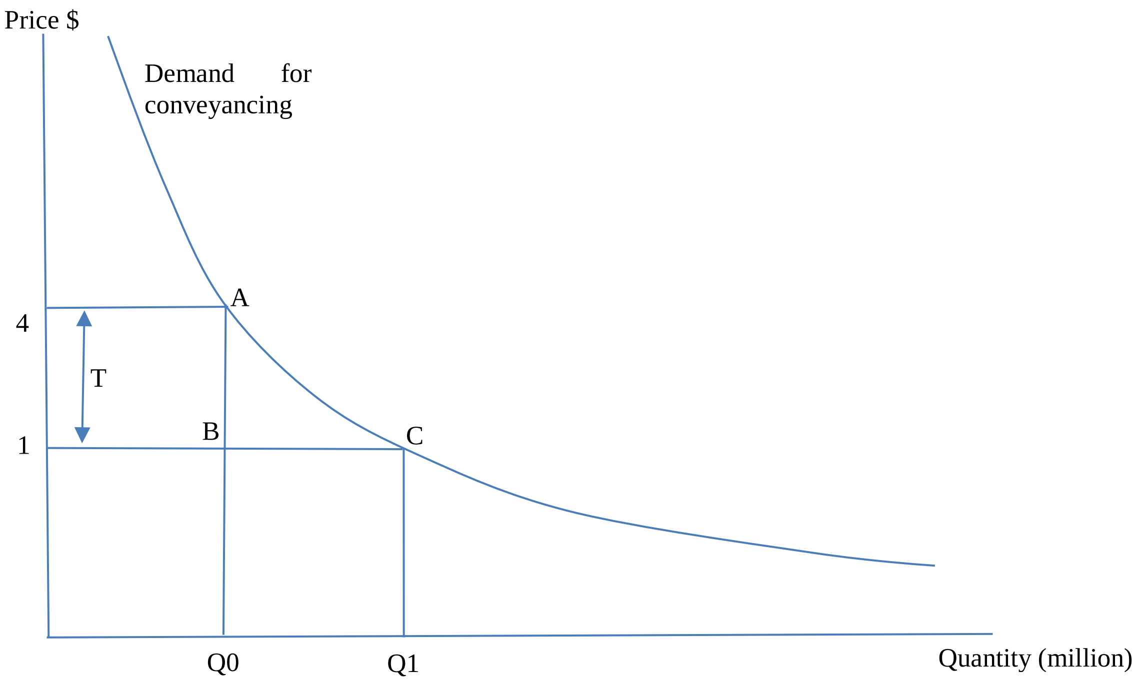


Table 6-1: Residential and business transfer duty on property, marginal and average excess burden (NSW and Australia)

	Marginal Column 1	**Average** Column 2
(i) Residential property conveyancing duty in NSW		
SEDI, NSW	307	194
Excess burden	107	42
(ii) Commercial property conveyancing duty in NSW		
SEDI, NSW	86	64
Excess burden	63	47

Table 6-2: State and national level macroeconomic impacts in 2034, due to a A$100m rise in residential property stamp duty collections in NSW and removal of the tax

		Res conv. rate Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	Remove res. conv. In NSW Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.046	-2.337
2	Capital stock (rental weights)	-0.023	1.102
3	Real investment	-0.027	1.279
4	Employment	-0.038	1.898
5	Real GSP	-0.041	1.831
6	Real private consumption	-0.041	1.686
7	Real public (state) consumption	-0.041	1.686
8	Imports, volume	-0.026	1.202
9	Exports, volume	-0.093	4.729
10	Real post-tax consumer wage	-0.015	0.759
11	Real producer wage	-0.008	0.567
12	Tax base ($m)	-80.161	7913.020
13	Aggregate tax revenue ($m)	125.380	-9387.450
	(b) National results		
14	Real GDP	-0.006	0.179
15	Real private consumption	-0.007	0.206
16	Real public (state and federal) consumption	-0.005	0.152
17	Real investment	0.000	0.000
18	Real exports	-0.007	0.317
19	Real imports	-0.004	0.162
20	Real GNI	-0.005	0.158
21	Capital stock (rental weights)	-0.001	0.040
22	Employment	-0.003	0.133
23	Capital rentals (investment-price deflated)	0.002	-0.108
24	Real post-tax consumer wage	-0.013	0.636
25	Real producer wage	-0.008	0.437
26	Terms of trade	0.002	-0.104
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.005	0.197
29	Tax base (all states and federal, $m)	-83.063	8106.662
30	Aggregate tax revenue (all states and federal, $m)	-0.656	-3193.140
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.007

Table 6-3: State and national level macroeconomic impacts in 2040, due to a A$100m rise in commercial property stamp duty collections in NSW and removal of the tax

		Bus. Conv. rate Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	Remove bus. conv. In NSW Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.024	-0.318
2	Capital stock (rental weights)	-0.024	0.338
3	Real investment	-0.027	0.377
4	Employment	-0.018	0.226
5	Real GSP	-0.020	0.247
6	Real private consumption	-0.007	0.050
7	Real public (state) consumption	-0.007	0.050
8	Imports, volume	-0.017	0.226
9	Exports, volume	-0.080	1.101
10	Real consumer wage	-0.012	0.165
11	Real producer wage	-0.025	0.365
12	Tax base ($m)	-11.255	299.282
13	Aggregate tax revenue ($m)	167.260	-2515.550
	(b) National results		
14	Real GDP	-0.004	0.051
15	Real private consumption	-0.003	0.030
16	Real public (state and federal) consumption	-0.003	0.029
17	Real investment	-0.006	0.094
18	Real exports	-0.008	0.110
19	Real imports	-0.005	0.073
20	Real GNI	-0.004	0.043
21	Capital stock (rental weights)	-0.006	0.091
22	Employment	-0.002	0.028
23	Capital rentals (investment-price deflated)	0.001	-0.016
24	Real consumer wage	-0.012	0.155
25	Real producer wage	-0.012	0.172
26	Terms of trade	0.003	-0.037
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	0.001	-0.017
29	Tax base (all states and federal, $m)	-11.469	303.637
30	Aggregate tax revenue (all states and federal, $m)	100.090	-1672.540
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.000

Table 6-4: NSW industry impacts in 2040, due to a A$100m rise in residential stamp duty collections in NSW and removal of the tax

		Res conv. rate Effects on real industry output % deviation from baseline, 2040	Remove res. conv. In NSW Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.04	1.79
2	Mining	-0.06	3.05
3	Manufacturing	-0.06	3.14
4	Electricity, gas, water and waste services	-0.04	1.77
5	Construction	-0.02	1.09
6	Wholesale trade	-0.04	1.72
7	Retail trade	-0.03	1.22
8	Accommodation and food services	-0.03	0.96
9	Transport, postal and warehousing	-0.06	2.84
10	Information media and communications	-0.04	1.87
11	Financial and insurance services	-0.01	0.63
12	Dwelling ownership	-0.01	0.04
13	Business services	-0.04	2.62
14	Public administration and safety	-0.03	1.76
15	Education and training	-0.03	1.41
16	Health care and social assistance	-0.03	1.17
17	Other services	-0.02	0.99

Table 6-5: NSW industry impacts in 2040, due to a A$100m rise in commercial property stamp duty collections in NSW and removal of the tax

		Bus. Conv. rate Effects on real industry output % deviation from baseline, 2040	Remove bus. conv. In NSW Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.03	0.37
2	Mining	-0.07	0.92
3	Manufacturing	-0.05	0.73
4	Electricity, gas, water and waste services	-0.03	0.35
5	Construction	-0.02	0.30
6	Wholesale trade	-0.03	0.40
7	Retail trade	-0.02	0.28
8	Accommodation and food services	-0.02	0.32
9	Transport, postal and warehousing	-0.05	0.71
10	Information media and communications	-0.03	0.46
11	Financial and insurance services	-0.01	0.13
12	Dwelling ownership	-0.01	0.08
13	Business services	-0.02	0.34
14	Public administration and safety	-0.01	0.10
15	Education and training	-0.01	0.07
16	Health care and social assistance	-0.01	0.04
17	Other services	-0.02	0.21

7 Insurance taxes

Taxes are applied by the Australian states to life insurance, health insurance, motor vehicle insurance and other general insurance. The insurance tax rates vary from 6% to 11% of the gross premium [NSW Treasury (2016)]. In contrast to other states except Tasmania, NSW adds an additional charge (the fire service levy [FSL]), with most other states having shifted this hypothecated tax to a property tax.

Taxation of insurance is an additional indirect tax levied on a subset of services, namely insurance to reduce the costs of uncertain events. There is no market failure argument for additional taxation of insurance services relative to other goods and services [Henry *et al.* (2009)].

The effective insurance tax rate should be measured not as the rate on the gross premium, but rather relative to the expected cost of the services provided by insurance, that is the gross premium less the expected or average payout. Then, the effective insurance tax rate is several-fold the rate on the gross premium, and at least three-fold.

Figure 7-1 illustrates the effects of a tax on insurance. In the before-tax scenario, Q_D represents demand for insurance and MC is the marginal cost of providing the intermediary insurance service. Quantity *Q* is purchased initially. Imposition of the tax, *T*, increases the cost of insurance to *P* + *T*. Insurance purchased falls from *Q* to *Q'*, with an efficiency loss of area "**a**". The efficiency cost increases with the square of the effective insurance tax rate and with the elasticity of insurance demand. Reflecting the highly elastic supply curve of Figure 7-1, the majority of the tax is passed on to purchasers.

Herein, we begin by translating the insurance duties and levies in NSW to a common base; specifically, we report these taxes as rates on premium collections in section 7.1. In section 7.2, we use loss ratios to translate these rates to effective rates on resource usage. We briefly summarise our approach to evaluating excess burdens using VURMTAX in section 7.3, before summarising our results in sections 7.4 and 7.5.

7.1 Insurance tax rates on premium collections in NSW

The New South Wales government collects various stamp duties and levies from insurance providers. Herein, we study the excess burdens of duties and levies that fall upon three specific types of insurance:

1. **General Insurance duty:** The Office of State Revenue (OSR) in NSW identify three types of general insurers.[31] The stamp duty rate on each type of insurer is also distinct and summarised below. In this paper, we do not model the excess burdens of each of the duties imposed on each specific type of general insurer.
    - **Type A:** These are duties on general insurers other than motor vehicle, aviation, disability income, occupational indemnity, hospital and ancillary health benefits, crop and livestock insurers. The applicable rate of Type A general insurance duties is *9 per cent of the premium*.
    - **Type B:** These are duties on general insurers who provide motor vehicle, aviation, disability income, occupational indemnity, hospital and ancillary health benefit insurance. The applicable rate of Type B general insurance duties is *5 per cent of the premium*.
    - **Type C:** These are duties on general insurers who provide crop and livestock insurance. The applicable rate of Type C general insurance duties is *2.5 per cent of the premium*.
2. **Life Insurance duty:** Life insurance duty is defined as a proportion of the insured sum, rather than the premium. For term and non-group term insurance policies, the applicable rates are**:**
    - $1 for the first $2 000 of the sum insured, or a maximum of 0.05 per cent;
    - $0.2 for every $200 in excess of the first $2 000 of the sum insured, which is broadly equivalent to a tax rate of 0.1 per cent of the sum insured beyond $2000.

    In order to calculate the SEDI and excess burden of life insurance duties, we derived an estimate of the duty rate as a proportion of premiums collected, rather than the current basis, i.e., as a proportion of the insured sum. This estimate relied on data from the aggregate Statement of Financial Position of life insurers operating in Australia, which

[31] In this report we rely on General Insurance industry data sourced from APRA Quarterly Performance Statistics on the sector: http://www.apra.gov.au/GI/Publications/Pages/general-insurers-statistics.aspx. We use March 2017 data.

is collected by APRA.[32,33] To translate the duty levied on life insurers in NSW from a sum insured basis (denoted as T_{SI} herein), to an implied tax rate on premiums collected by life insurers in NSW (denoted T_{PC} henceforth), we solved the following equation:

$$T_{PC} \times PC = T_{SI} \times PVL, \tag{7.1}$$

where *PC*=A$18 200m are the aggregate life insurance premium collections for registered life insurers in Australia[34] over the one year to March 2017, and *PVL*=A$184 575m is the present value of accrued life insurance liabilities for registered life insurers in Australia at March 2017[35]. Because T_{SI} is non-uniform, i.e., a different rate (0.05 per cent) applies to the first A$2 000 of the sum insured compared to the remainder of the insured sum (0.1 per cent), the implied tax rate on premiums is expected to lie within the following range:

$$T_{PC} = [0.0005,0.001] \times \frac{184575}{18200} = [0.00507,0.01014], \tag{7.2}$$

or between *0.5 and 1.0 per cent of the premium*. For simplicity, herein we adopt a conservative assumption and assume the levied duty on life insurers in NSW is 1.0 per cent of premiums collected.

3. **Health Insurance Levy:** Whereas general insurance duties levied in NSW are ad valorem taxes (and are thus proportional to the premium), and life insurance duties can be translated into ad valorem tax equivalents on premiums using the approach described in point 2 above, the NSW Health Insurance Levy is a specific tax paid by any organisation that provides health benefits in NSW. The dollar rate of the levy charged per week and per effective contributor (where an individual policyholder is regarded as one contributor, and holders of a family policy are regarded as having two effective contributors) is calculated on an annual basis and published by the NSW Office of State Revenue. The levy per week per effective contributor was $1.49 for the period 1 April

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[32] Life Insurance data is sourced from APRA Quarterly Performance Statistics on the sector: http://www.apra.gov.au/lifs/Publications/Pages/quarterly-life-insurance-statistics.aspx. We use March 2017 data.

[33] We use national data because NSW state-level data on premiums collected from NSW contributors (and accrued liabilities from NSW policy holders) was not publically available from APRA.

[34] See Gross Policy Revenue in Table 1(a) of the Quarterly Life Insurance Performance Statistics by APRA for March 2017.

[35] See Gross Policy Liabilities in Table 2(a) of the Quarterly Life Insurance Performance Statistics by APRA for March 2017.

2017 to 31 March 2018, which amounts to \$77.48 per customer per annum. To convert this specific tax to an ad valorem equivalent on premiums[36], we rely on data collected by APRA for Australian health insurers.[37, 38] As at March 2017, 11.354 million Australians were covered by some form of private hospital cover and they paid an aggregate of A\$22,841m in premiums over the year to March 2017 for that cover. Multiplying the Health Insurance Levy per policyholder per annum by the number of policyholders, and dividing by aggregate premium payments, yields an approximate ad valorem equivalent tax rate T_{HIL} for the health insurance levy of:

$$T_{HIL} = 77.48 \times \frac{11.354}{22841} = 0.0385, \qquad (7.3)$$

or *3.85 per cent of the premium.*

7.2 Calculating the effective tax rate on insurance provision by insurer type for NSW

The main service provided by insurance is the spreading of risk. If the community pays y dollars in insurance premiums and receives $\alpha * y$ in payouts, where $0 < \alpha < 1$ and is defined as the gross loss ratio, then assuming that the provision of insurance services is fairly competitive, we deduce that the resources used by insurers are worth $(1 - \alpha)*y$. If the ad valorem tax rate on premiums is t, then the rate of tax on the provision of insurance services τ can be written in terms of the ad valorem duty/levy rate and the loss ratio:

$$\tau = \frac{t \times y}{(1-\alpha)\times y} = \frac{t}{1-\alpha}. \qquad (7.4)$$

If α is close to 1, then even if t is quite moderate, we would conclude that the activity of providing insurance services is heavily taxed and might be seriously underprovided, which would materialise via large, positive marginal and average excess burden figures.

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[36] In VURMTAX, purchases prices $P_{P,i}$ differ from basic prices $P_{B,i}$ by the value of margin services and indirect taxes. All indirect taxes are also assumed to be ad valorem taxes, i.e., ignoring margins service costs, $P_{P,i} = (1 + t)*P_{B,I}$ where t is the applicable indirect tax rate. Modelling the impact of a specific tax (like the Health Insurance levy) in this way is permissible when movements in basic prices for good i (in this case, insurance services) are expected to be small.

[37] Private Health Insurer data is sourced from APRA Quarterly Performance Statistics on the sector: http://www.apra.gov.au/PHI/Publications/Pages/Quarterly-Statistics.aspx. We use March 2017 data.

[38] We once more rely on national data on the number of policy holders and the total value of premiums paid, because NSW state-level data was not publically available from APRA. We assume the membership base comprises Australian's who are covered for hospital treatment, as opposed to the (broader) general insurance policyholder base.

APRA reports loss ratios for various types of general insurers operating in Australia[39]. This facilitated the evaluation of NSW-specific tax rates on the provision of general insurance services of types A – C, which we report in equations (7.5a) – (7.5c) below:

$$\tau_{GI,A} = \frac{.09}{1-0.586} = 0.217, \tag{7.5a}$$

$$\tau_{GI,B} = \frac{.05}{1-0.74} = 0.19, \tag{7.5b}$$

$$\tau_{GI,C} = \frac{.025}{1-0.47} = 0.047. \tag{7.5c}$$

For life insurers[40] and health insurers[41], we used national premium collection and claims data to determine tax rates for insurance service provision. The relevant figures are reported below:

$$\tau_{LI} = \frac{.01}{1-0.93} = 0.143, \tag{7.6a}$$

$$\tau_{HI} = \frac{.0385}{1-0.85} = 0.257. \tag{7.6b}$$

On the basis of the available data, the loss ratios for life and health insurers are high (0.93 and 0.85 respectively). Because the tax rate on premiums for health insurance is nearly four times as large as the tax rate on premiums for life insurers (3.85 per cent versus 1 per cent), the effective tax rate on resource usage for the health insurance levy (25.7 per cent) exceeds the effective rate due to life insurance duties. The rate for Type A general insurers is also high, because the tax rate on premiums is very high, relative to the premiums rates for other types of insurance.

[39] See the figures for March 2017 in Tables 1(f) to 1(q) of the APRA Quarterly Performance Statistics (http://www.apra.gov.au/GI/Publications/Pages/general-insurers-statistics.aspx). For General Insurers of Type A, we assumed the applicable aggregate net loss ratio was General Insurers who underwrite houseowners/householders, mortgages, reinsurers, and public liability insurers [Table 1(f), (n), (p), (q) and (k)]. For Type B, we calculated the loss ratio using aggregated premium collections and claims across Domestic and Commercial Motor Vehicles, Professional Indemnity and Employers' liability insurers operating in NSW [Table 1(g), 1(i), 1(l) and 1(m)]. For Type C, we adopted the loss ratio for other direct General Insurers in NSW [Table 1(o)].

[40] From Key statistics tables in the APRA Quarterly Life Insurance Performance Statistics (March 2017), we found that net premium revenue (Australia-wide) was A$58 049 in the one year to 31 March 2016, while net policy payments were A$54 538m, which yields a net loss ratio of 0.93.

[41] From page 3 of the APRA Quarterly Performance Statistics for health insurers, we found that premium revenue (Australia-wide) for health insurers was A$22 841m in the one year to 31 March 2017, while benefits paid/claims amounted to A$19 514m over the same period. This yielded a loss ratio of 0.85.

7.3 Calculating excess burdens using VURMTAX

As part of this paper, we provide marginal and average SEDIs and excess burdens for insurance duties/levies in NSW. All our results are derived from changes in insurance duties/levies in NSW only, i.e., all other states and territories (and the federal government) are assumed to retain their current taxation systems. We use equations (3.3) and (3.4) to evaluate all SEDIs and excess burdens reported herein.

7.4 The impact of whole-of-industry insurance taxes

In VURMTAX, insurance taxes are modelled as sales taxes on the consumption of insurance commodities by NSW industries or households. Taxes collected from the insurance industry in VURMTAX are calibrated to match the data reported in Table 2 of ABS cat. no. 5506.0 for 2015/16, i.e., the NSW government collected A$2,438m of tax from the insurance industry. The marginal and average SEDIs and excess burdens for insurance taxes collected at the whole-of-industry level are summarised in Table 7-1(i).

In Table 7-1(i), the set of marginal SEDI and excess burden in column [1] relate to a small rise in the whole-of-industry insurance tax rate. This rise is calibrated to raise an additional A$100m in insurance tax revenue for NSW. From the marginal SEDI, the collection of an additional $1 in insurance tax revenue in NSW costs the state economy 97 cents in lost output and leisure, and the national economy 37 cents in lost income and leisure.

7.5 The impact of general, life and health insurance taxes

Importantly, the figures in ABS cat. no. 5506.0 reflect aggregate collections from many different types of insurance duties/levies. Because NSW continues to collect the FSL from NSW insurers, FSL collections also persist within ABS cat. no. 5506.0, and the results reported in Table 7-1(i) therefore also reflect the removal of the FSL.

With the known and calculated tax rates on premiums from section 7.2, we can begin to disaggregate tax collections in VURMTAX into tax collections from general, life and health insurers. Additional data from ABS 5506.0 can be used to disentangle FSL and compulsory third party (CTP) motor vehicle duties from aggregate insurance tax collections in NSW:

Total collections (NSW): **A$2,438**

Consisting of:

1. Fire Service Levy: A$769m
2. Third party taxes: A$212m

3. Other insurance levies/duties: A$1,456m

The breakdown above illustrates that any simulation to determine the average and/or marginal excess burden from insurance duties/levies in NSW, would effectively be adjusting the rates of many different taxes (which may be incident upon different industries based in different regions, or households from different regions) simultaneously. *Other insurance levies/duties* above refers specifically to collections from duties and levies we wish to consider in this paper: those from general, life and health insurers. To disaggregate this figure into values for general, life and health insurance, we were guided by financial statements from the Office of State Revenue (OSR) for NSW[42] and state-by-state data on premium collections by insurer type from APRA (where available[43]). Having disaggregated tax collections by insurance type, we use the effective tax rates on resource usage derived in section 7.2 to disaggregate Insurance industry output in NSW into multiple insurance commodities. Our approach introduces the following five insurance commodities: *FSL insurance*, *General insurance*, *Third party insurance (CTP)*, *Life insurance*, and *Health insurance*. All are produced by a single Insurance industry.

VURMTAX includes data on the consumption of the (aggregate) insurance commodity across various users, e.g., households and industries. In order to disaggregate consumption of insurance at basic prices in VURMTAX into consumption of the five new insurance commodities, we were guided by the VURMTAX database, which is based on ABS Input/Output accounts data. For example, to determine the share of insurance consumed by households represented by health insurance (at basic prices), we divide the effective tax rate due to the health levy in NSW (25.7 per cent) by health insurance levy revenue in NSW (A$193m). This yields an initial estimate for household consumption of insurance service at basic prices of A$751m. Using a similar approach for the other taxes, we arrive at an initial estimate for insurance consumption by consumer type (industry or households), by region (NSW, rest-of-Australia, and foreign) and by insurance type (*FSL*, *General*, *Life*, *Third Party* and *Health insurance*).[44] A bi-proportional scaling algorithm is then used to balance the final

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[42] See the OSR: 2015-16 Year in Review, http://www.osr.nsw.gov.au/sites/default/files/file_manager/year_in_review.pdf

[43] Where state-by-state data was not available, we assumed the share of NSW premium collections to aggregate (Australia-wide) premium collections matched the share of NSW-to-national collections by other insurers for which data was available.

[44] We do not report effective tax rates for the FSL or third party motor vehicle insurance herein. Nevertheless, effective tax rates for these taxes were calculated. For the FSL, we used the loss ratio for Fire and Industrial Special Risk (ISR) general insurance providers from Table 1(h) in the APRA Quarterly Performance Statistics for General

consumption at basic prices, and sales tax matrices.[45] Movements in relative prices then reconcile the demand- and supply-side of all five insurance commodity markets, under the standard VURMTAX CGE framework.[46]

7.5.1 Simulations and results

Using VURMTAX, we then performed:

(3) Three distinct simulations, where we accommodate a marginal increase in (i) general insurance duty rate, (ii) health insurance levy rate, and (iii) life insurance duty rate, that increase tax-specific collections by A$100m (for general insurance) or A$10m (for life and health insurance).[47] The results yield marginal SEDIs and excess burden estimates for each tax; and,

(4) Three additional simulations, where we removed each duty/levy to determine their average SEDIs and excess burdens.

Our results are summarised in Table 7-1(ii) – (iv). We make several observations regarding these results below:

- The marginal and average SEDIs are all positive and large, with the relative magnitudes dependent on both the effective tax rate on premiums derived in section 7.2 and the tax base.
    - o Because the health insurance levy is a narrow based tax (on household consumption of insurance), and its rate is high relative to general and life

Insurers (http://www.apra.gov.au/GI/Publications/Pages/general-insurers-statistics.aspx), together with an estimate of the impact the FSL has on premium collections from the Insurance Council of Australia, which reported that the FSL drives up premiums in NSW by an average of 20 per cent (see http://www.insurancecouncil.com.au/assets/media_release/2017/12052017_The%20Emergency%20Services%20Levy%20transition%20%20key%20facts%20(revision).pdf). For third party insurance, we referred to the loss ratio for CTP motor vehicle insurers from Table 1(j) of the APRA Quarterly Performance Statistics for General Insurers, and the CTP tax rate on motor vehicles registered in metropolitan Sydney (26.15% of the premium) reported by the NSW Treasury (2016).

[45] Final insurance tax collections in NSW therefore total A$2342m in VURMTAX, with General Insurance duty collections elevated at A$1093m in order to balance insurance consumption at basic prices in the VURMTAX database, and implied tax rates on resource usage derived herein.

[46] In disaggregating consumption of an aggregate insurance commodity into a series of distinct commodities, we set all household expenditure elasticities in the Klein-Rubin utility function for each type of Insurance commodity to 1. Industries purchase some insurance commodities as intermediate inputs to production, with a Leontief production function.

[47] We note that for some insurance taxes, collections are small. As such, we adjust the size of the tax rate shock for life and health insurance, so as to ensure a reasonable estimate of the marginal SEDI and excess burden are derived from VURMTAX.

insurance taxes, its marginal and average SEDIs are larger than the other taxes we report results for in Table 7-1[48];

- The tax base for the life insurance duties are also narrow, while the tax rate is of similar order to health insurance. Thus, the marginal and average SEDIs are similar in magnitude to the health insurance levy;
- While the effective tax rate on general insurance premiums is similar in magnitude (28.1 per cent for type A general insurance duties) to the health insurance levy and life insurance duties, the tax base for NSW general insurance duties is much broader, i.e., this duty is collected from most industries in NSW as well as households from NSW, the rest of Australia and some foreigners. With a much broader base, the marginal and average SEDIs for general insurance duties are lower than the corresponding metrics for other insurance taxes.

- At the national level, the excess burdens reported for insurance taxes are lower than the SEDIs, chiefly because the national measure is constrained by the immobility of labour into/out of Australia. This is not true for the SEDI measure.

7.6 **Macroeconomic impacts**

The long-run (2040, twenty-one years after the tax policy shock) macroeconomic impacts of insurance duty/levy shocks are summarised in Table 7-2. Column [1] and column [2] summarise the impacts of a A$100m rise in general insurance duty collections or removal of general insurance duties. In column [3] and column [4], we report summarise the impact of a A$10m rise in health insurance levy collections and removal of the levy. The results for equivalent simulations, only for life insurance duties, are provided in column [5] and column [6]. Table 7-2(a) summarises the state-level impacts, with national results provided in Table 7-2(b) and Table 7-2 (c).

For each tax, the results of our marginal excess burden simulation are very small (see columns [1], [3] and [5] in Table 7-2). We therefore focus on the results of complete removal of the taxes, in columns [2], [4] and [6] of Table 7-2. Because life insurance duties and the health insurance levy both fall upon households, the macroeconomic impact of removing these two

[48] Life insurance duty collections are lower than the value of additional revenue raised in calculating the marginal excess burden of this tax. The effective marginal burden is therefore likely to lie below the value specified herein. For an explanation as to why we perform the simulation we do, we refer the reader to the previous footnote.

taxes largely scales with the change in collections once the two taxes are removed. To illustrate, from row 13 and column [4] in Table 7-2 (a) we see that removing the health insurance levy generates a fall of A$373m in aggregate NSW tax revenue in 2040. This is roughly 2.5 times the impact of removing life insurance duties (row 13, column [6] of Table 7-2(a): A$143m). We also observe that the deviation in long-run state employment of life insurance duty removal (+0.022 per cent from column [6] in Table 7-2(a)) is roughly two-fifths of the deviation caused by removal of health insurance duties (+0.055 per cent from column [4] in Table 7-2(a)). For this reason, we will focus on the impact of health insurance levy and general insurance duty removal.

We begin by studying the national results of health insurance levy removal, in column [4] of Table 7-2 (b). Because health insurance is entirely consumed by the household sector, when we remove the health insurance levy rate, the consumption price deflator falls relative to the GDP deflator [rows 27 and 28 of column [4] in Table 7-2 (b)]. This causes the real consumer wage to rise relative to baseline (row 24). As discussed in section 3.1, we allow labour supply to respond to movements in the real consumer wage. The rise in the long-run real consumer wage (row 24) accounts for the long-run rise in national employment (row 22). With long-run employment slightly above baseline, so too is the national capital stock (row 21) and real GDP at market prices (row 14). The foreign ownership share of the insurance sector is low, and thus the movement in long run real GDP (row 14) and real GNI (row 20) are quite similar. The rise in real GNI causes real private and public consumption spending to rise relative to baseline (rows 15 and 16). This causes import volumes to also rise relative to baseline (row 18). As discussed in section 3.2, our macroeconomic closure has the effect of preventing large deviations in the long-run balance of trade : GDP ratio from baseline. Hence, with long-run import volumes above baseline (row 18), so too are long-run export volumes (row 19).

The national impacts of general insurance duty removal differ in important ways from the impacts of health insurance levy removal discussed previously. Because general insurance duties are sales taxes on both the use of insurance as intermediate inputs to production, and on household demand for insurance, removal of general insurance duties have a more pronounced impact on the national capital stock. In the long-run, with rates of return on capital largely given, removal of a tax on intermediate input use lowers the marginal product of capital. This requires the capital / labour ratio to rise in the long-run. This is clear from rows 21 and 22 in column [2] of Table 7-2 (b). The increase in the capital / labour ratio, together with the decrease in taxation of business use of intermediate inputs, generates a long-run positive deviation in the real wage (row 24), and thus a positive deviation in labour supply. This explains the positive deviation in national employment (row 22).

Together, the positive deviations in employment and the capital stock generate a positive deviation in long-run real GDP (row 14). Because the capital / labour ratio increases, the deviation in real investment (row 17) also exceeds the real GDP deviation. The rise in real national income (row 20) is less than the rise in real GDP because part of the capital stock expansion (row 21) is foreign financed, and the terms of trade decline (row 26). Because the real national income deviation is lower than the real GDP deviation, so too are the deviations in real private and public consumption (rows 15 and 16) lower than the real GDP deviation. Despite an increase in investment relative to GDP, the damped response of real consumption relative to real GDP is sufficient to drive real GNE below real GDP. The real balance of trade thus moves towards surplus (rows 18 and 19). The positive export volume deviation explains the negative terms of trade deviation (row 26), which, as noted above, dampens somewhat the deviations in the real wage and real GNI.

We now turn to the state level impacts of removing the health insurance levy [see column [4] in Table 7-2 (a)]. Because health insurance is used by households, the initial effect of removing the health insurance levy is to reduce the NSW consumer price index relative to baseline. As discussed in section 3.1, we model short-run movements in inter-regional migration as sensitive to movements in inter-regional real wage relativities. In the short-run, the reduction in the NSW consumer price index caused by the removal in the gambling tax rate increases real (CPI-deflated) wages and incomes in NSW relative to the rest of Australia. This increases net interstate migration to NSW, so that over the long-run, NSW population (and thus labour supply and employment) rises (row 4). The increase in NSW labour supply reduced the wage rate in NSW, and thus removal of the health levy passes into a reduced unit cost of labour in NSW. This puts downward pressure on the NSW GSP deflator (row 1) relative to the national GDP deflator (row 28). This reduction in the cost of NSW goods relative to the cost of goods sourced from the rest of Australia and overseas, induces economic agents in NSW and the rest of Australia to substitute towards goods produced in NSW. The resulting increase in economic activity in NSW explains the long-run increase in NSW real GSP, and the expenditure-side components of GSP (rows 5 – 9).

Finally, we turn to the state level impacts of general insurance removal [see column [2] in Table 7-2 (a)]. In the short-run, with real wages sticky, removal of a tax that is partly incident on intermediate inputs to production causes NSW employment to rise, and creates upward pressure on NSW wages. This increases net immigration to NSW from the rest of Australia. Over time, this expands the NSW population, generating positive deviations in long-run NSW labour supply and employment (row 4). In the long-run, with rates of return on capital to the NSW economy largely given, and with movements in net inter-regional immigration driving a process of convergence in real wages across regions, there is little scope for long-run movement in the ratio of capital rental prices to wages. Hence, with the long-run regional wage / rental ratio largely given, the increase in NSW employment (row 4) is matched by an increase in the NSW capital stock (row 2). With both NSW employment and capital higher than baseline, so too is NSW real GSP (row 5). Because capital growth rates by sector converge in the long-run towards their baseline levels, the long-run positive deviation in the NSW capital stock (row 2) generates a long-run positive deviation in NSW investment (row 3). The deviation in each of the real consumption components are damped relative to the GSP deviation, because general insurance taxes are deductable for the purpose of calculating the federal income tax base. This blunts the impact that removing taxes on intermediate inputs to production have on regional post-tax incomes. Real consumption thus rises, albeit at a reduced rate relative to real GSP.

7.7 Industry impacts

Table 7-3 shows results for output in the ANZSIC-level 1 industries in NSW. The table is structured in a similar way to Table 7-2; column [1] and column [2] summarise the impacts of a A$100m rise in general insurance duty collections or removal of general insurance duties. Column [3] and column [4] give equivalent results for the health insurance levy, while the results for our life insurance duty simulations are provided in column [5] and column [6]. Once again, we focus on the outputs in column [2] and column [4] in our discussion.

As expected, the financial and insurance services industry benefits from general insurance duty removal (output expands by 0.44 per cent from column [2] in Table 7-3) and health insurance levy removal (+0.13 per cent in column [4] of Table 7-3). Consistent with the damped consumption response relative to real GSP for NSW discussed above for general insurance duty removal, the low-ranked sectors in terms of output deviation for general insurance duty removal, tend to be those with high shares of their output accounted for by sales to private and public consumption. This explains the low output deviations for dwelling services, healthcare and social assistance, public administration and safety, education and training, financial and insurance services, and other services. Sectors that sell comparatively large shares of their output to international or interstate trade, or for whom general insurance duties are an important input tax, are highly ranked in terms of output expansion.

The Construction sector expands in line with investment when both general insurance duties and the health insurance levy are removed. Transport, public administration, wholesale trade, business services and manufacturing all show small positive effects in line with the growth in GSP.

7.8 Concluding remarks

In this section, we described the current system of insurance taxation in NSW, and quantified the relative efficiency impact of various types of insurance taxes using VURMTAX. We performed eight simulations, where we examined the impact of all insurance duties/levies, and the individual impact of general, life and health insurance duties/levies. These simulations were used to generate marginal and average SEDIs and excess burdens. The values of these excess burdens were summarised, and their relative values were compared with reference to their effective tax rates on resource usage and their tax bases. We concluded by studying some of the macroeconomic and industry level impacts of changes in insurance tax policy in NSW.

7.9 Tables and Figures

Figure 7-1: Sketch of the impact of Insurance taxes.

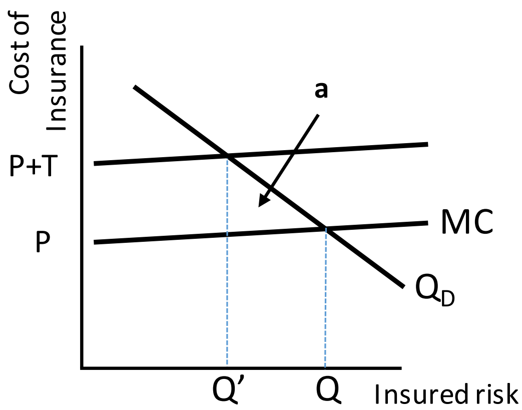


Table 7-1: Marginal and average excess burdens for (a) NSW insurance duties in aggregate; (b) NSW General insurance duty; (c) NSW Health insurance levy; and (d) NSW life insurance duty.

	Column [1] Marginal	**Column [2]** Average
(i) All Insurance duties/levies, inc. third party taxes		
SEDI, NSW	97	89
Excess burden	37	29
(ii) General insurance duties		
SEDI, NSW	81	78
Excess burden	36	29
(iii) Health insurance levy		
SEDI, NSW	130	114
Excess burden	31	24
(iv) Life insurance		
SEDI, NSW	128	117
Excess burden	27	22

Table 7-2: Long-run (year 2040) NSW state and national level macroeconomic impacts of insurance tax rate rises or removal.

		General Insurance duties Macroeconomic impact in 2040		Health insurance levy Macroeconomic impact in 2040		Life insurance duties Macroeconomic impact in 2040	
		$100m rise in collections	Removal of duty/levy	$10m rise in collections	Removal of duty/levy	$10m rise in collections	Removal of duty/levy
		Column [1]	**Column [2]**	**Column [3]**	**Column [4]**	**Column [5]**	**Column [6]**
	(a) NSW state-level results						
1	Price deflator, GSP	0.026	-0.291	0.004	-0.068	0.004	-0.024
2	Capital stock (rental weights)	-0.019	0.214	-0.002	0.039	-0.002	0.015
3	Real investment	-0.020	0.217	-0.002	0.033	-0.002	0.014
4	Employment	-0.019	0.210	-0.003	0.055	-0.003	0.022
5	Real GSP	-0.018	0.199	-0.003	0.047	-0.003	0.018
6	Real private consumption	-0.011	0.114	-0.002	0.040	-0.002	0.015
7	Real public (state) consumption	-0.011	0.114	-0.002	0.040	-0.002	0.015
8	Imports, volume	-0.010	0.100	-0.001	0.022	-0.001	0.010
9	Exports, volume	-0.055	0.614	-0.007	0.111	-0.008	0.048
10	Real post-tax consumer wage	-0.012	0.133	-0.001	0.028	-0.001	0.011
11	Real producer wage	-0.018	0.195	-0.001	0.023	-0.001	0.009
12	Tax base ($m)	-28.903	375.085	-13.918	293.364	-14.536	115.889
13	Aggregate tax revenue ($m)	175.310	-1983.330	18.480	-373.910	18.470	-143.287
	(b) National results						
14	Real GDP	-0.003	0.031	0.000	0.006	0.000	0.002
15	Real private consumption	-0.003	0.027	0.000	0.006	0.000	0.002
16	Real public (state and federal) consumption	-0.003	0.023	0.000	0.005	0.000	0.002
17	Real investment	-0.003	0.033	0.000	0.001	0.000	0.001
18	Real exports	-0.003	0.036	0.000	0.005	-0.001	0.002
19	Real imports	-0.002	0.016	0.000	0.001	0.000	0.001
20	Real GNI	-0.003	0.028	0.000	0.005	0.000	0.002
21	Capital stock (rental weights)	-0.004	0.043	0.000	0.005	0.000	0.002
22	Employment	-0.002	0.022	0.000	0.005	0.000	0.002
23	Capital rentals (investment-price deflated)	0.000	-0.004	0.000	-0.002	0.000	0.000
24	Real post-tax consumer wage	-0.011	0.128	-0.001	0.026	-0.001	0.010
25	Real producer wage	-0.009	0.104	-0.001	0.018	-0.001	0.007
26	Terms of trade	0.001	-0.013	0.000	-0.002	0.000	-0.001
27	Price deflator, consumption (CPI)	0	0	0	0	0	0
28	Price deflator, GDP	-0.002	0.024	0.000	0.008	0.000	0.003
29	Tax base (all states and federal, $m)	-29.847	385.684	-14.503	305.115	-15.041	119.806
30	Aggregate tax revenue (all states and federal, $m)	98.491	-1134.809	8.579	-186.930	8.840	-75.558
	(c) Change expressed as percent of GDP						
31	Balance of trade	0.000	0.001	0.000	0.000	0.000	0.000

Table 7-3: NSW industry output deviations in 2040, due to a rise in insurance duty/levy rates in NSW or removal of the taxes

		General Insurance duties Industry impact in 2040		Health insurance levy Industry impact in 2040		Life insurance duties Industry impact in 2040	
		$100m rise in collections	Removal of duty/levy	$10m rise in collections	Removal of duty/levy	$10m rise in collections	Removal of duty/levy
		Column [1]	**Column [2]**	**Column [3]**	**Column [4]**	**Column [5]**	**Column [6]**
1	Agriculture, forestry and fishing	-0.08	0.84	-0.03	0.06	-0.04	0.03
2	Mining	-0.02	0.23	-0.02	0.05	-0.02	0.01
3	Manufacturing	-0.02	0.21	-0.03	0.05	-0.02	0.02
4	Electricity, gas, water and waste services	-0.01	0.14	-0.02	0.03	-0.01	0.01
5	Construction	-0.01	0.13	-0.01	0.02	-0.01	0.01
6	Wholesale trade	-0.01	0.15	-0.02	0.03	-0.02	0.01
7	Retail trade	-0.01	0.1	-0.01	0.02	-0.01	0.01
8	Accommodation and food services	0	0.03	-0.01	0.01	-0.01	0.01
9	Transport, postal and warehousing	-0.02	0.22	-0.02	0.04	-0.02	0.02
10	Information media and communications	-0.01	0.12	-0.02	0.03	-0.01	0.01
11	Financial and insurance services	-0.04	0.41	-0.06	0.13	-0.06	0.05
12	Dwelling services	0	0.04	0	0	0	0
13	Business services	-0.01	0.11	-0.01	0.02	-0.01	0.01
14	Public administration and safety	-0.01	0.06	-0.01	0.02	-0.01	0.01
15	Education and training	-0.01	0.09	-0.02	0.03	-0.02	0.01
16	Health care and social assistance	-0.01	0.06	-0.01	0.02	-0.01	0.01
17	Other services	-0.01	0.06	-0.01	0.01	-0.01	0.01

8 Fire service levy

In contrast to other states except Tasmania, NSW imposes a fire service levy [FSL] on insurance funds in NSW, with most other states having shifted this hypothecated tax to a property tax. In this section, we build on previous work in section 7 by using VURMTAX to study the economic impact of the NSW FSL. We discuss how the effective FSL ad valorem tax rate in VURMTAX is calibrated, and briefly summarise the marginal and average SEDIs and excess burdens of this tax. We do not explore the economic impact of alternative fire and emergency service funding arrangements, e.g., see the Insurance Council of Australia (2017), and focus exclusively on the system currently in place in NSW.

8.1 Calculating the tax rate on the provision of insurance services due to the FSL

The tax on the provision of insurance services due to the FSL in NSW is calculated using a similar approach to the one implemented in section 7. As discussed in section 7.2, the main service provided by insurance is the spreading of risk. If the community pays y dollars in insurance premiums and receives $\alpha * y$ in payouts, where $0 < \alpha < 1$ and is defined as the gross loss ratio, then assuming that the provision of insurance services is fairly competitive, we deduce that the resources used by insurers are worth $(1 - \alpha) * y$. If the ad valorem tax rate on premiums is t, then the rate of tax on the provision of insurance services τ can be written in terms of the ad valorem duty/levy rate and the loss ratio:

$$\tau = \frac{t \times y}{(1-\alpha) \times y} = \frac{t}{1-\alpha}. \qquad (8.1)$$

If α is close to 1, then even if t is quite moderate, we would conclude that the activity of providing insurance services is heavily taxed and might be seriously underprovided, which would materialise via large, positive marginal and average excess burden figures.

APRA reports loss ratios for various types of insurers operating in Australia by state and territory[49].

In NSW, the FSL is levied upon insurance companies in order to fund metropolitan and rural fire brigades and the State Emergency Service (SES). Under the system currently operating in NSW, each financial year the NSW Government notifies insurers of their statutory FSL

[49] See the figures for March 2017 in Tables 1(f) to 1(q) of the APRA Quarterly Performance Statistics (http://www.apra.gov.au/GI/Publications/Pages/general-insurers-statistics.aspx).

contribution for that year. As discussed by the Insurance Council of Australia (2017), insurance companies typically pass on this expense to their household and commercial insurance clients.

To calibrate the FSL in VURMTAX using the approach from section 7 for other insurance duties/levies, we adopted a conservative stance on the loss ratio α in equation (8.1) and set it to 0.69, which is equal to the average net loss ratio for Fire and Industrial Special Risk (ISR) general insurance providers from 2014 - 2017 in Table 1(h) of the APRA Quarterly Performance Statistics for General Insurers[50].

To attribute FSL collections between households and industry, we assume the proportion of FSL collections from industries relative to households in VURMTAX is equal to the ratio of premium collections from Fire and ISR policies in NSW, relative to house owners/householder[51] insurance premium collections in NSW, over the year ending March 2017. Using this approach, 43.9 per cent of FSL collections in VURMTAX were assumed to have come from industry insurance policies.

In addition, we relied on a conservative estimate of the ad valorem tax equivalent on premiums caused by the FSL, or t in equation (8.1). This was sourced from the Insurance Council of Australia (2017), which reports that the impact of the FSL in NSW on insurance premiums ranges between 20 per cent (the impact on household premiums) and 30 per cent (the impact on commercial premiums). We adopted a lower bound and set t=0.21 in VURMTAX. From equation (1), this yielded a rate on the provision of insurance services due to the FSL (denoted τ_{FSL}) to be:

$$\tau_{FSL} = \frac{0.21}{1-0.69} = 0.677. \tag{8.2}$$

8.2 Simulations and results

Using VURMTAX, we performed two simulations:

(1) We accommodate a marginal increase in FSL rate, which yields an additional A$100m in NSW FSL collections. The results yield marginal SEDI and excess burden estimates for the NSW FSL (under the system presently in operation); and

[50] See http://www.apra.gov.au/GI/Publications/Pages/general-insurers-statistics.aspx.

[51] See Table 1(f) of the of the APRA Quarterly Performance Statistics for General Insurers (http://www.apra.gov.au/GI/Publications/Pages/general-insurers-statistics.aspx).

(2) The NSW FSL is removed to determine the average SEDI and excess burden of this tax.

Our simulation results are reported in Table 8-1(a). At the national level, the excess burden of the NSW FSL exceeds the excess burdens of all other insurance taxes. The SEDIs trail those calculated for life insurance duties and the health insurance levy however. This is because those taxes fall entirely on households, and changes in their rates drive changes in regional real wage relativities. This means that inter-regional migration is more sensitive to changes in taxes like the health insurance levy, because it feeds entirely into private consumption prices and consumer real wage rates.

8.3 Macroeconomic impacts

The long-run macroeconomic impacts of a (i) small rise in the FSL that yields an A$100m increase in tax-specific collections; and (ii) removal of the current NSW FSL, are summarised in column [1] and column [2] of Table 8-2. State results are given in Table 8-2(a), while national results are provided in Table 8-2(b) and (c). Because the macroeconomic impacts of a small rise in the FSL are small, we instead focus on the impacts of FSL removal in column [2]. While the direction and magnitude of the simulation results for any given variable differ, the relative impacts on the variables are similar between the two simulations.

Removal of the current FSL in NSW has similar macroeconomic impacts to removal of general insurance duties NSW. This is because both indirect taxes fall on both industries and households, as opposed to life insurance duties and the health insurance levy, which fall entirely on households. While the magnitude of the macroeconomics of FSL removal may therefore differ from the impact of removing general insurance duties in NSW, the general pattern we discussed in section 7.6 are similar. For this reason, we provide a short summary of the macroeconomic effects of FSL removal from column [2] in Table 8-2 here, and refer the reader to section 7.6 for a more detailed description.

National impacts

- In the long-run, with rates of return on capital largely given, removal of the NSW FSL lowers the marginal product of capital. This requires the capital / labour ratio to rise in the long-run. This is clear from rows 21 and 22 in column [2] of Table 8-2(b).

- This generates a long-run positive deviation in the real wage (row 24), and thus a positive deviation in labour supply and national employment (row 22).
- Together, the positive deviations in employment and the capital stock generate a positive deviation in long-run real GDP (row 14).
- Because the capital / labour ratio increases, the deviation in real investment (row 17) also exceeds the real GDP deviation.
- The rise in real national income (row 20) is less than the rise in real GDP because the terms of trade decline (row 26).
- Because the real national income deviation is lower than the real GDP deviation, so too are the deviations in real private and public consumption (rows 15 and 16) lower than the real GDP deviation.
- The real balance of trade thus towards surplus (rows 18 and 19). The positive export volume deviation explains the negative terms of trade deviation (row 26).

State impacts

- In the short-run, with real wages sticky, removal of a tax that is partly incident on intermediate inputs to production causes NSW employment to rise, and creates upward pressure on NSW wages.
- Net immigration to NSW from the rest of Australia is stimulated. The NSW population expands.
- This generates positive deviations in long-run NSW labour supply and employment (row 4).
- With the long-run regional wage / rental ratio largely given, the increase in NSW employment (row 4) is matched by an increase in the NSW capital stock (row 2).
- With both NSW employment and capital higher than baseline, so too is NSW real GSP (row 5).
- The deviation in each of the real consumption components are damped relative to the GSP deviation, because the NSW FSL is deductible when calculating corporate income tax liabilities. This blunts the impact that removing taxes on intermediate inputs to production have on regional post-tax incomes. Real consumption thus rises, albeit at a reduced rate relative to real GSP.
-

8.4 **Industry impacts**

Table 8-3 shows results for output in the ANZSIC-level 1 industries in NSW. The table is structured in a similar way to Table 8-2; column [1] and column [2] summarise the impacts of a A$100m rise in FSL collections and the removal of the FSL, respectively. Once more, because the incidence of the FSL is similar to general insurance duties, we observe similar industry output patterns when the FSL is increased or removed to those we summarised in section 7.7. Because the impacts of a small rise in the FSL are relatively small, we focus exclusively on the impact of FSL removal on NSW industries and provide a short summary of our findings:

- Financial and insurance service output expands (+0.30 per cent in column [2] of Table 8-3). This reflects the rise in insurance demand, following the removal of the indirect tax on insurance output.
- Export-oriented sectors, and sectors that are relatively intensive users of the taxed insurance commodity, benefit when the FSL is removed. Export oriented sectors benefit because of real devaluation, whereas sectors that are relatively intensive in FSL consumption benefit from a cost reduction.
- Agriculture, forestry and fishing expands largely due to real devaluation, which differs from the reason for its expansion when we remove general insurance duties. This is because general insurance duty removal includes type C general insurance duties, which are exclusively purchased by the Agriculture sector in VURMTAX, whereas the agricultural sector does not consume a large degree of insurance services that carry the FSL;
- The Construction sector expands in line with increased real investment. Transport, Public sector, Business services and Manufacturing all show small positive effects in line with the growth in GSP.

8.5 **Conclusions**

This section has built on the work presented in section 7, where we studied the economic impact of general, life and health insurance duties/levies in NSW, by exploring the economic impact of the NSW fire and emergency service levy (FSL). This was achieved using VURMTAX. We described two simulations that were conducted with VURMTAX to determine the SEDI and excess burden of the existing FSL on Insurance sales in NSW. Future work directions may involve an examination of the economic impact of proposed alternative arrangements for the FSL in NSW. If, as expected, the revised FSL is levied in addition to existing council rates on unimproved land values in NSW, we expect the excess burden to be broadly in line with the marginal excess burden of council rates in NSW, which we report in section 11.

8.6 Tables and Figures

Table 8-1: Marginal and average SEDI and excess burden results for the fire services levy (FSL) in NSW.

	Marginal	**Average**
	Column 1	Column 2
NSW Fire Service levy		
SEDI, NSW	88	162
Excess burden	43	32

Table 8-2: NSW state and national level macroeconomic impact in 2040, due to a A$100m rise in FSL on insurance collection in NSW, or removal of the levy.

		Fire Service levy Macroeconomic impact in 2040	
		$100m rise in collections	Removal of duty/levy
		Column [1]	**Column [2]**
	(a) NSW state-level results		
1	Price deflator, GSP	0.026	-0.214
2	Capital stock (rental weights)	-0.019	0.130
3	Real investment	-0.020	0.124
4	Employment	-0.019	0.139
5	Real GSP	-0.020	0.133
6	Real private consumption	-0.013	0.070
7	Real public (state) consumption	-0.013	0.070
8	Imports, volume	-0.010	0.053
9	Exports, volume	-0.052	0.420
10	Real post-tax consumer wage	-0.014	0.103
11	Real producer wage	-0.018	0.142
12	Tax base ($m)	-50.565	528.358
13	Aggregate tax revenue ($m)	173.310	-1454.980
	(b) National results		
14	Real GDP	-0.004	0.025
15	Real private consumption	-0.004	0.022
16	Real public (state and federal) consumption	-0.003	0.021
17	Real investment	-0.003	0.021
18	Real exports	-0.002	0.022
19	Real imports	-0.002	0.009
20	Real GNI	-0.003	0.022
21	Capital stock (rental weights)	-0.004	0.029
22	Employment	-0.002	0.017
23	Capital rentals (investment-price deflated)	0.001	-0.003
24	Real post-tax consumer wage	-0.013	0.099
25	Real producer wage	-0.010	0.077
26	Terms of trade	0.001	-0.008
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.003	0.021
29	Tax base (all states and federal, $m)	-50.730	529.965
30	Aggregate tax revenue (all states and federal, $m)	87.702	-793.166
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.001

Table 8-3: NSW industry impacts in 2040, due to a A$100m rise in FSL collections in NSW or removal of the tax

		Fire Service levy Industry impact in 2040	
		$100m rise in collections	Removal of duty/levy
		Column [1]	**Column [2]**
1	Agriculture, forestry and fishing	-0.03	0.27
2	Mining	-0.05	0.38
3	Manufacturing	-0.03	0.25
4	Electricity, gas, water and waste services	-0.02	0.15
5	Construction	-0.02	0.11
6	Wholesale trade	-0.02	0.11
7	Retail trade	-0.01	0.05
8	Accommodation and food services	-0.01	0.01
9	Transport, postal and warehousing	-0.03	0.23
10	Information media and communications	-0.02	0.14
11	Financial and insurance services	-0.03	0.30
12	Dwelling services	-0.01	0.04
13	Business services	-0.01	0.10
14	Public administration and safety	-0.01	0.05
15	Education and training	-0.01	0.07
16	Health care and social assistance	-0.01	0.04
17	Other services	-0.01	0.03

9 Motor vehicle taxes

NSW imposes a number of special taxes on the use of motor vehicles. In this section we consider the following:

- Vehicle transfer stamp duty and transfer fees on used car sales;
- The weight/engine capacity tax and registration fees (annual) on privately owned vehicles, and vehicles that facilitate road passenger transport and road freight transport;
- The above two taxes are incident on both used vehicles, however must also both be paid when purchasing a new car. To study the impact of new motor vehicle taxes, we separate the share of weight and registration charges, and transfer duties, that are attributable to new car sales in NSW. We model these taxes as taxes on industry-specific investment in new motor vehicles.

Drivers licence and parking space levies are not considered in this paper. In what follows, we begin with a brief synopsis of the impact of these taxes on motor vehicle use, before outlining how motor vehicle taxes are modelled in VURMTAX and concluding with a results summary.

9.1 Effects of Motor Vehicle taxes

Figure 9-1 provides one way to picture the effects of the current commonwealth and state taxes on motor vehicles. The market is separated into two related decisions: part A shows decisions to purchase motor vehicles, or the extensive margin; and, part B shows decisions on the use of motor vehicles in terms of kilometres travelled by location and by time period, or the intensive margin. For the extensive margin:

- the downward sloping demand curve D_e reflects household decisions to spend on cars (relative to other goods and services) from their income; and
- the decisions of business to use road versus other modes of transport; while
- a constant marginal cost curve reflects Australia as a price taker in a large global vehicle market.

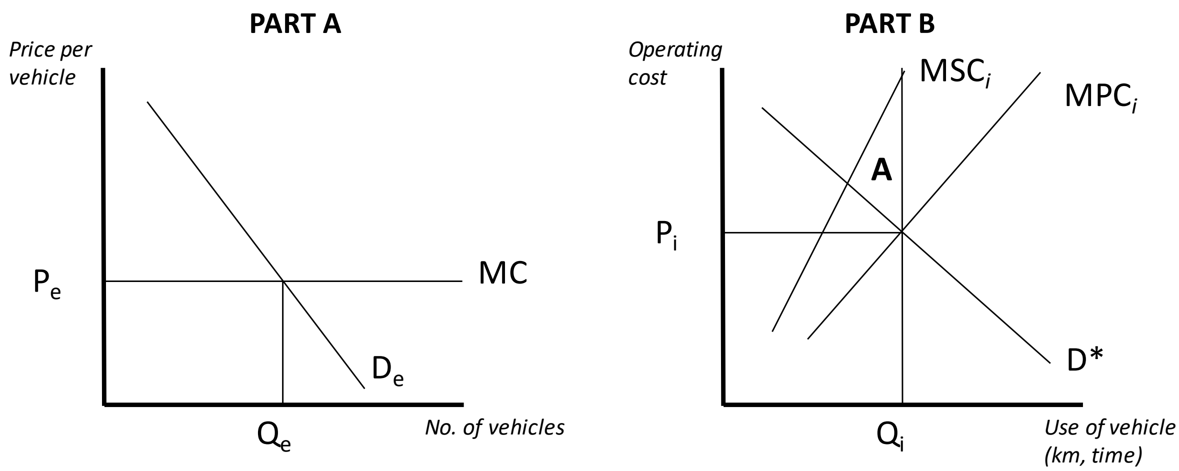
For the intensive margin:

- the position of the demand curve D_i is conditional on vehicles purchased (determined in the extensive margin decision); and

- the demand curve is downward sloping to reflect responses to operating costs, such as fuel, maintenance, labour, and charges for use;
- MPC_i represents the marginal private costs of additional travel; and
- MSC_i represents the marginal social cost composed of the MPC_i plus the costs of government provided road infrastructure, policing, emergency services and so forth, costs of congestion where relevant, and costs of pollution.

We now use the model of Figure 9-1 to describe: (a) the market outcome under a situation where there are no special taxes on motor vehicles; (b) the effects of current special taxes on market outcomes; and (c) implications for economic efficiency and equity.

Figure 9-1: Depiction of the efficiency loss arising from excessive motor vehicle use



9.1.1 Market outcomes in the absence of taxes

In the absence of the various special taxes on motor vehicles and their use noted in section 9.1 above, a market solution as shown in Figure 9.1 would have number of vehicles Q_e purchased per period at the price P_e, and vehicle use of Q_i with operating cost P_i equal to marginal private operating costs.

Since the costs of government provision of road infrastructure, policing and other relevant services, together with the costs of congestion and pollution, are ignored in private market decisions, the use of motor vehicles is too high given their social costs, with an efficiency loss of area '**A**'.

9.1.2 Effects of the current NSW motor vehicle tax system

The weight tax, stamp duty and fees on vehicle transfers and registration are essentially lump sum taxes per vehicle.[52] Then, in the context of Figure 9-1, the effects of these special taxes include:

- An increase in the extensive margin for vehicle purchase of the marginal cost per vehicle
- A fall in number of vehicle quantity below Q_e;
- A small inward shift of the intensive demand curve, leading to a lower vehicle use rate Q_i and some reduction of the efficiency loss of area '**A**'. But, these taxes are a very blunt and poorly targeted instrument to internalise the external benefits of government provided road infrastructure, etc., and the external costs of congestion and pollution;
- The vehicle stamp duty has its own distortion costs in reducing the transfer of vehicles, including the purchase of new vehicles with greater personal benefits and with external benefits of greater safety and pollution reduction, and the mutually beneficial transfer of second hand vehicles (much as discussed with conveyance duty for property in section 6).

The parking space levy acts as a disincentive to the use of motor vehicles in the inner city, and it is an indirect tax to reduce congestion and its external costs.

9.2 **Modelling the impact of motor vehicle taxes in VURMTAX**

In this section we describe how VURMTAX is used to study the economic impact of three major NSW motor vehicle taxes:

1. The weight tax ($1,989 million in 2015-16) and registration duties on used (existing) vehicles;

2. Stamp duty ($786 million, over both new and used motor vehicle transfers in 2015-16) and the transfer fee on used motor vehicle transfers;

3. All fees and duties incident upon the purchase of new motor vehicles in NSW, which include new car registrations, weight taxes and transfer fees/duties.[53]

These all operate on the extensive margin. The taxes not modelled accounted for $165 million in 2015-16, most of it raised by the parking space levy ($104 million). While the parking space

[52] Although the weight fee is varied by vehicle type to reflect an average damage by vehicle type to road infrastructure

[53] See Table 5.4 of the NSW Budget Statement 2017-18, Budget Paper No. 1.

levy acts on the intensive margin, we consider that its major intent is not revenue raising, but rather the mitigation of a congestion externality. Analysis of the effects of this tax therefore requires an estimation of the degree to which it mitigates the externality, rather than a conventional excess burden analysis. As adumbrated above, we exclude drivers licence fees as being largely an administrative charge, and so too the private transport operator's levy of $22m.

As discussed above, the vehicle taxes we model (the annual weight-based registration duty, stamp duties on new vehicle sales, and stamp duties on transfers of existing vehicles) are levied on motor vehicle use by households (such as use by the household of its own motor vehicle and purchase of taxi rides), and by industry (such as trucks used by the road freight sector and other commercial vehicles). In our analysis we conduct separate computations for new and used vehicles. For both domestically produced new vehicles and imported vehicles, we model:

1. The weight tax and registration duties on existing motor vehicles as (i) a sales tax on the use of private transport services by households; and (ii) a production tax on other industries, which is distributed across industries according to their relative investment shares in new motor vehicles;
2. Stamp duty and transfer fees on used motor vehicle transfers, which are modelled as a sales tax on household consumption of a new VURMTAX commodity, *Used motor vehicle transfers*, with a sales tax rate equal to 45%[54];
3. All fees and duties incident upon the purchase of new motor vehicles in NSW are modelled as a flat-rate sales tax on the purchase of new motor vehicles in NSW by investors.

For used vehicle registrations and weight taxes, the incidence of the tax falls across households in a direct sense (via their consumption of private transport services) and in an indirect sense, because they consume road passenger transport services, i.e., via use of taxi services. Industries also bear some of the burden, with a larger share of the industry load distributed across industries which exhibit larger shares of new motor vehicle investment. These sectors include the road freight industry, which is a key margin commodity.

[54] The sales structure of the commodity, *Used motor vehicle transfers*, was formed on estimates of the cost of transferring a vehicle. For sales via car dealers, we made this estimate on the basis of figures for resource costs (e.g. wages, capital, marketing) as a share of total sale price in Peters (2017) for US used-car dealers. Windle (2017) gives a similar figure for Australian motor vehicle dealers in general. Private sale non-tax transfer costs were estimated on the basis of marketing costs (e.g. advertising, vehicle inspection) only. The distribution between car-dealer and private sales by households and by industry were estimated on the basis of UK information in Parkin *et al*. (2015).

Because we assume used car transfers are largely paid by households (essentially, we assume industry do not pay transfer duty on used vehicles because they prefer to consume new vehicles), the incidence of this tax is also largely on households. Thus, we evaluate the excess burden of these taxes on the sale of used car transfer in a similar way to our treatment of transfer duty in section 6.

9.3 Data

Data on the distribution of weight taxes, registration fees, transfer fees, and stamp duties between new and used car sales were not publically available. To appropriately parameterise sales and production tax arrays in VURMTAX, we perform separate calculations to disaggregate the following publically available data for NSW:

- Vehicle registration and transfer fee revenue of A$407m;
- Weight tax collections of A$1 989m;
- Stamp duties on vehicle transfers (new and old) of A$786m.

across two dimensions:

- Their incidence upon new versus used vehicles;
- Their incidence across industries, investors and households.

We began by disaggregating vehicle registration fees (an annual charge) from vehicle transfer fees (a tax fee incurred when a single vehicle is transferred between users). Using ABS 9314.0, we determined that total new car sales in NSW for 2016-17 were equal to 397 000.[55] With new motor vehicle sales determined, we then used an iterative procedure to estimate the proportion of new versus used motor vehicle transactions in NSW. Our constraint was:

- The total number of registered vehicles in NSW at the end of 2017, which were 5 509 181. This was assumed to be equal to total vehicle registration fee collections, divided by the annual registration fee per vehicle (taken to be a flat rate equal to $63 per vehicle herein from NSW Treasury [2016]);

[55]We arrive at a very similar figure by relying on the number of motor vehicles on the NSW motor vehicle census register for 2016 and 2017 in ABS 9309.0. Taking the change in the size of the motor vehicle fleet in NSW from ABS 9309.0 between 2016 and 2017, and allowing for an attrition rate of 5 per cent of the 2016 vehicle fleet, e.g., for de-registered (retired) vehicles, we estimate the number of new motor vehicles purchased in NSW in 2016/17 as being equal to 403 000.

The starting point for our estimates was Peters (2017) who provides data on used car sales for the United States. This allowed us to estimate the share of used car sales in the total number of cars sold in the US as 69 per cent. Iterating around this initial estimate, we arrive at an estimate for used car sales as a proportion of total car sales in NSW of 82 per cent. With the transfer fee on used car sales being equal to $32 per transaction, this yielded an estimate for used car transfer fees of $60m, and an estimate for vehicle registration collections of A$347m.

Next, we disaggregated weight and registration taxes (A$1 989 + A$347m) across industries, households and investors using:

- The share of taxes incident on households we set according to the share of passenger vehicles, campervans and motor cycles in NSW in 2016 from ABS 9309.0, relative to the size of the aggregate fleet in 2017 (which yielded a share of 79.5 per cent);
- The share of taxes incident on industries was set according to the share of buses, non-freight carrying vehicles, articulated trucks, heavy rigid trucks, light rigid trucks and light commercial vehicles in NSW in 2016 from ABS 9309.0, relative to the size of the aggregate fleet in 2017 (which yielded a share of 18 per cent);
- The remainder of the taxes were assumed to fall on expansion of the fleet from its 2016 to 2017 levels via new car purchases (yielding a share of 2.5 per cent), which are assumed to fall on investors

To split transfer duties between new and used cars, we assumed the price of a new car to be equal to 1, and the average age of used cars sold to be equal to 5 years. Using standard depreciation rates[56], this yields the average price of a used car sold to be 50 per cent of the average new car. Weighting relative prices by the total number of used versus new car sales in NSW (82 versus 17 per cent), yields the share of stamp duties incident of households of 63 per cent, with a corresponding share on new car sales (investment) of 37 per cent.

9.4 Simulations and results

Having parameterised VURMTAX, we undertake six simulations in total:

(i) To calculate the marginal SEDI and excess burden of each motor vehicle tax, we:

[56] For each of the first 3 years 15 per cent, and 10 per cent for each year after that.

1. Raise the state government production tax rate on NSW industries who invest in new motor vehicles, and the sales tax rate on private transport services, by a sufficient amount to raise $100 m. of additional NSW used car weight/registration tax revenue;
2. Raise the state government sales tax rate on new motor vehicles sold in NSW, by a sufficient amount to raise $100 m. of additional NSW new car tax revenue;
3. Raise the sales tax rate on resources consumed by households to transfer their used motor vehicles by a sufficient amount to raise $100 m. of additional NSW used car transfer duty revenue;

To calculate average SEDIs and excess burdens, we perform similar simulation to those outlined above, however we reduce the relevant tax rates by 95 per cent, rather than raising them.

The excess burdens from NSW motor vehicle taxes were then calculated using the approach outlined in section 3.5, with the results summarised in Table 9.1. At the national level, our marginal excess burdens for used vehicle registrations are slightly below previous studies [see KPMG (2010), who estimate the marginal excess burden of motor vehicle registrations to be 37]. We suspect this may be because we treat new motor vehicle registrations as a distinct tax: the burden of used motor vehicle registrations does not fall on investment, and thus our excess burden lies below previous estimates.

With regard to our estimated excess burdens for new cars and used car stamp duties, we found no directly comparable previous estimates for these taxes. This is because the present study extends past work, by taking explicit account of the incidence of these taxes on households and investors. In so doing, we find new car taxes to be the most damaging of the NSW motor vehicle taxes at the national level.

We now turn our attention to an analysis of the macroeconomic and industry impacts of motor vehicle taxes. While macroeconomic and state impacts for all six tax experiments are reported in Table 9-2 - Table 9-4, in our discussion we will focus explicitly on the impact of a rise in used car duties in Table 9-4. We make some short remarks regarding the other taxes and their impacts in the conclusion to section 9.4.1.

9.4.1 Macroeconomic impacts

To begin, we focus on national impacts of a rise in NSW transfer duty on used motor vehicles as shown in the bottom panel of Table 9.4. As discussed in section 9.3, we assume that used car transfer duty is a tax paid by households seeking to purchase a used motor vehicle. Hence, when we raise the used car duty rate, the consumption price deflator rises relative to the GDP deflator (rows 27 and 28 in Table 9-4). This causes the real consumer wage to fall relative to baseline (row 24). As discussed in section 3.1, we allow labour supply to respond to movements in the real consumer wage. The fall in the long-run real consumer wage (row 24) accounts for the long-run fall in national employment (row 22). Because stamp duty on motor vehicle transfers is a tax on the resources employed by households seeking to transfer used motor vehicles in NSW, motor vehicle transfer services are generally labour intensive. The rise in the transfer duty rate therefore has little effect on the national capital stock (row 21) because it is largely a tax on labour-intensive elements of consumption. Nevertheless, with employment lower than baseline, so too is real GDP at factor cost and real GDP at market prices (row 14). The foreign ownership share of services sector that produces motor vehicle transfer services is low, and thus the movement in long run real GDP (row 14) and real GNI (row 20) are similar. The fall in real GNI causes real private and public consumption spending to fall relative to baseline (rows 15 and 16). This causes import volumes to fall relative to baseline (row 19). Because the long-run balance of trade : GDP ratio does not deviate from baseline (see section 0 and row 31 in Table 9-4), long-run export volumes also fall (row 18).

We turn now to the impacts on the NSW macro-economy (the top panel of Table 9-4). As discussed above, because used car transfer services are used by households, the initial macroeconomic effect of an increase in the stamp duty rate is to raise the NSW consumer price index relative to baseline. As discussed in section 3.1, we model short-run movements in inter-regional migration as sensitive to movements in inter-regional real wage relativities. In the short-run, the increase in the NSW consumer price index caused by the rise in stamp duty on motor vehicles depresses real (CPI-deflated) consumer wages and incomes in NSW relative to the rest of Australia. This reduces net interstate migration to NSW, so that over the long-run, NSW population (and thus labour supply and employment) falls (row 4). Ceteris paribus, a reduction in NSW labour supply relative to baseline raises the wage rate in NSW, and thus the rise in stamp duty on motor vehicles passes into a higher unit cost of labour in NSW, raising the NSW GSP deflator (row 1) relative to the national GDP deflator (row 28). This increase in the cost of NSW goods relative to the cost of goods sourced from the rest of Australia and overseas, induces economic agents in NSW and the rest of Australia to substitute towards goods produced outside NSW. The resulting decrease in economic activity in NSW explains the long-run reductions in NSW real GSP, and the expenditure-side components of GSP (rows 5 – 9).

With regard to the other two motor vehicle taxes, some key differences in the economic responses are evident compared to the results of a rise in the used car transfer duty rate, and we highlight and explain some of these here:

- As a tax on investment, a rise in new car taxes in NSW drives a much larger real investment response than the one caused by changes in used car duty rates (evident by comparing row 17 [national] and row 3 [state] in Table 9-3 and Table 9-4). At the national level, we see this investment response driving a fall in the capital/labour ratio (see rows 21 and 22). Additionally, because a large share of motor vehicles purchased in NSW are imported, new car taxes fall quite heavily on motor vehicle imports. This explains the larger deviation in import volumes in rows 8 and 19 of Table 9-3, relative to our results in Table 9-4.
- As a production tax that is incident across most NSW industries, and with long-run rates of return on capital largely given, a rise in weight and registration taxes in NSW must increase the marginal product of capital. The capital stock thus falls relative to employment (see rows 21 and 22 in Table 9-2 and Table 9-4).

9.4.2 Industry impacts

We summarise the NSW industry impacts of changes in motor vehicle tax rates in NSW in Table 9-5 - Table 9-7. Once again, we focus on the impact of a small rise in used motor vehicle duties in NSW, which are reported in the first column in Table 9-7. Used car transfer services are classified under the “Other services” sector. A rise in the transfer duty rate causes the purchaser’s price of used car transfer duties to rise, relative to prices for other commodities. This induces substitution towards consumption of other goods on the part of households in NSW. As a result, output of transfer services in NSW fall, i.e., the number of transfers falls. This is reflected in “Other services” experiencing the largest output contraction of the seventeen sectors reported in Table 9-7.

The output deviations for the remaining sectors are in line with the general negative deviations in the summary measures of NSW activity (real GSP, and the expenditure side components of GSP) discussed in reference to Table 9-4. An exception is “Dwellings services”. In Table 9-4, we see that real private consumption spending falls, yet in Table 9-7 output of dwelling services is largely unchanged. The explanation is substitution by the household sector. When the price of motor vehicle transfer services rises, households substitute towards consumption of other commodities. Consumption of dwelling services is a major component of household consumption spending, and is thus a beneficiary of the expenditure-switching induced by the rise in the stamp duty rate.

With regard to two remaining motor vehicle taxes, some key differences in the industry responses are evident compared to the results of a rise in the used car transfer duty rate:

- As a tax on investment, a rise in new car taxes in NSW drive manufacturing output in NSW below baseline (row 2, Table 9-6). The "other services" sector is most affected, because private transport services are intensive in new car investment activity. Transport, postal and warehousing, retail trade and wholesale trade see larger declines for similar reasons.

- As a tax that falls in part on road transport margins, and in part on private transport services, it is unsurprising to see that a rise in weight and registration taxes in NSW have the largest impacts on the Transport margins and Other services sectors. Other sectors, such as Wholesale trade, consume a large share of the NSW road freight industry' output, either directly as an intermediate input to production, or as a margin. The manufacturing industry is in turn impacted directly (because it utilizes road freight as a margin), but also because it is intensive in the use of wholesale trade margins.

9.5 **Conclusions**

We have provided detailed modelling of the impact of unilateral changes in three NSW motor vehicle taxes: (i) weight/registration fees on used motor vehicles; (ii) weight/registration and stamp duties on new car purchases; (iii) stamp duties on used car transfers. We find that the incidence of each type of motor vehicle tax differs; for example, used motor vehicle duties fall largely on households, whereas new car taxes impact on investment, and weight and registration charges impact industries directly via their incidence on transport margins, and households both directly (via their incidence on private motor vehicles) and indirectly, because households consume road passenger and freight transport.

9.6 Tables

Table 9-1: Motor vehicle tax excess burdens in 2034

	Column [1]	**Column [2]**
	Marginal	Average
(i) New car taxes		
SEDI, NSW	184	184
Excess burden	97	96
(ii) Registration and weight taxes on used cars		
SEDI, NSW	42	40
Excess burden	25	24
(iii) Used car duties		
SEDI, NSW	176	157
Excess burden	24	14

Table 9-2: State and national level macroeconomic impacts in 2040, due to a A$100m rise in weight tax/registration duty collections in NSW or removal of the taxes

		MV registrations rate rise Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	MV registrations removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.022	-0.422
2	Capital stock (rental weights)	-0.012	0.247
3	Real investment	-0.019	0.377
4	Employment	-0.010	0.171
5	Real GSP	-0.010	0.185
6	Real private consumption	-0.001	0.004
7	Real public (state) consumption	-0.001	0.004
8	Imports, volume	-0.013	0.253
9	Exports, volume	-0.049	0.899
10	Real post-tax consumer wage	-0.008	0.154
11	Real producer wage	-0.006	0.087
12	Tax base ($m)	-45.989	1012.970
13	Aggregate tax revenue ($m)	170.750	-3220.910
	(b) National results		
14	Real GDP	-0.002	0.047
15	Real private consumption	-0.001	0.007
16	Real public (state and federal) consumption	-0.001	0.007
17	Real investment	-0.005	0.108
18	Real exports	-0.007	0.156
19	Real imports	-0.004	0.083
20	Real GNI	-0.002	0.033
21	Capital stock (rental weights)	-0.004	0.082
22	Employment	-0.001	0.025
23	Capital rentals (investment-price deflated)	0.000	-0.004
24	Real post-tax consumer wage	-0.007	0.122
25	Real producer wage	-0.004	0.068
26	Terms of trade	0.002	-0.045
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.003	0.053
29	Tax base (all states and federal, $m)	-49.345	1080.504
30	Aggregate tax revenue (all states and federal, $m)	94.909	-1727.060
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.005

Table 9-3: State and national level macroeconomic impacts in 2040, due to a A$100m rise in taxes on new motor vehicles in NSW or removal of the taxes

		New MVs rate rise Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	New MV tax removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.065	-0.233
2	Capital stock (rental weights)	-0.064	0.232
3	Real investment	-0.080	0.289
4	Employment	-0.032	0.116
5	Real GSP	-0.042	0.153
6	Real private consumption	-0.028	0.104
7	Real public (state) consumption	-0.028	0.104
8	Imports, volume	-0.049	0.179
9	Exports, volume	-0.121	0.433
10	Real post-tax consumer wage	-0.021	0.076
11	Real producer wage	-0.043	0.155
12	Tax base ($m)	-66.637	243.464
13	Aggregate tax revenue ($m)	167.920	-608.388
	(b) National results		
14	Real GDP	-0.009	0.033
15	Real private consumption	-0.005	0.017
16	Real public (state and federal) consumption	-0.004	0.014
17	Real investment	-0.019	0.069
18	Real exports	-0.020	0.070
19	Real imports	-0.014	0.052
20	Real GNI	-0.007	0.025
21	Capital stock (rental weights)	-0.017	0.061
22	Employment	-0.004	0.013
23	Capital rentals (investment-price deflated)	0.000	0.003
24	Real post-tax consumer wage	-0.017	0.062
25	Real producer wage	-0.020	0.073
26	Terms of trade	0.006	-0.019
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	0.003	-0.011
29	Tax base (all states and federal, $m)	-73.417	266.490
30	Aggregate tax revenue (all states and federal, $m)	63.881	-234.208
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	-0.001

Table 9-4: State and national level macroeconomic impacts in 2040, due to a A$100m rise in used motor vehicle transfer duty collections in NSW or removal of the taxes

		Used MV duty rate rise Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	Used MV duty removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	NSW state-level results		
1	Price deflator, GSP	0.036	-0.186
2	Capital stock (rental weights)	-0.021	0.108
3	Real investment	-0.018	0.090
4	Employment	-0.036	0.188
5	Real GSP	-0.031	0.155
6	Real private consumption	-0.031	0.152
7	Real public (state) consumption	-0.031	0.152
8	Imports, volume	-0.019	0.095
9	Exports, volume	-0.074	0.380
10	Real consumer wage	-0.016	0.084
11	Real producer wage	-0.008	0.045
12	Tax base ($m)	-4.988	24.890
13	Aggregate tax revenue ($m)	167.630	-951.921
	National results		
14	Real GDP	-0.003	0.013
15	Real private consumption	-0.004	0.019
16	Real public (state and federal) consumption	-0.003	0.013
17	Real investment	0.002	-0.012
18	Real exports	-0.004	0.019
19	Real imports	-0.001	0.006
20	Real GNI	-0.003	0.011
21	Capital stock (rental weights)	0.000	0.002
22	Employment	-0.003	0.014
23	Capital rentals (investment-price deflated)	0.001	-0.009
24	Real consumer wage	-0.013	0.071
25	Real producer wage	-0.008	0.042
26	Terms of trade	0.002	-0.007
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.005	0.028
29	Tax base (all states and federal, $m)	-13.718	69.200
30	Aggregate tax revenue (all states and federal, $m)	66.257	-427.495
	Change expressed as percent of GDP		
31	Balance of trade	0.000	0.001

Table 9-5: NSW industry impacts in 2040, due to a A$100m rise in weight tax/registration duty collections in NSW or removal of the taxes

		MV registrations rate rise Effects on real industry output % deviation from baseline, 2040	MV registrations removed Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.02	0.35
2	Mining	-0.04	0.67
3	Manufacturing	-0.03	0.55
4	Electricity, gas, water and waste services	-0.01	0.20
5	Construction	0.00	0.00
6	Wholesale trade	-0.02	0.41
7	Retail trade	-0.01	0.27
8	Accommodation and food services	0.00	-0.07
9	Transport, postal and warehousing	-0.02	0.31
10	Information media and communications	-0.01	0.18
11	Financial and insurance services	0.00	0.00
12	Dwelling ownership	0.01	-0.18
13	Business services	-0.01	0.13
14	Public administration and safety	0.00	0.02
15	Education and training	0.00	0.05
16	Health care and social assistance	0.00	-0.02
17	Other services	-0.04	0.97

Table 9-6: NSW industry impacts in 2040, due to a A$100m rise in new car taxes in NSW or removal of the taxes

		New MVs rate rise Effects on real industry output % deviation from baseline, 2040	New MV tax removed Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.06	0.20
2	Mining	-0.08	0.28
3	Manufacturing	-0.09	0.31
4	Electricity, gas, water and waste services	-0.04	0.15
5	Construction	-0.03	0.12
6	Wholesale trade	-0.07	0.25
7	Retail trade	-0.06	0.20
8	Accommodation and food services	-0.03	0.11
9	Transport, postal and warehousing	-0.06	0.21
10	Information media and communications	-0.04	0.14
11	Financial and insurance services	-0.02	0.07
12	Dwelling ownership	-0.01	0.02
13	Business services	-0.03	0.12
14	Public administration and safety	-0.02	0.06
15	Education and training	-0.02	0.09
16	Health care and social assistance	-0.02	0.08
17	Other services	-0.09	0.33

Table 9-7: NSW industry impacts in 2040, due to a A$100m rise in used car transfer duty collections in NSW ort removal of the taxes

		Used MV duty rate rise Effects on real industry output % deviation from baseline, 2040	Used MV duty removed Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.03	0.15
2	Mining	-0.05	0.24
3	Manufacturing	-0.05	0.26
4	Electricity, gas, water and waste services	-0.03	0.15
5	Construction	-0.02	0.08
6	Wholesale trade	-0.03	0.15
7	Retail trade	-0.02	0.11
8	Accommodation and food services	-0.02	0.09
9	Transport, postal and warehousing	-0.05	0.25
10	Information media and communications	-0.03	0.16
11	Financial and insurance services	-0.01	0.04
12	Dwelling ownership	0.00	0.00
13	Business services	-0.02	0.11
14	Public administration and safety	-0.02	0.08
15	Education and training	-0.03	0.13
16	Health care and social assistance	-0.02	0.11
17	Other services	-0.13	0.73

10 Gambling Taxes

10.1 **Current System**

As described in NSW Treasury (2016), there is a diverse mix of different tax bases and rates on different forms of gambling, including gaming machines, wagering, casinos and lotteries.

In cases where supply is restricted by government, including casinos and gaming machines, taxation of the economic rents generated by the limited supply provide a non-distorting source of revenue.

Another rationale for special taxation of gambling over and above general taxes on expenditure involves the use of a special tax as a policy instrument to internalise some of the external costs of problem gambling [Freebairn *et al.* (2015)].

We start this section by using partial equilibrium models to assess the market, efficiency and equity effects of these two rationales for additional and special taxation of gambling. We also comment on the rationale for using CGE analysis. In addition, we highlight some of the complexities that arise when it comes to thinking about the efficiency costs of gambling taxation. We discuss some of these in detail in section 10.3. In a practical sense, representing these complexities within a consistent CGE framework is difficult. VURMTAX does not model the impact of issues such as problem gambling, and this should be recognised as a limitation on the CGE modelling we present

10.2 **Taxation of Gambling Rents**

The market situation where governments limit the supply of a particular form of gambling (like casinos, and gaming machines) is illustrated in Figure 10.1. At the limited supply of Q, demand exceeds the average cost of production generating a scarcity rent to the owners of the gambling licence. The effective supply curve is given by ABC, with A representing the average cost of market inputs to produce the gaming product, and Q the regulation-constrained quantity. The demand curve crosses the supply curve at price P > A. An economic rent for the scarcity value of the limited supply is given by the rectangle of area “a”.

In principle, all of the rent could be taken as taxation with no effect on market price P or quantity Q. The tax might take the form of a tax or fee per unit of gambling, or the return from auctioning the limited quantity of property rights to supply gambling. In reality, imperfect information about the gambling demand curve, risk aversion, and effective lobbying are likely to result in a portion of the economic rent being retained by the supplier.

An economic rent tax on government limited supply of gambling products has no distortions or economic efficiency costs, and nor would it alter the price paid by consumers. It simply redistributes a government created rent from the supplier to government revenue.

10.3 Taxation to Internalise Problem Gambling External Costs

For most forms of gambling, there are some so-called "problem gamblers" who generate external costs ranging from financial hardship arising from mismanagement of family finances through to criminal acts to secure finance (Productivity Commission, 2010). Also, some individuals take what they, in retrospect, regard as irrational decisions. Special taxation of gambling often is justified by state and territory governments as a policy intervention to internalise the external costs of problem gambling; and as a complement to other policy interventions.

However, for many gamblers, gambling is an alternative recreation choice where all the costs and benefits are rationally internalised in the private decision. The Productivity Commission estimates as much as a half of gambling (by expenditure) involves minimal externality costs. Of course, this same dichotomy arises with the consumption of alcohol and special taxation of alcohol by the Commonwealth.

Figure 10.2 sketches a model of market supply and demand for gambling as one way to assess the effects of an ad valorem or per unit tax on gambling. Note that there is some ambiguity about what is represented on the price and quantity axis, both for participants in the market as well as for an analysis (whether PE or CGE). Quantity could be represented as the number of gambling units (say gaming machines, poker tables, races or race meetings), gross dollars gambled, or net dollars lost. Price might be represented as an average percentage of gross dollars gambled or of dollars gambled lost, net loss per event or hour of gambling. Regardless of the specific P and Q choice, demand would be downward sloping. For simplicity, the Figure assumes a constant marginal private cost of supply, S = AC= MPC (marginal private cost).

For simplicity, the dichotomy of "problem gamblers" and "other gamblers" is represented as follows. Other gamblers are represented via demand curve Dn, crossing the supply curve at a quantity Qn, and involving no external costs. Demand by "problem gamblers" is denoted by demand curve Dp. When problem gamblers consume gambling, this creates not only private costs, but also external costs. The marginal social cost of problem gambling supply is denoted by MSC, and is the sum of the marginal private cost (MPC) and marginal external cost (MEC).

An economic efficient benchmark would involve zero special taxation of other gamblers and a special tax equal to MEC to induce problem gamblers to reduce gambling to Q* for an efficiency gain of triangle “b+c+d”. However, the information needed to implement such a discriminatory set of gambling taxes is unavailable.

Rather, governments have imposed a flat tax on all gamblers, albeit with different taxes on different forms of gambling. Figure 10.2 illustrates a flat tax of T per unit of gambling to raise the effective supply curve to S’ = S + T. The higher price, with the tax fully passed forward to consumers under the infinitely elastic supply assumption, results in less gambling by all categories of gamblers. Whether there is a net efficiency gain in applying the tax is unclear as the efficiency gain of less gambling by “problem gamblers” of trapezoid “c+d” has to be traded off against the efficiency loss of triangle “a” encountered by other gamblers. Of course, since all taxes other than pure economic rent taxes (illustrated in Figure 10.1) involve efficiency costs, an objective of a zero distortion cost is inappropriate.

Given that gambling expenditure generally falls as a share of income, this form of taxation is regressive. Also, it fails a horizontal equity evaluation, i.e., households with similar incomes and assets would not pay the same amount in tax.

It seems unlikely that a logical application of externality correction or achieving similar distortion cost per dollar of gambling tax revenue could justify the very diverse range of different effective special gambling tax rates on the different gambling choice products found across Australia. That is, the current variety of different tax rates on different gambling products distorts the choice of gambling product with the usual measures of tax distortion costs.

Again, it would be a challenge to argue that the different effective special gambling taxes on the different gambling products contribute to society objectives of vertical or horizontal equity with gamblers of a similar socio-economic class paying more tax than non-gamblers.

10.4 **Simulations and results**

We undertake two VURMTAX simulations:

(i) To calculate the marginal SEDI and excess burden, we raise the state government production tax rate on NSW gambling by an amount that is sufficient to raise $100 m. of additional NSW gambling tax revenue.

(ii) To calculate the average SEDI and excess burden, we lower the state government production tax rate on NSW gambling and eliminate 95% of NSW gambling tax revenue.

By shocking the production tax rate, we ensure that all users of NSW gambling, whether they be local households, interstate households, or foreign tourists, are subject to the change in the tax rate.

The SEDI and excess burden results for NSW gambling taxes are shown in Table 10-1.

In the following sections we discuss the macroeconomic and industrial effects of the a small rise in the gambling production tax rate in NSW. Our discussion of the mechanisms underlying the simulation carries over to the simulation where we remove gambling taxes, because the two simulations are identical in all respects other than the magnitudes and directions of the shocks. Hence, for brevity, we confine our discussion to the rate rise simulation.

10.5 **Macroeconomic impacts**

The VURMTAX database shows that the bulk of NSW gambling output is sold to the household sector. Hence, when we raise the gambling tax rate, the consumption price deflator rises relative to the GDP deflator (rows 27 and 28 of Table 10.2). This causes the real consumer wage to fall relative to baseline (row 24). As discussed in section 3.1, we allow labour supply to respond to movements in the real consumer wage. The fall in the long-run real consumer wage (row 24) accounts for the long-run fall in national employment (row 22). The rise in the gambling tax rate has little effect on the national capital stock (row 21) because it is largely a tax on a labour-intensive elements of consumption. Nevertheless, with employment lower than baseline, so too is real GDP at factor cost. The fall in in real GDP at market prices (row 14) exceeds the fall in real GDP at factor cost because of the allocative efficiency loss created by the rise in the gambling tax rate. The foreign ownership share of the gambling sector is assumed to be low, and thus the movement in long run real GDP (row 14) and real GNI (row 20) are quite similar. The fall in real GNI causes real private and public consumption spending to fall relative to baseline (rows 15 and 16). This causes import volumes to fall relative to baseline (row 18). As discussed in section 3.2, our macroeconomic closure has the effect of preventing large deviations in the long-run balance of trade : GDP ratio from baseline. Hence, with long-run import volumes below baseline (row 18), so too are long-run export volumes (row 19).

We turn now to the impacts on the NSW macro-economy (the top panel of Table 10-2). As discussed above, because gambling services are primarily used by households, the initial macroeconomic effect of an increase in gambling tax is to raise the NSW consumer price index relative to baseline. As discussed in section 3.1, we model short-run movements in inter-regional migration as sensitive to movements in inter-regional real wage relativities. In the short-run, the increase in the NSW consumer price index caused by the rise in the gambling tax rate depresses real (CPI-deflated) per capita income in NSW relative to the rest of Australia. This reduces net interstate migration to NSW, so that over the long-run, NSW population (and thus labour supply and employment) falls (row 4). The reduction, relative to baseline, in NSW labour supply raises the wage rate in NSW, and thus the gambling tax passes into a higher unit cost of labour in NSW and thus raises the NSW GSP deflator (row 1) relative to the national GDP deflator (row 28). This increase in the cost of NSW goods relative to the cost of goods sourced from the rest of Australia and overseas induces economic agents in NSW and the rest of Australia to substitute towards goods produced outside NSW. The resulting decrease in economic activity in NSW explains the long-run reductions in NSW real GSP, and the expenditure-side components of GSP (rows 5 – 9).

10.6 **Industry impacts**

Table 10-3 reports impacts on the output of NSW sectors. The gambling industry is classified under the "Other services" sector. The rise in the gambling tax rate causes the purchaser's price of gambling to rise, relative to prices for other commodities. This induces substitution towards consumption of other goods on the part of households in NSW and the rest of Australia, while also causing foreign tourists to reduce their purchases of NSW gambling. As a result, output of gambling contracts. This is reflected in "Other services" experiencing the largest output contraction of the seventeen sectors reported in Table 10-3.

The next two sectors most adversely affected by the increase in the gambling tax rate are "Transport, postal and warehousing" and "Accommodation and food services". This reflects the way foreign tourism is modelled in VURMTAX. In modelling export tourism, we assume that foreign tourists purchase a NSW tourism bundle, with limited substitution possibilities allowed within this bundle. The tourism bundle comprises tourism-related commodities, namely: accommodation and food, road passenger transport, air transport, gambling, and other services. Because gambling is a component of the tourism bundle, when we raise the gambling tax rate, we also raise the price of the tourism bundle. This causes foreign tourism in general to NSW to decline, and with it, demand for the individual components of the tourism bundle also fall. This accounts for the relatively strong negative output deviations for "Transport, postal and warehousing" (which subsumes road passenger transport and air transport), and accommodation and food services. It also adds to the negative output deviation for "Other services", which not only includes the gambling commodity, but also the other services commodity, which is a component of the tourism bundle.

The output deviations for the remaining sectors are in line with the general negative deviations in the summary measures of NSW activity (real GSP, and the expenditure side components of GSP) discussed in reference to Table 10-2. An exception is "Dwellings services". In Table 10-2 we see that real private consumption spending falls, yet in Table 10-3 output of dwelling services is largely unchanged. The explanation is substitution by the household sector. When the price of gambling rises, households substitute towards consumption of other commodities. Consumption of dwelling services is a major component of household consumption spending, and is thus a beneficiary of the expenditure-switching induced by the rise in the gambling tax rate.

10.7 **Limitations and future work**

As discussed above, the modelling presently assumes one aggregate gambling sector. In future work, it might be appropriate to disaggregate gambling supply across different gambling products. This would: (a) allow the modelling to distinguish those activities subject to regulated quantity generating scarcity rents, and those with no or limited supply restriction; (b) facilitate the addition of different rates of externality associated with problem gambling across different gambling products.

Modelling of the social costs of problem gambling would also be a valuable extension to the excess burden calculations for this tax. Just as we augment our excess burden calculations with valuations of changes in leisure time, in future research it would be appropriate to link changes in the quantity of gambling to a measure of change in the social cost of problem gambling. Tax-induced changes in the social cost of problem gambling could then feed into our excess burden calculations. Not only would this be a useful extension for the modelling of the excess burden of gambling taxes, it would also be a valuable supplement to the calculation of the excess burden of other taxes that perturb relative consumption prices, like the GST.

10.8 **Tables and Figures**

Figure 10.1. Taxation on gambling rent

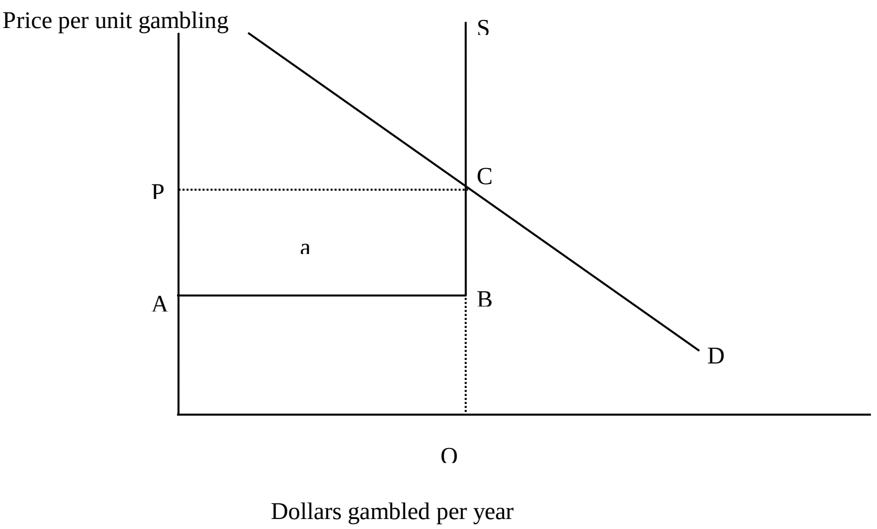


Figure 10.2. Externality correction taxation of gambling

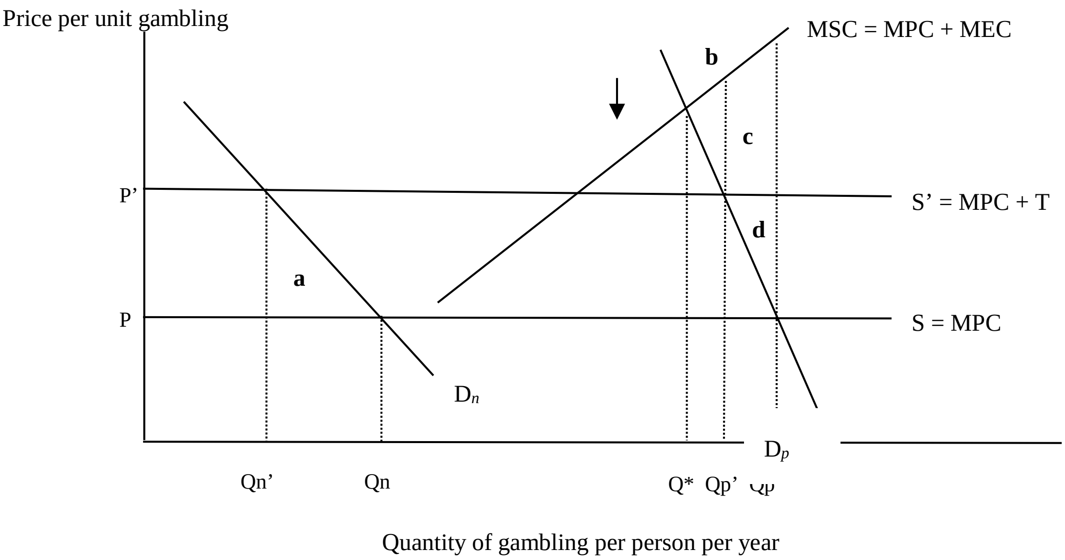


Table 10-1: Marginal and average excess burden for gambling taxes (cents per dollar of revenue)

	Marginal Column 1	**Average** Column 2
Gambling production taxes in NSW		
SEDI, NSW	140	125
Excess burden	46	34

Table 10-2: State and national level macroeconomic impacts in 2040, due to a A$100m rise in gambling tax collections in NSW and removal of the taxes

		Gambling rate rise Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	Gambling tax removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.033	-0.713
2	Capital stock (rental weights)	-0.015	0.324
3	Real investment	-0.018	0.385
4	Employment	-0.025	0.554
5	Real GSP	-0.024	0.507
6	Real private consumption	-0.020	0.418
7	Real public (state) consumption	-0.020	0.418
8	Imports, volume	-0.018	0.393
9	Exports, volume	-0.077	1.671
10	Real post-tax consumer wage	-0.014	0.304
11	Real producer wage	-0.013	0.284
12	Tax base ($m)	141.085	-2985.640
13	Aggregate tax revenue ($m)	167.560	-3863.220
	(b) National results		
14	Real GDP	-0.003	0.067
15	Real private consumption	-0.004	0.074
16	Real public (state and federal) consumption	-0.003	0.061
17	Real investment	-0.001	0.011
18	Real exports	-0.006	0.130
19	Real imports	-0.004	0.080
20	Real GNI	-0.003	0.059
21	Capital stock (rental weights)	-0.001	0.018
22	Employment	-0.002	0.051
23	Capital rentals (investment-price deflated)	0.001	-0.029
24	Real post-tax consumer wage	-0.012	0.256
25	Real producer wage	-0.009	0.184
26	Terms of trade	0.002	-0.042
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.003	0.072
29	Tax base (all states and federal, $m)	124.840	-2573.363
30	Aggregate tax revenue (all states and federal, $m)	73.569	-1803.010
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.001

Table 10-3: NSW industry impact in 2040, due to a A$100m rise and elimination of gambling taxes in NSW

		Gambling rate rise Effects on real industry output % deviation from baseline, 2040	Gambling tax removed Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	-0.02	0.51
2	Mining	-0.04	0.83
3	Manufacturing	-0.04	0.91
4	Electricity, gas, water and waste services	-0.02	0.51
5	Construction	-0.01	0.31
6	Wholesale trade	-0.02	0.51
7	Retail trade	-0.02	0.38
8	Accommodation and food services	-0.03	0.69
9	Transport, postal and warehousing	-0.05	1.08
10	Information media and communications	-0.03	0.67
11	Financial and insurance services	-0.01	0.14
12	Dwelling ownership	0.00	-0.02
13	Business services	-0.02	0.42
14	Public administration and safety	-0.01	0.24
15	Education and training	-0.02	0.38
16	Health care and social assistance	-0.01	0.29
17	Other services	-0.09	1.90

11 Council Rates on unimproved land values

11.1 Council rates in NSW: Background

In NSW local councils impose rates on properties on the basis of land values as assessed by the Officer of the Valuer General.[57] Rating structures are set by individual councils in order to raise sufficient revenue to cover their expenditure assignment. Rates are pegged in accordance with the Local Government Act so that total revenue does not grow faster than a given percentage. Councils usually charge different rates to different categories of property. Most rate payers pay ordinary rates, which in general have a significantly higher rate for business than for residential or farmland – these being the major categories of property for council rates. Higher charges might also be imposed on different sub-categories, such as industrial land, CBD properties, and certain urban centres.

Essentially, local council rates act in the same way as state land taxes, with the exception that there are a different set of exempt categories. For instance, farmland is subject to council rates, and most importantly, council rates are payable on owner-occupiers' principal place of residence. As discussed in Section 5 on land tax, the major distortion arising from NSW land tax relates to land tax being payable on land allocated to rental properties, but not on land used for owner-occupier dwellings. However, council rates are payable on virtually all residential properties, and thus does not generate a tenancy choice distortion. In this section, we use VURMTAX to simulate the effects of both small increases in NSW council rate collections via rate adjustment, and removal of NSW council rates in the year 2019. A short discussion of the state, national and industry impacts are provided for 2040, twenty-one years post the tax policy shock.

11.2 Simulations

In 2015-16 the total revenue from municipal rates by all NSW Councils was $4,169 million.[58] To calibrate council rate collections in VURMTAX, we relied on council rate revenue by source shares in Page (2011), which highlighted that 65 per cent of council rate collections in NSW

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[57] See Office of the Valuer General (2017). Councils may choose to base rates entirely on the land values of properties, which may have some specified minimum amount payable, or they may charge a fixed component combined with a rate on land value. While this choice may have an effect on equity, it would appear to have little effect on efficiency.

[58] Table 1 New South Wales Local Government General Operating Statement, Government Finances Statics, Australia 2015-16 (cat. No. 5512.0).

are derived from residential rates, with rates on business and farmland accounting for 25 per cent and 7 per cent of aggregate collections, respectively. The remaining 3 per cent were classified as other rate sources. In VURMTAX, we distribute other rate sources across business, farmland and residential according to their identified collection shares in Page (2011). Thus, NSW derived 67 per cent of aggregate council rate collections from residential properties, with 26 per cent and 7 per cent derived from business and farmland, respectively.

We run two council rate simulations. In the first, to calculate the average excess burden, we cut the rate of council tax by 95%. In the second, to calculate the marginal excess burden, we raise the rate by an amount sufficient to raise an additional $100 m. of revenue. The macroeconomic and industrial effects of these tax changes are reported in Table 11-1 and Table 11-2. Below, we focus our discussion on the results from removing the tax, i.e., we cut the rate of council tax on UIV in NSW by 95%. Because the two simulations differ only in terms of direction and magnitude, but not in nature, our discussion of the results for the average excess burden simulation is generalizable to the results of the marginal excess burden simulation.

11.3 **Macroeconomic impacts**

As discussed in section 5, the excess burden of land tax can be largely traced to the allocative efficiency distortion arising from the exempt status of land used in the supply of owner-occupied dwelling services. Council rates do not generate this distortion because they are applied to land used in both rented and owner-occupied dwelling service provision (see section 11.1). This causes the council rates SEDI and excess burden measures to be lower than those of land taxes (see Table 2-1). Indeed, both the SEDI and excess burden of council rates on UIV are not only lower than that of land tax: they are negative. Without the allocative distortion introduced by the land tax exemption of owner-occupied land, we are left in the council rates simulation with only the gain arising from part of the tax incidence falling on foreign land owners. Put another way, both land tax and council rates are paid in part by foreign landowners. Ceteris paribus, this pushes the values of the excess burden measures for these taxes towards negative. However, by exempting owner-occupied dwellings, land tax creates an allocative efficiency distortion that more than offsets the gains from taxing foreign owned land, resulting in a net positive excess burden measure.

The macroeconomic consequences of council rates' negative excess burden is apparent in Table 11-1, where we find in rows 15 and 16 of column (2) that removal of council rates causes negative deviations in long-run private and public consumption spending. The incidence of council rates falls on landowners. When council rates are reduced or eliminated, national income falls because part of the council rates are being paid by foreign landowners (row 20). In VURMTAX, national private and public consumption spending is indexed to national income. Hence, the negative deviation in national income generated by reduced council rates revenue from foreign landowners causes a negative deviation in private and public consumption spending. Removal of the tax has little effect on real GDP (row 14); hence, the negative deviation in private and public consumption causes the real balance of trade to move towards surplus (rows 18 and 19). The resulting positive deviation in export volumes (row 18) causes a negative deviation in the terms of trade (row 26). This also contributes to the negative deviation in national income (row 20). The positive deviation in the real balance of trade encourages expansion of capital-intensive export and import competing sectors. At the macroeconomic level, this is reflected in small positive deviations in aggregate capital stock (row 21) and real investment (row 17).

We turn now to the macroeconomic outcomes for NSW. The loss of council rate revenue from foreign and interstate owners of land, and the resulting rise in lump-sum taxation of NSW households, generates negative deviations in private and public consumption spending in NSW (rows 6 and 7 of column (2)). It also generates a reduction in population and employment in NSW (row 4) because, as discussed in Section 3.1, net interstate immigration to NSW falls in response to the fall in NSW household post-tax real incomes. With real wages in NSW largely tied-down by the condition that households move between regions to gradually equalise real post-tax per capita wages, and with long-run rates of return on capital in NSW largely tied-down by the process of investment responding to movements in rates of return, there is little change in the long-run NSW ratio of capital rental prices to wage rates. Hence, there is little impetus for a long-run change in the NSW labour / capital ratio. Hence, with long-run NSW employment lower because of the higher long-run lump sum tax load on NSW households, NSW capital is also below baseline in the long-run (row 2). With NSW employment and capital below baseline in the long-run, so too is NSW real GSP (row 5).

11.4 **Industry impacts**

Table 11-2 reports the sectoral consequences of changing NSW council rates. As discussed above, the main macroeconomic effect of removing NSW council rates is to reduce private and public consumption spending and increase net foreign exports. These macroeconomic outcomes are reflected in the pattern of sectoral impacts reported in Table 11-2. Three sectors experience expansions in activity: agriculture, forestry and fishing; manufacturing; and mining. These sectors produce traded goods (that is, they have a heavy orientation towards production of goods that are exported or compete with imports in the local Australian market). Hence, they are among the beneficiaries, in terms of output expansion, of the movement towards surplus in Australia's balance of trade. Provision of trade-facilitating margin services is an important activity of the transport, postal and warehousing sector. Hence, output of this sector is broadly in line with baseline, because of the aforementioned movement towards surplus in the balance of trade.

Consistent with the primary first round impact of the removal of NSW council rates being a reduction in private and public consumption spending, the sectors most adversely affected are producers of consumption goods. This accounts for the negative output deviations of accommodation and food services; health care and social assistance; other services; retail trade; education and training; public administration and safety; and dwelling services. The remaining sectors (construction; wholesale trade; financial and insurance services; business services; information media and communications services; electricity, gas, water, and waste services) are characterised by being important producers of intermediate or capital inputs (thus rendering the magnitudes of their output deviations similar to that of the NSW real GSP deviation) or, like the utilities sector, have a low expenditure elasticity (thus insulating their output from the decline in real consumption spending).

11.5 **Conclusions**

Part of the incidence of council rates falls on foreign landowners. Hence, a cut to council rates reduces national income. This requires national consumption to fall and net exports to rise. At the sectoral level, this buoys output of industries in the traded goods sector, but damps output of industries producing goods for private and public consumption. At the NSW level, because of the loss of tax revenue on foreign landowners, the tax mix switch described by a reduction in council rates and increase in lump sum taxation represents a net increase in the tax burden on NSW households. The result is a reduction in net interstate emigration to NSW. This causes the long-run size of the NSW economy to contract.

11.6 **Tables**

Table 11-1: State and national level macroeconomic impacts in 2040, due to a A$100m rise in council rate revenue or removal of council rates in NSW

		Council rate (UIV) rise Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	Council rates (UIV) removed Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.002	-0.065
2	Capital stock (rental weights)	0.004	-0.182
3	Real investment	0.005	-0.221
4	Employment	0.004	-0.168
5	Real GSP	0.004	-0.189
6	Real private consumption	0.009	-0.378
7	Real public (state) consumption	0.009	-0.378
8	Imports, volume	0.005	-0.234
9	Exports, volume	-0.004	0.143
10	Real post-tax consumer wage	0.001	-0.020
11	Real producer wage	-0.001	0.025
12	Tax base ($m)	-158.3	6736.63
13	Aggregate tax revenue ($m)	172.090	-7321.160
	(b) National results		
14	Real GDP	0.000	-0.012
15	Real private consumption	0.001	-0.036
16	Real public (state and federal) consumption	0.001	-0.023
17	Real investment	0.000	-0.002
18	Real exports	-0.001	0.028
19	Real imports	0.001	-0.039
20	Real GNI	0.001	-0.025
21	Capital stock (rental weights)	0.000	-0.005
22	Employment	0.000	-0.005
23	Capital rentals (investment-price deflated)	0.000	0.001
24	Real post-tax consumer wage	0.000	-0.009
25	Real producer wage	0.000	-0.006
26	Terms of trade	0.000	-0.009
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	0.000	-0.003
29	Tax base (all states and federal, $m)	-164.13	6998.27
30	Aggregate tax revenue (all states and federal, $m)	155.990	-6619.123
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.000	0.011

Table 11-2: State industry impacts in 2040, due to a A$100m rise in council rate revenue or removal of council rates in NSW

		Council rate (UIV) rise Effects on real industry output % deviation from baseline, 2040	Council rates (UIV) removed Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	0.00	0.04
2	Mining	0.00	0.19
3	Manufacturing	0.00	0.01
4	Electricity, gas, water and waste services	0.00	-0.10
5	Construction	0.00	-0.20
6	Wholesale trade	0.00	-0.19
7	Retail trade	0.01	-0.27
8	Accommodation and food services	0.01	-0.35
9	Transport, postal and warehousing	0.00	-0.03
10	Information media and communications	0.00	-0.12
11	Financial and insurance services	0.00	-0.12
12	Dwelling ownership	0.01	-0.24
13	Business services	0.00	-0.11
14	Public administration and safety	0.00	-0.17
15	Education and training	0.01	-0.25
16	Health care and social assistance	0.01	-0.30
17	Other services	0.01	-0.29

12 Personal Income Tax

This section focuses on the impacts of Australia’s personal income tax. While traditional CGE models distinguish federal taxes as indirect taxes and tariffs, or factor income taxes, e.g., capital taxes or labour taxes, VURMTAX models personal income tax as a tax on labour, capital and land income that accrues to local residents. While we recognise that Australia’s personal income tax system is progressive, in this paper we take VURMTAX’s assumption of a representative household and model the personal income tax as a flat-rate tax on taxable household income. We do not capture impacts such as heterogenous labour supply responses, e.g., due to differing labour supply elasticities across the income spectrum and by gender, or the progressive nature of the income tax rate scale. This biases our estimate of the marginal excess burden downwards.

In what follows, we briefly summarise the tax base and means by which franking credits are accounted for in our modelling in section, before summarising the data, equation system and assumptions used to model Australia’s personal income tax system in VURMTAX.

12.1 **Franking credits and personal income tax liabilities**

Australia’s franking credit system was implemented in July 1987 (Peirson *et al*. 2009) to avoid double taxation of company profits paid out as dividends to Australian-resident investors in Australian-listed companies. Essentially, when resident shareholders receive a franked dividend from an Australian company, they are provided a tax credit by this company in addition to the dollar value of the dividend they receive. This credit reflects the fact that the company has already paid tax (at the company tax rate) on the profits from which the dividend has been paid, i.e., the dividend is paid out of post-Australian-company-tax profits. In receiving a fully-franked dividend, capital income received by Australian residents is effectively taxed at the personal income tax rate.

Dividend imputation systems are rare internationally, with most countries undertaking some form of 'double taxation' whereby corporate income taxes are paid on profits and personal income taxes are paid on dividends (with some countries levying lower personal tax rates on dividends compared to earned income) [The Senate, 2015]. Australia, New Zealand, Chile and Mexico are the only OECD countries to operate a dividend imputation system [Australian Government, 2015].

Because of the role played by franking credits in offsetting personal income tax liabilities in Australia's tax system, VURMTAX distinguishes capital ownership along two dimensions:

- **By investor type:** The domestic capital stock is either foreign-owned or locally owned, with the industry-i and region-q-specific capital foreign capital ownership shares defined as $FORSHR(i,q)$ in equation (2.13). Income from locally owned capital accrues to households. Where that capital is not personal income tax exempt, e.g., as is the case for owner occupied dwellings, the income is subject to personal income tax;
- **By income type:** Capital income is also identified as being either franked or unfranked, with the share of franked dividends received by capital owner type $o \in \{Loc, Fgn\}$ defined as $FSHARE(o)$. While $FSHARE("Fgn")$ is non-zero (because foreign investors do own some shares that pay franked dividends), they are not permitted to claim back those franking credits in VURMTAX. As such, we include the parameter $FCLAIM(o)$. In the baseline forecast for VURMTAX, we then set $FCLAIM("Fgn") = 0$. $FCLAIM("Loc")$ and $FSHARE(o)$ are then calibrated such that the ratio of franked dividends claimed as personal income tax offsets relative to aggregate company tax paid is equal to 33 per cent. This matches the average claim ratio in ATO Taxation Statistics for Australian companies over the time period spanning 2010-11 to 2013-14.

Via a detailed study of Australia's double taxation treaties (DTT) with all DTT partners[59], we account for the impact treaty agreements have in reducing withholding tax liabilities of foreign investors who receive unfranked dividend payments. This provides the necessary framework to study the regional, industry and economic welfare impacts of changes in Australia's interconnected personal and corporate income tax systems.

In order to model Australia's system of dividend imputation, we allow tax credits attached to franked dividends paid by companies to local capital owners to be claimed by those owners as an offset on their personal income tax liabilities. This is achieved using the framework developed in Dixon and Nassios (2018a). This yields the following expression for personal income tax collections (*PITTAX*) in VURMTAX, in terms of the flat-rate personal income tax rate T_{PIT}:

$$PITTAX = T_{PIT} \cdot PITBASE \; - PI \cdot FCRED \tag{12.1}$$

[59] We rely on Treaty Information and Implementation documents compiled and documented by The Treasury at https://treasury.gov.au/tax-treaties/income-tax-treaties

where

$$PITBASE \;\; = DEDPIT \cdot (LABIN + NOTRET \cdot CAPIN[1 - T_{CAP} \cdot DEDCIT] + PI \cdot FCRED) \qquad (12.2)$$

Where:

LABIN is labour income earned by households;

CAPIN is taxable capital income earned by households. This includes, for example, income earned from rented low- and high-density housing, but excludes imputed owner-occupied housing rents. The public sector is also assumed to be personal income tax exempt;

FCRED is the aggregate dollar value of franking credits claimed by households in their tax returns;

PI is the degree to which franking credits paid to households can be claimed back to offset personal income tax liabilities. This variable takes the default value of 1;

DEDPIT is the impact of tax-free thresholds and tax deductions on the personal income tax base, calibrated to ensure the average tax rate in VURMTAX equals the Australian average personal income tax rate set out in the Parliamentary Budget Office (2017) report of 23.9 per cent. This yields a value for *DEDPIT* of 82.7 per cent;

DEDCIT is the impact of interest expense deductibility on Australia's corporate income tax base. We calibrate the share of interest expense deductions claimed by industries in VURMTAX to the share Australian corporates claimed in ATO Taxation statistics, relative to corporate earnings before interest and tax (EBIT). This reduces the corporate income tax base in VURMTAX, relative to a base equal to aggregate capital income, by 38.3 per cent. Reflecting this, we set the value of *DEDCIT* to 0.617, which yields an economy-wide average company tax rate of 17.9 per cent that is of similar order to the US Congressional Budget Office (2017) estimate for Australia of 17.0 per cent;

NOTRET is the impact of retained corporate profits, which reduces personal income tax liabilities on corporate income earned by households. In VURMTAX, the share of retained profit is set to 20 per cent by setting *NOTRET* equal to 0.8, which yields a payout ratio of 80 per cent that is similar to the economy-wide payout ratio in Australia in 2015 (Bergmann 2016).

In this framework, pre-tax rates of return on capital in Australia are industry- and region-specific, but do not differ across capital owners, i.e., foreign investors and local investors own the same type of industry- and region-specific capital. Post-tax rates of return differ however: for local investors, the tax rate on capital income is generally set by the personal income tax rate, after allowances are made for allowable deductions and retained earnings (which are not taxed at the personal income tax rate herein). Where locally owned capital does not pay franked dividends, some double taxation of capital income accruing to local investors is also recognised. Foreign investors generally pay the corporate tax rate, less allowances for deductions and double taxation treaty concessions.

Together with VURMTAX's upward-sloping labour supply specification, the framework outlined herein provides sufficient detail to study the impact of: (i) adjustment in the average rate of personal income tax in Australia; (ii) changes in corporate interest deductibility; (iii) changes in foreign taxation treaty agreements; (iv) long-run trends in dividend payout ratios; and (v) partial (or complete) scale back in Australia's dividend imputation system (see for example Dixon and Nassios (2018b).

12.2 Marginal and average excess burdens of flat-rate personal income tax

Using VURMTAX, we performed two simulations:

(1) We accommodate a marginal increase in the personal income tax rate, which yields an additional A$100m in personal income tax collections. The results are used to evaluate the MEB of Australia's personal income tax at the national-level; and
(2) The personal income tax is removed to determine the AEB of this tax at the national-level.

Our simulation results for excess burdens are reported in Table 12-1. From Table 12-1, we see that the MEB of a flat-rate personal income tax system in Australia is 39 cents per dollar of net revenue, which as expected lies slightly above the average excess burden of 34 per cent.

12.3 Macroeconomic impacts

The long-run (2040, fifteen years post tax policy shock) macroeconomic impacts of a (i) small rise in the personal income tax rate that yields an A$100m increase in tax-specific collections; and (ii) removal of the personal income tax, are summarised in column [1] and column [2] of Table 12-2. State results are given in Table 12-2(a), while national results are provided in Table

12-2(b) and (c). We study the impact of removing the tax, i.e., the outputs in column [2]. While the direction and magnitude of the simulation results for any given variable differ, the relative impacts on the variables are similar between the two simulations. Hence, an explanation of results for one column serves as an explanation of results for the other column.

Focusing on the national results in Table 12-2 (b), from row 24 in column [2] of Table 12-2(b), we see a strong rise in the post-tax consumer wage (+20 per cent) in response to removal of the personal income tax. This drives a significant long-run expansion in employment (+3.34 per cent in row 22 of column [2] in Table 12-2(b)), because the participation rate increases in response to the rise in the post-tax real wage.

Why does the capital stock rise so sharply (+6.67 per cent in row 21 of column [2] in Table 12-2(b)) in the long-run? In VURMTAX, as discussed in section 12.1, corporate equity income that accrues to local investors is taxed at the personal income tax rate. Removing the personal income tax increases the post-tax rate of return for local equity investors, relative to foreign equity investors. [60] This drives the capital stock above baseline. With the capital stock and employment above baseline in the long-run, real GDP is also elevated relative to baseline (+3.1 per cent in row 14 of column [2] in Table 12-2(b)), with the capital/output ratio rising (because capital growth exceeds the growth in real GDP), and the investment/GDP ratio also rises.

While also increasing the share of the domestic equity stock owned by locals, which pushes net inflows of foreign capital income to Australia towards surplus. All else equal, this pushes the income account towards surplus. With the income account tending towards surplus, real national income rises relative to real GDP (rows 14 and 20 in column [2] of Table 12-2(b)). Because national income increases relative to real GDP, real private and public consumption also rise relative to real GDP (rows 14, 15 and 16 in column [2] of Table 12-2(b)). With real private and public consumption, and real investment, all rising relative to real GDP, real GNE rises relative to real GDP and the real balance of trade moves towards deficit (see rows 18 and 19 in column [2] of Table 12-2(b)).

How is this growth in the national capital stock financed, in light of deterioration in the trade balance? As a single country model of a small, open economy, at the margin new investment

[60] Foreign investors benefit indirectly from removal of personal income taxes because employment increases, which drives up the marginal product of local and foreign-owned capital.

in the capital stock VURMTAX is foreign-financed. This foreign financing requirement can be met in two ways: either via an increase in foreign equity capital inflows, or via an increase in net foreign debt. With foreign equity shares tied down by changes in relative post-tax rates of return on equity between local and foreign investors, the trade deficit that arises when we cut the personal income tax rate is financed by foreign debt. In VURMTAX, Australia is assumed to pay a fixed real interest rate on its stock of foreign debt. Importantly, the rate of interest on net foreign debt is lower than the rate of return on Australian equity. This ensures the income account surplus caused by the increase in local ownership of the domestic equity stock, is preserved despite the increase in net foreign debt payments.[61] Our findings are therefore sensitive to changes in the

For this reason, while personal income tax cuts increase local ownership shares of the domestic stock of equity capital, they also drive up the stock of net foreign debt. At the margin, new capital investment in Australia is therefore financed by an increase in foreign debt, rather than foreign equity. This change in the national capital structure drives the income account balance towards surplus, which buoys real GNI relative to real GDP.

12.4 **Industry impacts**

Table 12-3 shows results for output in the ANZSIC-level 1 industries in NSW. The table is structured in a similar way to Table 12-2; column [1] and column [2] summarise the impacts of a A$100m rise in personal income tax collections and removal of the personal income tax respectively. As in section 12.3, we focus exclusively on the impact on NSW industry of personal income tax removal. As highlighted in column [2] of Table 12-3, all NSW industries benefit from removal of the personal income tax. Consistent with the expansion in labour supply at the macro level, the biggest beneficiaries are labour-intensive industries such as Accommodation and food services (+7.04 per cent) and financial and insurance services (+6.24 per cent), while the output of construction (+6.68 per cent) rises in line with the rise in real investment. Expansion of export-oriented sectors such as Agriculture, forestry and fishing is constrained by the supply of fixed factors (land in this case). Other sectors, such as Transport, the Public sector, Business services and Manufacturing all expand in line with the growth in NSW GSP, which from row 5 of column [2] in Table 12-2(a) rises by 5.29 per cent, which exceeds the rise in real GDP (+4.36 per cent).

[61] Our findings are therefore sensitive to changes in our assumed real interest rate on foreign debt.

12.5 **Conclusions**

In this section, we have described how a flat-rate personal income tax system has been modelled in VURMTAX. This system takes explicit account of the role franking credits play in Australia's personal income tax system. Interestingly, we find that personal income tax cuts. In our macroeconomic discussion, we highlight why removal of such a tax drives an expansion of Australia's capital/output and capital/labour ratios. The key to understanding this result lies in understanding the compositional shift a reduction in the personal income tax rate causes on the stock of Australian net foreign liabilities: at the margin, Australian investment is financed less by foreign equity investment, and more via foreign debt. We also summarise the key long-run industry impacts at the ANZSIC-1 aggregate level.

12.6 **Tables**

Table 12-1: Marginal and average excess burdens (in cents-per-dollar-of-tax-revenue generated) caused by changes in the personal income tax rate in Australia.

	MEBs	AEBs
Personal income tax rate		
National	39	34

Table 12-2: State and national level macroeconomic impacts in 2040, due to a A$100m rise in personal income tax collections or removal of personal income tax in Australia

		Column [1] PIT rate Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	**Column [2]** Remove personal income tax Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	(a) NSW state-level results		
1	Price deflator, GSP	0.000	0.642
2	Capital stock (rental weights)	-0.004	8.116
3	Real investment	-0.004	7.303
4	Employment	-0.002	4.190
5	Real GSP	-0.003	5.287
6	Real private consumption	-0.004	7.131
7	Real public (state) consumption	-0.004	7.131
8	Imports, volume	-0.003	6.232
9	Exports, volume	0.002	-3.164
10	Real post-tax consumer wage	-0.002	3.413
11	Real producer wage	-0.001	2.283
12	Tax base ($m)	-20.613	41099.200
13	Aggregate tax revenue ($m)	-3.070	6135.910
	(b) National results		
14	Real GDP	-0.002	4.361
15	Real private consumption	-0.003	5.392
16	Real public (state and federal) consumption	-0.003	5.325
17	Real investment	-0.003	6.381
18	Real exports	0.002	-1.313
19	Real imports	-0.003	5.338
20	Real GNI	-0.003	5.559
21	Capital stock (rental weights)	-0.003	6.673
22	Employment	-0.002	3.335
23	Capital rentals (investment-price deflated)	0.002	-5.271
24	Real post-tax consumer wage	-0.009	22.134
25	Real producer wage	-0.001	2.587
26	Terms of trade	0.000	0.413
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	0.000	0.082
29	Tax base (all states and federal, $m)	-54.613	103952.100
30	Aggregate tax revenue (all states and federal, $m)	156.609	-324997.430
	(c) Change expressed as percent of GDP		
31	Balance of trade	0.001	-1.126

Table 12-3: NSW industry impacts in 2040 due to a small rise in the personal income tax rate, or removal of personal income tax in Australia

		Column [1] PIT rate Effects on real industry output % deviation from baseline, 2040	Column [2] Remove personal income tax Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	0.00	-0.91
2	Mining	0.00	-0.47
3	Manufacturing	0.00	2.06
4	Electricity, gas, water and waste services	0.00	4.09
5	Construction	0.00	6.68
6	Wholesale trade	0.00	4.75
7	Retail trade	0.00	5.68
8	Accommodation and food services	0.00	7.04
9	Transport, postal and warehousing	0.00	2.26
10	Information media and communications	0.00	5.25
11	Financial and insurance services	0.00	6.24
12	Dwelling ownership	0.00	4.87
13	Business services	0.00	5.11
14	Public administration and safety	0.00	5.87
15	Education and training	0.00	4.94
16	Health care and social assistance	0.00	6.15
17	Other services	0.00	6.61

13 Corporate income tax

13.1 **Introduction**

This section summarises recent work by Dixon and Nassios (2018a), which builds on previous work by Dixon and Nassios (2016) on corporate income tax (or company tax). Whereas Dixon and Nassios (2016) use a national model of Australia to study corporate tax cut implications under an assumption that all dividends received by local investors were fully franked, herein we embed previous model developments in our multi-regional recursive-dynamic model of Australia's states and territories, VURMTAX. We build on this work, by including a more detailed account of the franked/unfranked ownership split for local and foreign capital owners, while also modelling partial claim back of franking credits by local investors. Interest deductibility is also explicitly recognised, reducing the effective tax rate on capital relative to the statutory tax rate on capital. Via a detailed study of Australia's double taxation treaties (DTT) with all DTT partners, we also account for the impact treaty agreements have in reducing withholding tax liabilities of foreign investors who receive unfranked dividend payments. This provides the necessary framework to study the regional, industry and economic welfare impacts of changes in Australia's corporate tax rate.

We structure our analysis of Australia's corporate tax system as follows. To begin, a supply-and-demand overview of the market for capital is described, which elucidates the key issues in modelling a cut to company tax. Next, we describe the simulation conducted using VURMTAX and provide excess burden results from our modelling of company tax. Third, we describe a simulation in which company tax is cut by a hypothetical 5 percentage points for all businesses. This simulation helps to uncover some of the key results from a cut to company tax, and to explain the unconventional results of some of the excess burden calculations. Finally, we provide an attribution analysis, which serves to highlight the key points of difference between the analysis provided here, and previous studies of Australia's company tax system by KPMG-Econtech (2010), Cao *et al.* (2015), Koupouritsas *et al.* (2016) and Murphy (2016).

13.2 **A supply-demand framework for company tax**

Figure 13-1: The market for capital in Australia

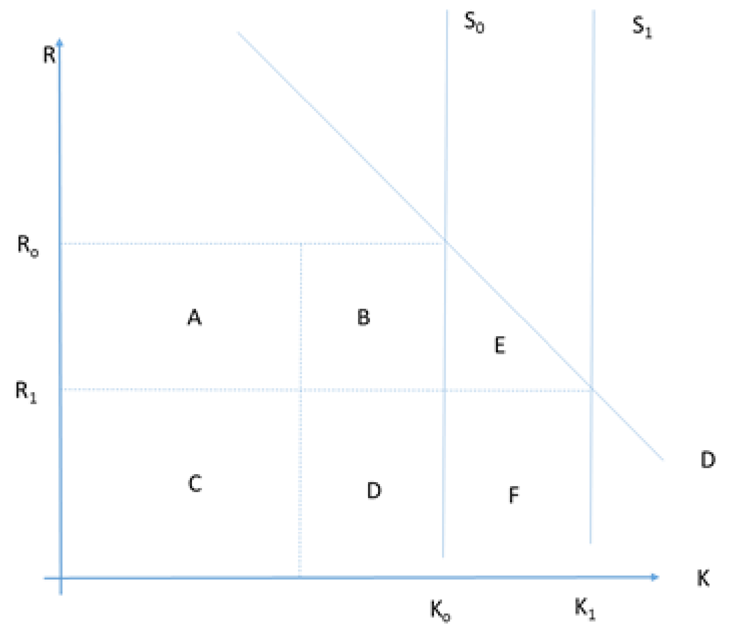

Figure 13.1 shows a supply and demand diagram for capital. Suppose initially that demand is given by *D*, and supply by S_0, such that each unit of capital stock generates pre-tax rental income of R_o. Capital income is taxed at the rate 100*(1-R_1/R_0)% (e.g. 30%), that is, post tax rental income is equal to R_1. Total capital income, equal to K_oR_o, accrues to three beneficiaries: domestic owners of capital receive C, foreign owners receive *D*, and the government receives tax revenue *A*+*B*. Under Australia's system of dividend imputation, a large proportion of *A* is returned to domestic capital owners through the personal income tax system.

In the short run, supply of capital is fixed, as new capital takes time to install. If the company tax rate was cut to zero, instead of accruing to government, in the short run *A* and *B* would accrue to the domestic and foreign owners of capital respectively. On the current account, the income account deficit would increase by *B*, as this amount accrues to foreign capital owners instead of the domestic government. The stock of net foreign liabilities would also increase by *B*, leading to an increase in interest payments in future years.

In response to the hypothetical elimination of company tax, the capital supply curve would shift rightward over a period of several years as the result of a positive investment response to higher post-tax rates of return. Assuming Australia is a price-taker on world capital markets, this process would continue, with the capital stock growing and the marginal product of capital falling, until in the long run the (pre- and post-tax) rental price of capital reached R_1.

Aggregate capital income is now K_1R_1. We assume that capital creation is funded at the margin by foreign investors, for two reasons. Firstly, under full dividend imputation the company tax rate for domestic capital is already zero, so a change in the tax rate makes no difference. Secondly, to the extent that imputed credits are not fully claimed, there is a change in the tax rate, but the domestic response to this change is limited by availability of domestic savings to fund new capital.

Of aggregate capital income K_1R_1, C accrues to domestic owners of capital, and D+F accrues to foreign owners of capital. A+B+E now accrues to other factors of production, chiefly labour.

To summarise, under a non-zero rate of company tax, such as $100*(1-R_1/R_0)$% depicted in Figure 13.1, the capital income that accrues to domestic agents (government and local owners of capital) is equivalent to A+B+C, while D accrues to non-residents. The immediate impact of eliminating company tax is to transfer B to non-residents.

The long run impact of eliminating company tax is that domestic residents (through their ownership of factors of production other than capital) gradually regain B, and gain E. That is, A+B transfers from government to labour, and E is gained, also by labour. Domestic capital owners retain C, while foreign capital owners retain D and gain F.

A simple long run view that the average excess burden of company tax is equal to $E/(A+B)$ ignores the fact that B is a valuable source of foreign taxation income that would be temporarily lost in the transition to a zero tax rate. In our dynamic analysis, the up-front loss of B is explicitly taken into account, as is the long run gain of E. Furthermore, as we shall illustrate in section 13.7, the effect of adding B to net foreign liabilities and the subsequent impact of interest payments on the current account is included.[62]

[62] In making this statement, we are assuming real consumption does not fall in response to the foreign windfall gain and reduction in national income. VURMTAX does not make such an assumption. As such, reductions in the corporate tax rate drive short-run falls in real consumption, because the average propensity to consume is sticky in the short-run. Real consumption thus moves in a similar way to national income. In the long-run, we allow for adjustment in real consumption relative to national income via endogenous determination of the propensity to consume, which adjusts to stabilise the deviation of net foreign liabilities relative to national income.

13.3 The excess burden of company tax in a dividend imputation system with partial foreign capital ownership

Because company tax is levied by the federal government, we do not report state-level results herein. In line with the approach outlined in section 3.5, we use equation (3.5) to calculate the national excess burden from two experiments:

1. A small rise in Australia's company tax rate that yields A$100m in revenue, which yields the marginal excess burden of the tax;
2. Removal of Australia's company tax, which yields the average excess burden.

Table 13-1 summarises our results, which are both negative and therefore in line with previous studies of the impact of a cut to the Australian company tax rate by Dixon and Nassios (2016). We find the marginal excess burden is -27 cents per dollar of net revenue in the long-run, which herein is defined as being twenty-one years post the initial tax policy shock. The average excess burden is -32 cents per dollar of net revenue.

Focusing on the average excess burden result herein for simplicity, under the (dynamic) simulation framework applied in VURMTAX we capture the up-front transfer to foreign investors caused by elimination of Australia's company tax. Because existing foreign investors willingly invested at the post-tax rate of return on investment offered in Australia at the current company tax rate of 30 cents per dollar of net profit, eliminating company tax delivers those investors a windfall gain. This reduces long-run GNI and thus national welfare, which materialises via a negative average excess burden. This result conflicts with several other analyses of Australia's corporate tax system, in particular those by Cao *et al.* (2015) and Murphy (2016). To highlight the key points of difference between these analyses, we provide an attribution analysis of our findings relative to the long-run comparative static CGE analysis by Cao *et al.* (2015). Our attribution analysis is reported in section 13.7. As we shall show, capturing the up-front foreign transfer that arises when company tax rates are altered materially impacts the overall excess burden estimate; this transfer is not captured by long-run comparative static CGE analyses. With no notion of a time-transition path in comparative static analyses, there is no scope to model the impact of upfront foreign windfall gains on economic welfare. As we shall discuss, a long-run comparative static analysis of a company tax cut can therefore be thought of as a dynamic analysis, under an assumption that any changes in the tax rate on capital income are grandfathered.

Prior to providing our attribution study, we give a brief discussion of the macroeconomic and industry impacts of a small rise in Australia's corporate tax rate, and removal of Australian company tax. We then consider the impact of the Federal Government's proposed 5 percentage point cut to Australia's company tax rate.

13.4 Macroeconomic impacts

The long-run (2034, fifteen years post-tax policy shock) macroeconomic impacts of a (i) small rise in the company tax rate that yields an A$100m increase in tax-specific collections; and (ii) removal of company tax, are summarised in column [1] and column [2] of Table 13-2. State results are given in Table 13-2(a), while national results are provided in Table 13-2(b) and (c). As in previous chapters, we study the impact of removing the tax, i.e., the outputs in column [2]. While the direction and magnitude of the simulation results for any given variable differ, the relative impacts on the variables are similar between the two simulations. Hence, an explanation of results for one column serves as an explanation of results for the other column.

Focusing on the national results in Table 13-2(b), removing a tax on capital increases the post-tax rate of return on capital in the short-run. This stimulates short-run investment and strong growth in the capital stock in the long-run (+3.68 per cent, see row 21 in column [2] of Table 13-2(b)), which increases the capital/output ratio (real GDP grows by 1.3 per cent from column [2] in Table 13-2(b), which trails the growth in the national capital stock). With capital stocks increasing, the capital-to-labour ratio also increases, which drives real wage growth (+2.28 per cent in row 24 of column [2] in Table 13-2(b)). Capital rentals also fall in the long-run (-4.70 per cent in row 23 of column [2] in Table 13-2(b)), because of the elevated capital/labour ratio. In contrast, elevated capital/labour ratios drive real consumer wages up relative to baseline in the long-run, which drives an increase in labour force participation and an expansion in long-run labour supply and employment (+0.29 per cent in row 22 of column [2] in Table 13-2(b)).

The results presented thus far are uncontroversial: real GDP, the capital stock and employment all rise, with wages also above baseline. Critically though, because of Australia's dividend imputation system, the post-tax rate of return on investment by locals is largely governed by the personal income tax rate[63]. The investment stimulus is thus largely financed by the foreigner, for whom the company tax cut increases the post-tax rate of return irrespective of

[63] This is particularly true for companies that operate domestically and thus pay Australian company tax, which is distributed as a franking credit when dividends are paid.

whether distributions are franked or unfranked. With an increase in foreign ownership of capital, the foreign capital income account moves towards deficit. This drives the income account balance towards deficit, which drives real gross national income (GNI) down in both absolute terms, and relative to GDP (-0.442 per cent in row 20 of column [2] in Table 13-2(b)). Thus, public and private consumption fall relative to baseline when we cut the corporate income tax rate (-1.67 per cent and -1.62 per cent in row 16 and row 15 of column [2] in Table 13-2(b), respectively).

Because we require net foreign liabilities to stabilise relative to GDP in the long-run, the trade account balance is required to move towards surplus: this drives an increase in long-run exports (+8.6 per cent in row 18 of column [2] in Table 13-2(b)) relative to imports (-0.498 per cent in row 19 of column [2] in Table 13-2(b)). This requires real devaluation, which sees the terms of trade fall relative to baseline (-2.13 per cent in row 26 of column [2] in Table 13-2(b)).

13.5 **Industry impacts**

Table 13-3 shows results for output in the ANZSIC-level 1 industries in NSW. The table is structured in a similar way to Table 13-2; column [1] and column [2] summarise the impacts of a A$100m rise in company tax collections or removal of company tax. Real devaluation and an increase in the economy-wide capital-labour ratio favours export-oriented, capital intensive industries. It is therefore unsurprising to see the Mining industry as a key beneficiary of elimination of company tax, with its output in NSW increasing by 8.35 per cent relative to baseline.

Transport, Public sector, Wholesale trade, Business services and Manufacturing all show positive effects, because NSW GSP is elevated relative to baseline.

Elsewhere, industries with higher degrees of foreign ownership expand relative to industries with little or no foreign ownership. As a result, industries that are assumed to be domestically owned, e.g., education and dwelling services, experience little or no output expansion in NSW, because local investors do not benefit from the company tax cut. Labour-intensive industries also suffer; this is because wages rise, which increases the cost of a key primary factor of production. This damages sectors such as Accommodation and food, whose output contracts by 2.5 per cent. Sectors that service the government (such as public administration) or households (such as Health care and social assistance, retail trade and other services) experience reductions in output, because national income falls relative to baseline, driving real public and private consumption down. Despite strong growth in exports, export-oriented industries such as Agriculture, forestry and fishing experience muted expansion (+0.63 per cent), because this industry is intensive in the use of a fixed factor (land) and labour, and is therefore impacted by the rise in wages.

Our analysis points to significant dispersion of industry outcomes when company tax rates are cut in Australia. This impact is pronounced, particularly relative to other taxes studied herein. Company tax cuts may therefore generate greater adjustment costs than other taxes, and the cost of this compositional change in output may be an important metric with which to gauge the impact of company tax cuts. This may mean that workers are obliged to retrain or relocate.

13.6 Illustrative dynamic results: Reducing the company tax rate in Australia by 5 percentage points

Finally, in this section we present some general results from a simulated, uniform reduction of 5 percentage points in the rate of company tax in 2019. The cut to company tax is hypothetical only; we assume the cut is funded via a non-distortionary lump sum tax on Australian households.[64] Additionally, key differences are evident when compared to the federal government's company tax cut package, specifically in the timing of the tax cut.

Nevertheless, we simulate a company tax rate cut, with a reduction from 30 per cent to 25 per cent. Because VURMTAX recognises that corporate tax is levied on company profits net of interest payments (so that the effective company tax rate on gross operating surplus in Australia lies below the statutory rate of 30 percent), a five percentage point cut in the corporate tax rate amounts to a 3.05 percentage point reduction in the tax rate on GOS. This tax cut accrues to both local and foreign owners of Australian capital. The key distinction between local and foreign investors then lies in their capacity to reclaim the company tax that is paid as a franked dividend. Because local investors pay personal income tax, they are able to claim franking credits as a discount on their personal income tax liabilities. Therefore, when the company tax rate is cut in Australia, we see an overall reduction in company tax paid, but an increase in personal income tax collections, because local owners of capital paying franked dividends ultimately pay their personal income tax rate on all income (both labour and capital) earned. This is evident in Figure 13-3.[65]

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[64] The region incidence of the lump sum tax is distributed on a per-capita basis.

[65] The local receipt of franked versus unfranked dividend payments is calibrated based on the ATO's 2014-15 Taxation Statistics data on Households, Superannuation Funds, Trusts, Partnerships, Charities and companies. Based on this data, we determined that approximately 10 per cent of franking credits distributed each period are

The immediate effect of a cut to company tax is to increase post-tax rates of return on capital. This creates an investment stimulus, and a small employment stimulus in the short-run. Figure 13-2 shows that the employment stimulus remains elevated in the long-run, because the labour-supply schedule in VURMTAX is upward sloping.

As a result of the increase in investment activity, the capital stock expands. Despite an increase in long-run employment, the economy-wide ratio of capital-to-labour increases, leading to an acceleration in real wage growth. The real wage settles at around 0.4 per cent above the baseline in the long-run.

The increase in capital stocks and employment leads to a long-run increase in real GDP. As such, the excess burden of taxation when measured with reference to GDP is positive, as is the case with other taxes. That is, the GDP result suggests that company tax imposes a cost to society. However, the story does not end here for company tax. Because the new capital is funded mainly by foreign investment, the impacts on gross national income (GNI) and GDP differ. This renders GDP a poor indicator of domestic welfare. In fact, Figure 13-4 shows that while there is an increase in real GDP, real GNI declines.

There are two phases in the evolution of the long run GNI result. Firstly, in 2019, the year of the company tax cut, there is a sharp fall in GNI. This is explained by the fall in tax revenue derived from the foreign owners of capital, area *B* in Figure 13-1. After 2020, employment gradually eases towards a long-run level that is about 0.1 percentage point above the baseline, via an increase in the national participation rate (caused by higher long-run real wages). The new capital created in response to the tax cut becomes the primary driver of GDP growth, because the capital/labour ratio increases. Because this capital income accrues mainly to the foreign owners of capital, GNI growth steadies and follows a similar pattern to long-run employment; it does not however recover the initial upfront deviation from the GDP result.

The final, long-run phase is also impacted by foreign debt. In our analysis, we seek to account for the problem that a long-run gain in GDP is a false measure of welfare if it is accompanied

not claimed. In addition, we determined that local investors received a dollar value of franking credits that is consistent with a 45/55 per cent ownership split of shares that pay franked dividends, versus shares that pay unfranked dividends. For non-resident investors, this share was determined to be 43/57 per cent. VURMTAX allows franked ownership shares of investors to adjust to changes in the post-tax rate of returns on franked versus unfranked capital, via a CET function that is parameterized by post-tax rates of return on capital by investor type. All else being equal, small increases in company tax rates therefore raise less revenue than otherwise anticipated at the current franked/unfranked ownership split, because local investors increase their ownership of shares paying franked dividends as opposed to those paying unfranked dividends.

by a growing level of debt relative to income. In the long-run, we move to a solution that is compatible with a sustainable level of net foreign liabilities relative to national income, via the sticky savings adjustment mechanism described in section 3.3. Figure 13-5 plots the deviation in the ratio of net foreign liabilities to GNI over the simulation period from the baseline forecast. In the long-run, we see that this ratio increases by 0.009 units, or 0.9 percent, from the baseline forecast level. The deviation from the baseline settles at this level, because the national savings rate increases. We recognise that economic growth driven by foreign-funded capital is a legitimate route to welfare gains and do not seek to return the ratio net foreign liabilities to GNI to its base case level. However, from 2022 onwards, we model a gradual stabilisation in the ratio of net foreign liabilities to GDP.

This is achieved by adjustment in the savings rate adjusts, until net foreign liabilities stabilise at a level that is 0.8 percent of GNI higher than in the base case. For net foreign liabilities to stabilise, the current account balance needs to move towards surplus. With the factors determining the income account balance fixed in place, this move is achieved through an increase in the savings rate and a balance of trade surplus. For the trade account balance to move towards surplus, real devaluation is required.

Figure 13.5 shows results for the expenditure composition of GDP. It shows that in the long-run, exports and investment account for a larger share of GDP, while absorption accounts for a smaller share. The results for exports and investment are as we expect: investment is larger to maintain a larger capital stock, while exports are larger to stabilise net foreign liabilities and fund profit repatriation.

13.7 Key differences between CoPS modelling and Cao *et al.* (2015)

Cognisant of the fact that the key conclusions from our study of the impact of company tax reform in Australia differ from the findings presented by Cao *et al.* (2015) and Murphy (2016), in this section we focus on attributing the differences between our key results and those by Cao *et al.* (2015). In studying Cao *et al.* (2015) report, we identified several differences in methodology and parameter assumptions:

1. Export demand (trade) elasticities in Cao *et al.* (2015) vary between -6 (for industries such as Mining) and -12, i.e., a classical small-country assumption with little scope for movements in export prices. In VURMTAX, we assume the trade elasticity is uniform across commodities and equal to -4; see section 3.3.2. Relative to the excess burden of company tax derived using VURMTAX, this parameterization biases the result derived

by Cao *et al.* (2015) up, because it damps the responsiveness of Australia's terms of trade to changes in the company tax rate;

2. The magnitude of labour-capital substitution elasticities applied by Cao *et al.* (2015) are equal to 0.9, which is much higher than the value of 0.4 traditionally adopted in VURMTAX; see section 3.3.1. Relative to the excess burdens reported herein, higher labour-capital substitution elasticities bias results upwards, because the capital/labour ratio is permitted to rise further in response to a company tax cut;

3. Other parameterization differences are evident across the two models. For example, whereas VURMTAX assumes no price-induced substitution between intermediate inputs and primary factor inputs to industry production, i.e., a Leontief production function governs industry production, Cao *et al.* (2015) allow some substitution via a CES production function where the substitution elasticity is set equal to 0.2. As we shall show, this has little explanatory power when it comes to attributing differences in relative company tax excess burden estimates.

The remaining three differences between Cao *et al.* (2015) and the analysis herein are methodological.

4. Cao *et al.* (2015) assume foreign owned capital shares to be homogeneous across industries, and equal to 20.7 per cent. VURMTAX carries theory that allows for inhomogeneous foreign capital ownership shares across Australian states/territories and industries. We use this theoretical structure to reflect the findings by Connolly and Orsmond (2011), allowing for higher foreign ownership shares in key export- and capital-intensive sectors, e.g., mining and LNG. States/territories that are intensive in mining and LNG production, are therefore more reliant on foreign capital. Additionally, we assume the company-tax-exempt dwelling and public service sectors to be overwhelmingly domestically-owned, with an average foreign ownership share for privately-owned capital of 20 percent.

5. Cao *et al.* (2015) assume that the stock of domestically owned capital is invariant. Based on the description in Cao *et al.* (2015), this is achieved via endogenous determination of the national savings rate. In VURMTAX, we assume that the national savings rate is sticky in the short-run, and adjusts in the long-run to stabilize the growth in net foreign liabilities relative to GNI. For a more detailed description of this mechanism, see section

3.2. As we shall show, the excess burden is generally insensitive to changes in the national savings rate, which is in line with similar findings by Cao *et al.* (2015);

6. Cao *et al.* (2015) utilize a comparative-static CGE model that operates under a long-run closure. As discussed in section 3 and by Dixon and Nassios (2018a), VURMTAX is a dynamic model that operates under a default assumption of adaptive investor expectations. In this framework, the economy transitions from a short-run environment of fixed real wages and capital stocks, to a long-run closure where capital stocks can adjust to drive rates of return on capital back to baseline and the unemployment rate returns to baseline via real consumer wage adjustment. This difference in modelling methodology is important, because comparative-static models operating under a long-run closure do not capture the upfront transfer to foreign investors that arises when company tax rates fall.

To illustrate the incremental impact of these differences on the marginal excess burden of a company tax cut, we performed eight simulations in VURMTAX. First, we simulate the impact of a 0.04 percentage point rise in the company tax rate. This is sufficient to raise A$100m in additional company tax revenue in 2019, using the standard parameterisation in VURMTAX. This simulation is identical to the one used to evaluate the long-run marginal excess burden reported in Table 13-1; see the results of this simulation in 2040 summarised therein. Seven additional simulations are then used to evaluate the impact of parameter assumption, model methodology and time dynamics on the marginal excess burden calculated using VURMTAX. These additional simulations are:

1. In simulation [1], we alter the standard VURMTAX parameterization by setting all export demand elasticities for Agriculture, Mining, Education and Tourism services to -6. All remaining export demand elasticities are set to -12. The shock is identical to simulation [1]. This flattens commodity-specific export demand curves, muting the terms of trade response to a change in the company tax rate;

2. In simulation [2] we set the labour/capital substitution elasticity to 0.9 across all 76 VURMTAX industries. All other parameter settings and the model closure are set in line with the default VURMTAX calibration described in section 3. This further damps the economy-wide capital stock. The capital/labour ratio therefore falls, relative to its levels under the default calibration of VURMTAX. National income and the MEB fall relative to the results derived under a standard parameterization of VURMTAX;

3. In simulation [3] we allow for price-induced substitution between intermediate and primary factor inputs to production by setting the substitution elasticity to 0.2. All other parameter settings and the model closure are set in line with the default VURMTAX calibration described in section 3. As we show, this has little impact on the national MEB of a company tax cut;
4. In simulation [4], we assume the share of foreign-owned capital is homogeneous across all 76 industries in VURMTAX. In so doing, we do not alter the share of the national capital stock that is foreign-owned capital. Instead, the stock of foreign-owned capital is re-distributed across industries in such a way that the average foreign ownership share is identical to the industry-by-industry foreign ownership share. All other parameters and closure assumption remain unaltered;
5. Simulation [5] is concerned with isolating the impact of differing assumptions of the national savings rate response to changes in the company tax rate. As such, we modify the default closure by deactivating the sticky savings rate adjustment mechanism, i.e., the APC of households remains at its baseline level;
6. To demonstrate the impact of dynamics, we quarantine foreign-owned capital installed at the time of the tax rate cut from the policy change, i.e., we simulate a rise in the corporate tax rate on newly-installed capital only. As the existing capital depreciates over time and is replaced, that new capital pays the new (higher) rate of 30.04 per cent. This deactivates an important feature of dynamic CGE analyses of company tax cuts, i.e., the upfront benefit (because we are raising the rate and raising revenue on existing foreign-owned capital stocks in turn) of the policy is no longer realized because the rate cut is grandfathered, in order to illustrate the effective impact of foreign windfall gains.
7. In simulation [7], we simultaneously implement all the changes studied in simulations [1] – [6], to examine their combined impacts.

Because we simulate the impact of an identical tax cut in 2019 in simulation [1] – [7], we can study the sensitivity of the MEB of company tax to changes in model parameterisation and methodology. This facilitates an attribution analysis.

We present MEB results over a twenty-one year time horizon (2019 – 2040) in Figure 13-7. The results in Figure 13-7 can be understood in the following way. The **green bars** and solid line with square markers map out the time-path of the year-on-year excess burden of a 0.04

percentage point company tax rate rise. As shown in Figure 13-7, under a standard VURMTAX parameterisation the MEB settles at -27 per cent in the long-run (2040). The negative excess burden is in sharp contrast to Cao *et al.* (2015), whose long-run comparative static result (ignoring profit shifting) of a marginal change in the company tax rate is equal to 42 per cent (see the **dark blue dot** in Figure 13-7).[66] The remaining coloured bars in Figure 13-7 map the incremental impact of each of the changes outlined previously in points [1] – [6]. When simulated in combination, i.e., we run simulation [7] described previously, the aggregate impact of each of these changes on the standard VURMTAX result (which we remind the reader is represented by the green bars in Figure 13-7), is summarised by the solid line with circle markers in Figure 13-7. The solid line with circle markers is therefore the time-path of the MEB of Australia's company tax, simulated using VURMTAX, under the parametrisation and closure in simulation [7]. In what follows, we summarise Figure 13-7:

- **Green bars**: Our standard dynamic MEB of company tax derived using VURMTAX, which is stable in year-on-year terms and equal to -27 per cent in the long-run;
- **Purple bars**: Relatively elastic export demand schedules mute the terms of trade impact of company tax rate rises in VURMTAX. The impact of this rise in the terms of trade response on the marginal excess burden is emphasised by the purple bars in Figure 13-7. In muting the rise in the terms of trade, relatively elastic export demand curves also mute the rise in national income. This elevates the MEB of a company tax cut. Overall, the MEB with elastic export demand curves rises 25 cents in the dollar relative to our default parameter setting, from -27 to -2 cents in the dollar;
- **Light blue bars:** Higher labour/capital substitution elasticities reduce the domestic capital stock relative to its level under a standard VURMTAX parameterisation, which also damps the real wage response. Via equation (3.1), this damps the long-run labour supply response to a company tax cut slightly; with real wage adjustment in the long-run assumed to drive unemployment rates back to their baseline levels, a smaller reduction in long-run labour supply drives a smaller reduction in long-run employment. The impact on capital stocks is more pronounced however, so higher labour/capital

[66] Profit shifting plays a relatively small role in driving the excess burden of company tax based on sensitivity analysis conducted by Cao *et al.* (2015). This is highlighted in Figure 13-7, where we include Treasury's result both with profit shifting (red dot in 2044) and without profit shifting (blue dot). In VURMTAX, we assume the proclivity to shift profits from Australia remains unaltered in response to changes in Australia's company tax rate.

substitution elasticities drive the capital/labour ratio, and thus national income, lower. Incrementally, this drives the MEB up by 25 cents in the dollar in 2040. The excess burden therefore once more increases from -27 to -2 cents in the dollar in 2040;

- **Red bars:** The impact of allowing intermediate input substitution is small: in incremental terms, the MEB falls by 2 cents in the dollar, from -27 cents to -29 cents in the dollar;
- **Grey bars:** Summarise the impact of adjusting the industry composition of foreign-owned capital. Reducing foreign ownership of capital in the mining and resources industries, comes at the expense of increasing foreign ownership of traditionally tax-exempt industries, such as the public service industries. Adjusting foreign capital ownership patterns across industries therefore damp the upfront costs of the rate rise on existing foreign-owned capital. This drives both national income and the MEB higher. In incremental terms, the MEB increases by 19 cents in the dollar in 2040, from -27 cents to -8 cents in the dollar;
- **Light green bars:** In incremental terms, moving to an exogenous national savings rate and relaxing our constraint on net foreign liability (NFL) accumulation has a small impact on the long-run national income level. As such, the impact on the MEB in incremental terms is small (+9 cents in dollar in 2040);
- **Orange bars:** Capture the impact of grandfathering the tax cut. No upfront transfer from existing foreign investors arises as a result. This significantly damps national income, particularly in the short-run, and thus the MEB (see Figure 13-7). Because exempt capital depreciates over time, the impact of grandfathering also diminishes over time; in the short-run, it is the dominant effect in the short-run, whereas by 2040 it is responsible for an incremental gain of 6 cents per dollar in the MEB.

In implementing each of the six modifications described in points [1] – [6], simulation [7] also takes account of interaction effects between the respective changes. These damp the overall impact on the marginal excess burden of each of the changes we have thus far considered in isolation. This interaction effect damps the MEB response by 11 cents per dollar of revenue raised, relative to a simple sum of the aforementioned long-run MEB responses.

Nevertheless, with all modifications active in simulation [7], VURMTAX yields an estimate for the MEB of Australian company tax rate of +37 cents in the dollar in 2040 (twenty-one years post-simulation). Differences in modelling methodology (specifically recursive time dynamics, and inhomogeneous foreign capital ownership patterns across industries) and parameterisation (principally, differences in export demand and labour/capital substitution elasticities) between the study presented herein and Cao *et al.* (2015), therefore explain 93 per cent of the discrepancy between the two sets of MEB estimates.

We suspect the remainder of the differences are a result of other methodological and parameterisation differences, with very little difference attributable to our use of real national income (leisure-adjusted) in lieu of measures of consumer welfare, e.g., equivalent variation.

13.8 **Conclusions**

In this section, we have summarised many of the key macroeconomic and distributional impacts of changes in Australia's company tax policy. This has been achieved via a detailed analysis of the macroeconomic and industry impacts of changes in Australia's company tax rate. Interestingly, we find the marginal and average excess burdens of company tax in Australia lie below zero, i.e., there is a marginal benefit to Australia's company tax system. We provide a detailed attribution of this result to past work, particularly that by Cao *et al.* (2015), who use a long-run comparative static CGE model to study Australia's tax system. This attribution accounts for 93 percent of the difference between the result by Cao *et al.* (2015) and the result reported herein. Substitution elasticities and foreign capital ownership shares are key drivers. Our parameter choices are motivated in section 3.3.1. Our use of a dynamic model that captures the impact of foreign windfall gains on the initial capital stock is important in highlighting where costs materialise: in the short-run, where the impact of grandfathering the rate changes is most pronounced.

13.9 **Tables and Figures**

Table 13-1: Marginal and average excess burdens (in cents-per-dollar-of-tax-revenue generated) caused by changes in the corporate income tax rate in Australia

	MEB	AEB
	Company tax rate	
National	-27	-32

Table 13-2: State and national level macroeconomic impacts in 2040, due to a A$100m rise in company tax collections or removal of company tax in Australia

		Column [1] CIT rate Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	**Column [2]** Remove company tax Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
		(a) NSW state-level results	
1	Price deflator, GSP	0.001	-0.444
2	Capital stock (rental weights)	-0.002	1.703
3	Real investment	0.000	0.106
4	Employment	0.001	-0.997
5	Real GSP	0.000	-0.247
6	Real private consumption	0.004	-2.842
7	Real public (state) consumption	0.004	-2.842
8	Imports, volume	0.002	-1.273
9	Exports, volume	-0.010	8.230
10	Real post-tax consumer wage	-0.003	1.916
11	Real producer wage	-0.004	2.565
12	Tax base ($m)	10.170	-6943.440
13	Aggregate tax revenue ($m)	1.490	-1174.380
		(b) National results	
14	Real GDP	-0.002	1.304
15	Real private consumption	0.002	-1.666
16	Real public (state and federal) consumption	0.002	-1.622
17	Real investment	-0.004	2.632
18	Real exports	-0.011	8.629
19	Real imports	0.001	-0.498
20	Real GNI	0.001	-0.618
21	Capital stock (rental weights)	-0.005	3.680
22	Employment	0.000	0.294
23	Capital rentals (investment-price deflated)	0.007	-4.700
24	Real post-tax consumer wage	-0.003	2.282
25	Real producer wage	-0.003	2.334
26	Terms of trade	0.003	-2.125
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	0.000	-0.051
29	Tax base (all states and federal, $m)	-1.423	3516.060
30	Aggregate tax revenue (all states and federal, $m)	96.809	-71524.500
		(c) Change expressed as percent of GDP	
31	Balance of trade	-0.002	1.336

Table 13-3: NSW industry impacts in 2040, due to a A$100m rise in company tax collections or removal of company tax in Australia

		CIT rate Effects on real industry output % deviation from baseline, 2040	Remove company tax Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	0.00	0.63
2	Mining	-0.01	8.35
3	Manufacturing	-0.01	4.84
4	Electricity, gas, water and waste services	0.00	0.79
5	Construction	0.00	-0.20
6	Wholesale trade	0.00	0.05
7	Retail trade	0.00	-1.47
8	Accommodation and food services	0.00	-2.54
9	Transport, postal and warehousing	0.00	1.99
10	Information media and communications	0.00	0.01
11	Financial and insurance services	0.00	0.19
12	Dwelling ownership	0.00	-1.70
13	Business services	0.00	0.72
14	Public administration and safety	0.00	-1.83
15	Education and training	0.00	-2.26
16	Health care and social assistance	0.00	-2.93
17	Other services	0.00	-1.65

Figure 13-2: Employment, capital, real wage and real GDP impacts of a five percentage point cut to the company tax rate in Australia

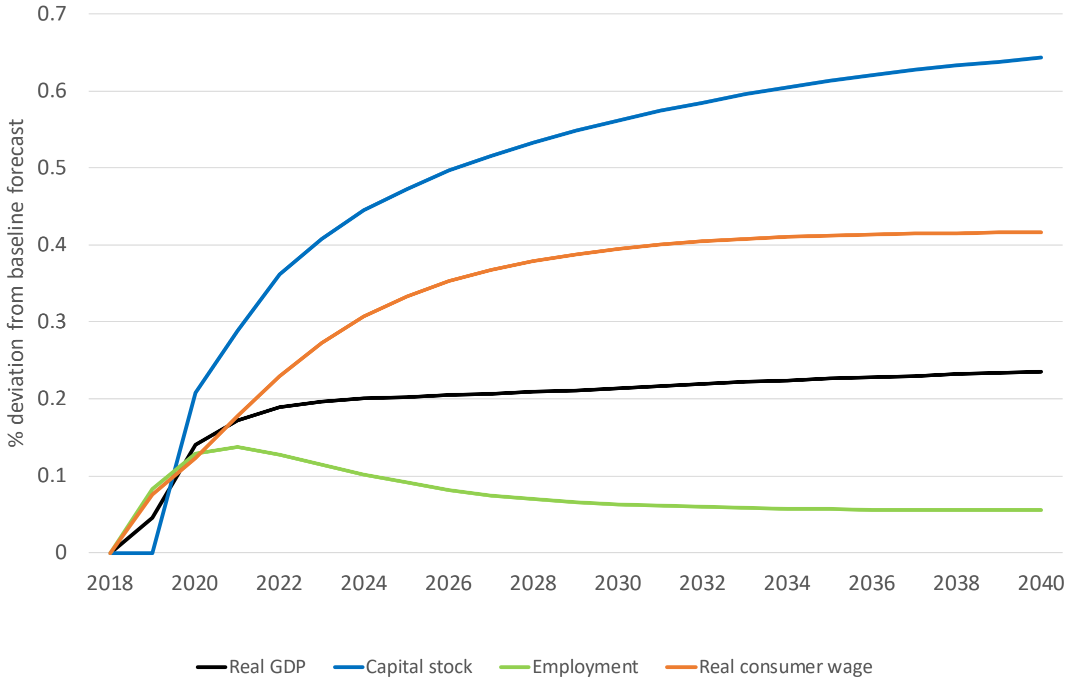


Figure 13-3: Company tax and personal income tax collection movements in response to a five percentage point cut to company tax in Australia

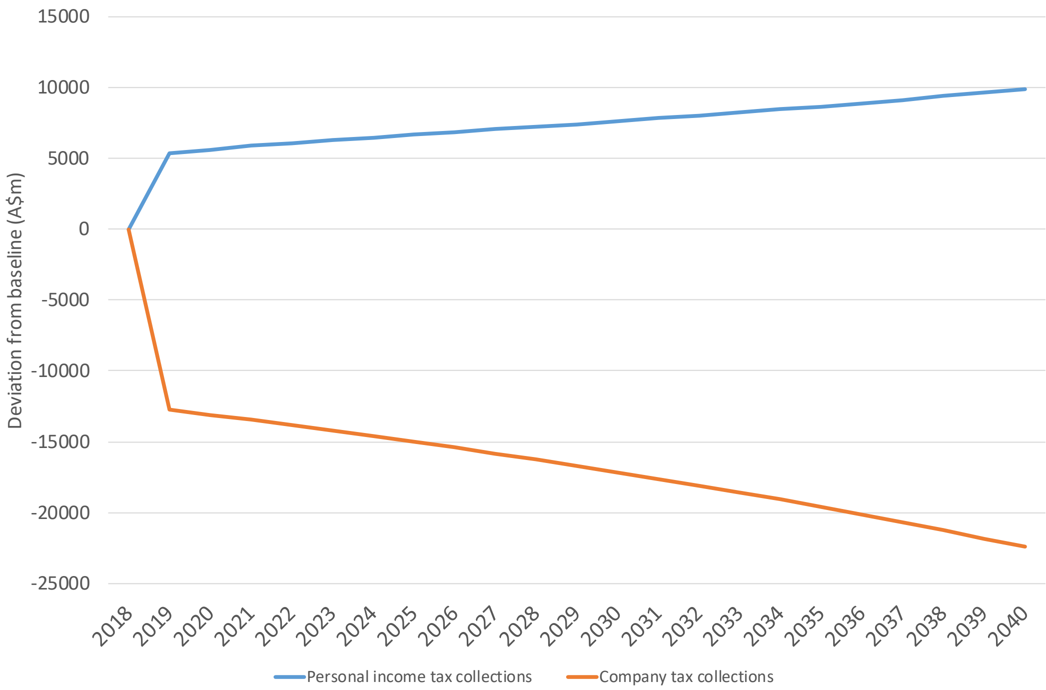


Figure 13-4: Impact on real GDP and GNI of a five percentage point cut to company tax

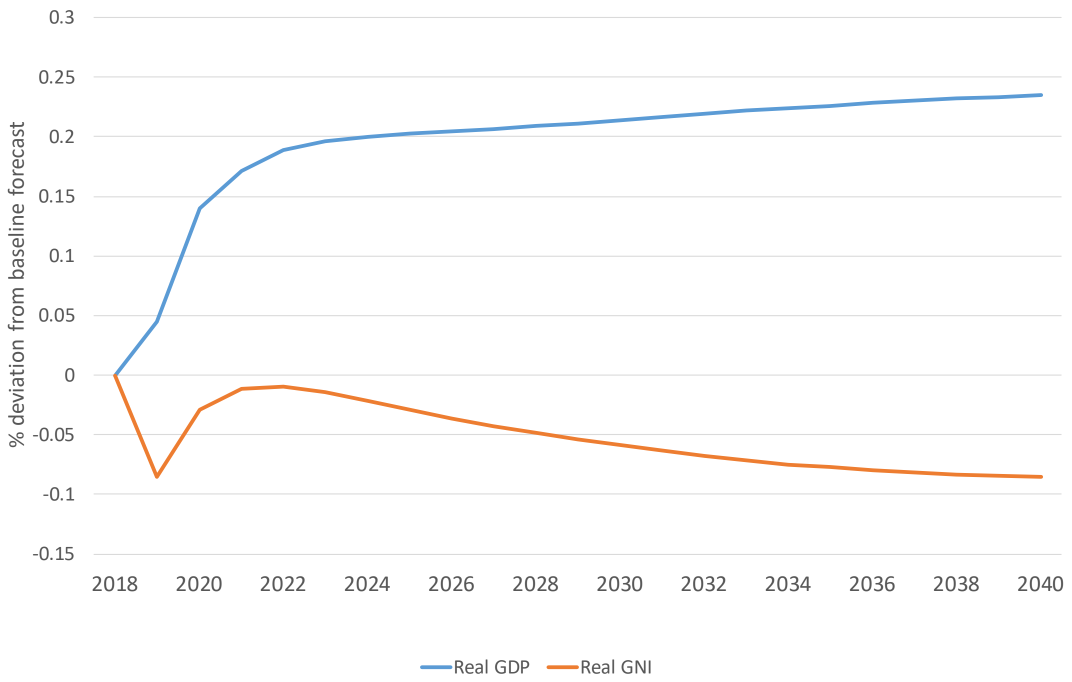


Figure 13-5: Change in the ratio of net foreign liabilities to GDP as a result of a five percentage point cut to company tax

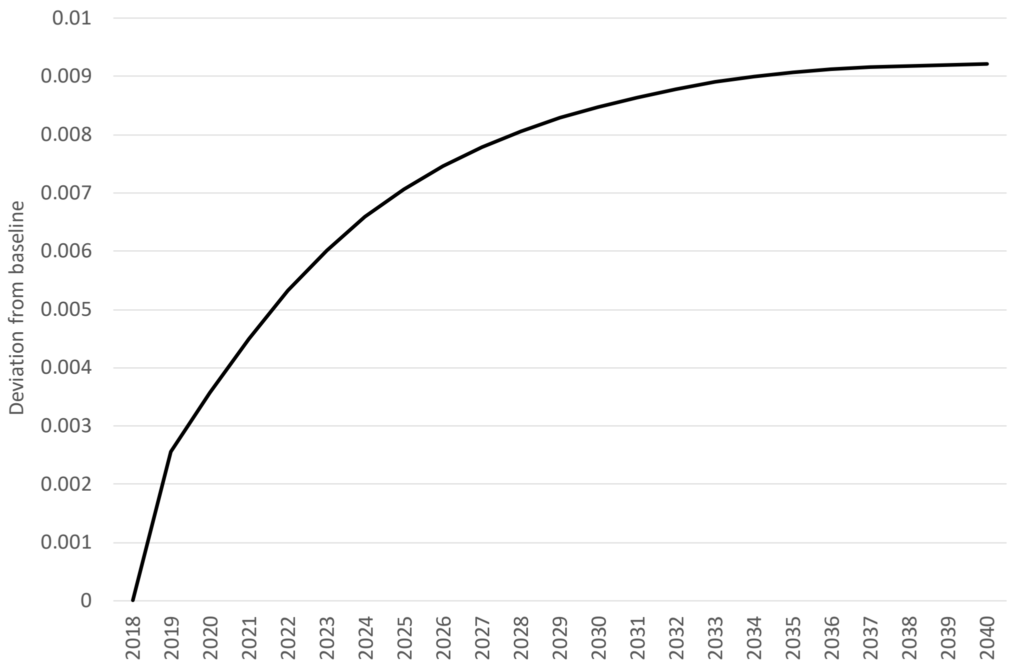


Figure 13-6: Changes to the expenditure composition of GDP as a result of a 5 percentage point cut to company tax

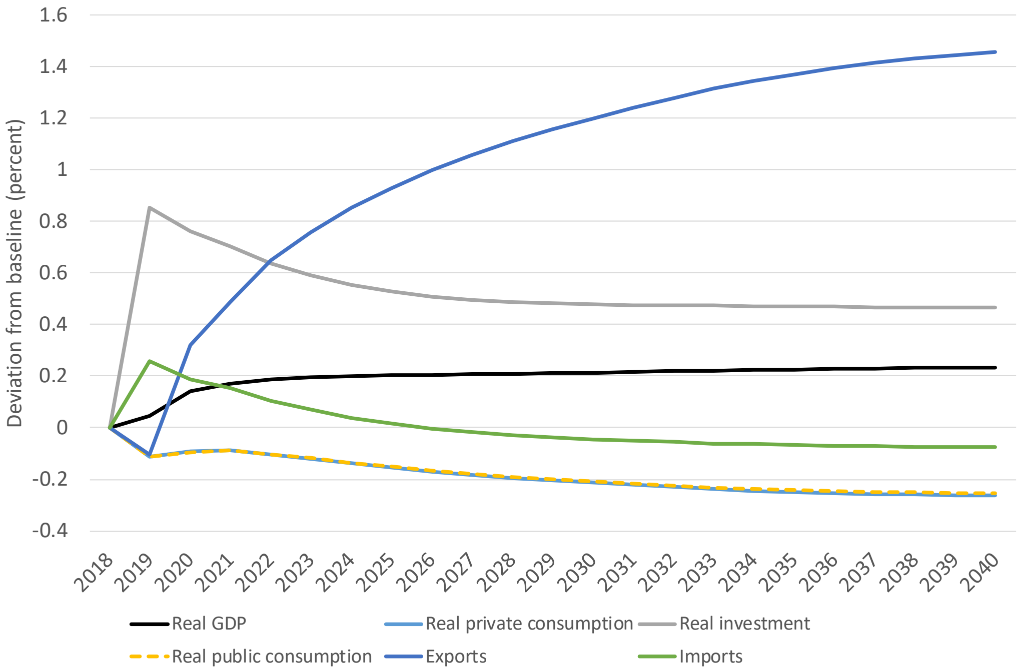
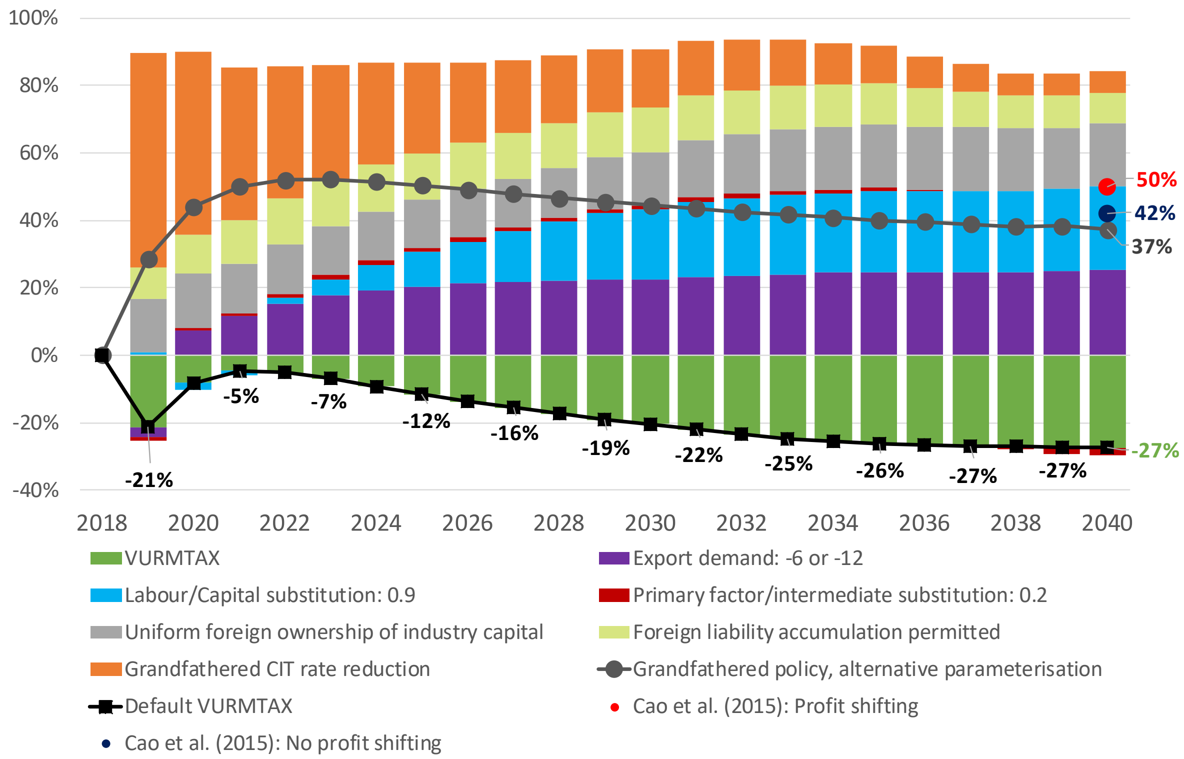


Figure 13-7: Attribution of CoPS' modelling of the marginal excess burden of company tax in Australia to Cao *et al.* (2015)



14 GST

14.1 **Introduction**

An ideal GST system (i.e., one imposing the lowest allocative efficiency and compliance costs) is characterised by a single rate on domestic sales, a zero rate on exports, and no exemptions (Tait, 1988 and Ebrill *et al*., 2001). Under this system, producers and importers charge GST on sales to all users (producers, capital creators, exports and consumers). However, the GST rate on exports is zero, and the effective rates are zero on inputs to production and capital formation because producers fully reclaim GST on inputs. Only on consumption are effective tax rates the same as legislated tax rates. Hence, a GST with these characteristics acts like a consumption tax. Early computable general equilibrium (CGE) studies of the effects of a GST modelled the tax in this way (Ballard *et al*., 1987; Kehoe *et al*., 1988). However, in practice, GST systems depart from the ideal system in many respects. Implemented GST systems can have multiple tax rates, multiple exemptions, different registration rates across sectors, sectoral limitations on GST refunds, informal activity, taxation of exports, and undeclared imports.

In broad terms, the Australian GST system follows the general pattern of the ideal system. For most commodities, a single 10% rate is levied on domestic sales, exports are taxed at 0%, and producers and investors can reclaim GST on inputs. However, there are a number of departures from the ideal system:

1. Domestic sales of a number of commodities have GST-free status (i.e. they are taxed at 0%). Producers collect no GST on sales of GST-free commodities, but can still claim GST on inputs. Examples of GST-free supplies include: most basic foods, educational courses, health services, health insurance, many medical aids and appliances, religious services, water services, sewerage and drainage services, and transport of passengers to and from Australia.

2. Supplies of a number of commodities are input-taxed (or in terms of the international VAT terminology, they are "GST exempt"). Input-taxed services include finance, life insurance, and the selling or renting of existing residential premises. For these services, producers charge no GST, but they are also unable to reclaim GST paid on production inputs. GST on inputs to production of exempt commodities passes into the input cost stream for these commodities, and is passed on as higher purchaser prices to users of the commodities, irrespective of whether they be consumers, foreigner buyers, or domestic producers and capital creators. This creates

tax cascading effects, with positive effective GST rates faced by all producers and foreigners purchasing the exempt goods.

3. Producers with turnover of $AUD 75,000 or less can choose whether to register for GST. Unregistered producers cannot charge GST on sales and cannot reclaim GST paid on inputs. This creates an additional source of input-taxed sales. Because non-registered firms can exist in any industry, sales of all products have the potential to be input-taxed to some degree.

4. A number of imported goods are GST exempt. These include imports falling below the low value threshold of $AUD1000,[67] and a number of goods with import-duty-free status.[68]

5. Not all exports are taxed at the zero rate. In particular, GST is collected on commodities purchased locally by non-residents (such as foreign tourists and students). A refund for GST under the Tourist Refund Scheme can only be claimed for a small subset of goods purchased locally by non-residents (DIBP 2017), and many visitors who can reclaim GST do not do so.

The first efforts to model the implemented features of the Australian GST system were undertaken by Dixon and Rimmer (1999). They used publicly available price results from the Commonwealth Treasury's price input-output model to infer the publicly unavailable Treasury assumptions about the net effects for commodity and user-specific indirect tax rates implied by the replacement of the wholesale sales tax by the GST. Dixon and Rimmer thus carried assumptions about changes in indirect tax rates on intermediate inputs, capital formation, and exports, and hence represented a departure from the traditional CGE modelling of GST systems based on the ideal system. However, the Dixon and Rimmer modelling did not explicitly model the details of the Australian GST system. There have been some general equilibrium studies which account for different VAT rates and exemptions, albeit while assuming that given sectors are either fully taxed or fully exempt (Gottfried and Wiegard 1991, Marks 2005, Toh and Lin 2005). Giesecke and Tran (2010) account for multi-production, differentiated degrees of exemption by commodity and user, and hence industry-specific differences in the refundability of VAT paid on inputs to production and investment. Giesecke and Tran (2012) further developed this system to include differentiated VAT registration rates, undeclared imports,

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[67] From 1 July 2018, GST will be imposed on low value imports of physical goods imported by consumers (Source: https://www.ato.gov.au/General/New-legislation/In-detail/Indirect-taxes/GST/GST-on-low-value-imported-goods/).

[68] These include goods of a scientific, educational or cultural kind; goods for international bodies or persons; goods relating to offshore areas; and goods that are personal effects.

unclaimed tax on purchases by tourists, and general and transaction-specific compliance rates. While noting the model's potential for embedding within a wider CGE framework, Giesecke and Tran (2012) used their model to examine VAT compliance rates outside of a CGE system. In this paper, we extend the Giesecke and Tran (2012) system by adding regional detail. We then embed the system within a multi-regional model of the Australian economy. This allows us to examine the consequences for Australia and its regions of the full details of the GST system as legislated.

As discussed in Giesecke and Tran (2012), a detailed GST modelling framework is important in CGE analysis of GST issues for two reasons. First, it allows GST payments to be correctly represented in the CGE model database. This is important for two reasons. First, ensuring that the database correctly represents the GST payment system is essential if we are to have an initial solution to our CGE model that is consistent with a theory of the GST as implemented. The alternative is to implement a naive GST theory that explains disaggregated "observed" (i.e. database value) GST revenues as a simple product of a tax base and an effective tax rate, thereby ignoring the complex reality of the tax system as legislated. Second, and irrespective of whether the model contains detailed GST theory, the correct representation of the distribution of indirect taxation in the model's initial database is important for welfare analysis. An important influence on the measured welfare consequences of policy change are allocative efficiency effects. These allocative efficiency effects depend on changes in economic activity across sectors with different rates of net indirect taxation. As such, accurate calculation of allocative efficiency effects depends on accurate representation of the distribution of indirect tax liabilities within the CGE model's database. The measured allocative efficiency effects from GST change will be miscalculated if GST is distributed across the wrong bases in the model's database. There is evidence of this in the ABS-supplied input-output data (ABS 2016a). The ABS data show no GST imposed on intermediate inputs to any industries other than the financial and dwelling sectors. This implies 100% GST registration rates across all industries and no informal activity. This effectively narrows the GST base, and as a result, we see in the ABS data implied GST rates that exceed the legislated 10% rate for a number of product flows.

Second, it allows the model's tax theory to carry the full details of the GST system as actually implemented. This improves the modelling of the relative price consequences of changes in the GST system, whether these changes come in the form of changes in rates, exemptions, registration rates, or other factors. This is so for two reasons. First, without theory describing the full detail of the GST, modellers must calculate changes in effective indirect tax rates outside of the model. Such calculations easily overlook the interplay between legislated rates, exemptions, and refund rates. Second, GST theory embedded within a wider CGE framework allows effective GST rates to be influenced by endogenous changes in economic structure. For example, the effective input taxation of a sector can be influenced by endogenous changes in the division of the sector's activity across production of exempt and non-exempt commodities.

A third benefit from explicit modelling of GST detail emerges when we investigate the regional consequences of changes in the GST. While the GST Act does not provide for differential treatment for GST purposes across regions, as we shall discuss there are several ways in which region-specific detail bear on the operations of the GST. These include the potential for regionally differentiated registration rates and propensities to import low value items, and the possibility that commodity and industry aggregation choices lead to the same sectors carrying different modelled legal GST rates and exemption factors across regions.

The work we present in this section is a summary of Giesecke and Tran (2017). The remainder of our GST section is structured as follows. The GST equation system of VURMTAX is presented in Section 14.2. The data sources for implementing the GST equation system are discussed in Section 14.3. Section 14.4 presents results of our marginal and average excess burden simulations.

14.2 **The VURMTAX GST theory**

Following Giesecke and Tran (2010, 2012, 2017), our detailed VURMTAX GST model recognises: different legislated tax rates across commodities; different legislated GST exemption statuses across commodities; different legislated capacities to reclaim GST paid on inputs to production and investment; different rates of registration for GST purposes across industries; effective taxation of exports via application of GST on domestic purchases by non-residents; and, the potential for incomplete GST collections due to non-compliance. Because the GST model is embedded within the multi-regional framework of VURM, it must also describe details of the legislated GST system as it relates to all commodities, from all sources, used by all agents in all regions. Consistent with the structure of VURM, the agents in the GST theory comprise industries, capital creators, and final demanders. The regions comprise the eight states and territories. The sources comprise the eight domestic regions plus imports. We expand below.

14.2.1 Modelling GST on sales to domestic users

We begin by calculating GST revenue collected on sales of commodity *c* from source *s* to domestic user *u* in region *r* as:

$$GST_{c,s,u,r} = LR_{c,s,u} \times TRBASE_{c,s,u,r} \times [1 - EEX_{c,s,u,r}][1 - REF_{u,r}] \times CR_{c,s,u,r} \qquad (E.1)$$

(c∈COM; s∈SRC; u∈DOMUSER, r∈REG)

where:

COM is the set of the model's 78 commodities.

REG is the set comprising Australia's eight states and territories.

SRC is the union of the set of eight domestic sources (REG) and the single foreign source (*foreign*).

IND is the set of the model's 76 producers.

INV is the set of the model's 76 creators of industry-specific capital.

DOMUSER is the set of all domestic users, comprising IND, INV, households, state and local government, and the federal government.

$LR_{c,s,u}$ is the legislated rate of GST levied on sales of commodity *c* from source *s* to user *u*.[69]

$GST_{c,s,u,r}$ is GST revenue from sales of commodity *c* from source *s* to user *u* in region *r*.

$TRBASE_{c,s,u,r}$ is the value of the transaction base on which GST is levied.

$EEX_{c,s,u,r}$ is the proportion of sales of commodity *c* from source *s* to user *u* in region *r* that is effectively GST exempt.

$REF_{u,r}$ is the proportion of GST paid on sales to user *u* in region *r* that is refundable.

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[69] The GST Act describes GST rates in terms of particular commodities. Hence the reader might wonder why source (*s*) and user (*u*) dimensions appear in our definition of LR. The *s* and *u* dimensions arise because the commodities represented in the model are aggregations of many detailed sub-products, which may have quite different GST characteristics. For example, the model commodity "insurance services" is an aggregation of health insurance, life insurance and many other types of insurance. Health insurance is GST-free, life insurance is input-taxed, and other types of insurance are taxable. The proportions of total insurance that these individual insurance products represent can differ across producing regions. Hence the *s* dimension on LR is needed. The proportions of these types of insurance product demanded by different users may also differ. For example, input-output data for the year 2013-14 (ABS 2016a) show that life and health insurance constitute 68% of all household purchases of insurance, whereas they are not purchased at all by other users. As a result, the LR values for insurance services in the model will be 3.17% for households, and 10% for other users.

$CR_{c,s,u,r}$ is the GST compliance rate for user *u* in region *r* with respect to purchases of commodity *c* from source *s*.

In (E.1), $LR_{c,s,u}$ and $CR_{c,s,u,r}$ are exogenous. $TRBASE_{c,s,u,d}$ is endogenous and calculated as the sum of other standard endogenous variables in VURM via:

$$TRBASE_{c,s,u,r} = VBAS_{c,s,u,r} + VTAX_{c,s,u,r} + \sum_{m \in MAR} VMAR_{c,s,u,r,m} \quad (E.2)$$

($c \in COM$; $s \in SRC$; $u \in DOMUSER$, $r \in REG$)

where $VBAS_{c,s,u,r}$ is the basic value of commodity *c* from source *s* purchased by user *u* in region *r*; $VTAX_{c,s,u,r}$ is the value of non-GST indirect taxes paid on these purchases, and $VMAR_{c,s,u,r,m}$ is the value of margin service *m* used to facilitate these purchases.

We endogenously determine the effective exemption rate ($EEX_{c,s,u,r}$) as a function of: (i) an exogenous legal exemption rate ($LEX_{c,s,u,r}$), i.e., the share of sales of commodity *c* from source *s* to user *u* in region *r* that are GST exempt by law;[70] and (ii) an endogenous de-facto exemption rate ($DEX_{c,s,u,r}$) arising from unregistered businesses, underground economic activity, household production for own use, and undeclared high-value imports.[71] That is,

$$EEX_{c,s,u,r} = LEX_{c,s,u,r} + (1 - LEX_{c,s,u,r}) \cdot DEX_{c,s,u,r} \quad (E.3)$$

($c \in COM$; $s \in SRC$; $u \in ALLUSER$, $r \in REG$)

where the set ALLUSER comprises DOMUSER and exports.

[70] The GST Act describes GST exemptions in terms of supply of particular commodities that are input-taxed. Hence the reader may wonder why source (*s*), user (*u*) and region (*r*) dimensions appear in our definition of LEX. Like our explanation in footnote 6 for LR, the dimensions *s* and *u* arise because model commodities may embody different proportions of exempt and non-exempt sales depending on source and user. Again we use the model's "insurance services" as an example. Life insurance is GST-exempt (i.e. LEX=1), whereas all other types of insurances are not (i.e. LEX=0). Input-output data for 2013-14 (ABS 2016a) show that life insurance constitutes 44% of all household purchases of insurance, whereas life insurance is not purchased by other users. As a result, LEX for insurance services will be 0.44 for households, and 0 for all other users. Another reason for the inclusion of the *u* dimension in LEX is that in some countries, different users may have differentiated GST-exemption statuses under tax law, even for the same detailed commodity. Including the *u* dimension extends the generality of our GST modelling framework. The *r* dimension arises because when we come to handling exempt imports, we are open to the possibility that the propensity to import low value items might differ across users and regions. For example, households in remote regions with limited local retail opportunities might have a higher propensity to import low value items relative to households in capital cities enjoying diverse shopping opportunities.

[71] E.g., purchases made by Australians while abroad of value above A$1000 and undeclared when returning home (e.g. jewelry, cameras).

In calculating $DEX_{c,s,u,r}$, we distinguish between domestically produced commodities and imports. For domestic commodities $(s \in REG)$, the de-facto exemption proportion depends on the proportion of activity within the industries producing the commodities that is undertaken by businesses that are unregistered for GST purposes. As outputs of registered businesses are taxable, the share of de-facto exemption for domestic good *c* in region *r* for all users will be one less the share of registered businesses in the production of *c*. That is, $DEX_{c,s,u,r}$ is endogenously calculated as:

$$DEX_{c,s,u,r} = 1 - \sum_{i \in IND} SJ_{c,s,i} \times REGIST_{i,s} \qquad \text{(E.4)}$$

$(c \in COM;\ s \in REG;\ u \in DOMUSER,\ r \in REG)$

where:

$REGIST_{i,s}$ is the proportion of the output of industry *i* in region *s* produced by businesses that are registered for the purposes of GST.

$SJ_{c,s,i}$ is the share of the output of commodity *c* from domestic source *s* produced by industry *i* in region *s*. $SJ_{c,s,i}$ is an endogenous variable, which can change in a multi-product environment with changing relative production costs and prices.

For imports, $DEX_{c,foreign,u,r}$ is calculated via:

$$DEX_{c,foreign,u,r} = ILM_{c,u,r} \qquad \text{(E.5)}$$

where $ILM_{c,u,r}$ is the proportion of imports of commodity *c* by user *u* in region *r* that are undeclared high-value imports (i.e. value of above $AUD1000).

$REGIST_{i,s}$ is the proportion of the output of industry *i* in region *s* produced by businesses that are registered for GST purposes. Via (E.6), we identify two sources of non-registration: businesses not required to be GST-registered by law, and businesses operating informally:

$$REGIST_{i,s} = (1\text{-}NRL_{i,s})(1\text{-}NRI_{i,s}), \quad i \in IND,\ s \in REG \qquad \text{(E.6)}$$

where

$\mathrm{NRL}_{i,s}$ is the proportion of the output of industry *i* in region *s* that is produced by firms that are legally permitted to not register for GST; and,

$\mathrm{NRI}_{i,s}$ is the proportion of the activity of industry *i* in region *s* generated by firms legally-required to register but who choose to operate informally and are not registered for the GST.

$\mathrm{REF}_{u,r}$ is the proportion of GST paid on purchases by user *u* in region *r* that is refundable. For industries undertaking current production, we recognise that the GST legislation only allows firms to claim refunds on GST to the extent that they are producing commodities that are not GST exempt. Hence, we calculate the industry refund factor via:

$$\mathrm{REF}_{i,s} = \mathrm{REGIST}_{i,s} \times \sum_{c \in COM} \mathrm{SO}_{c,i,s} \sum_{u \in USER} \sum_{r \in REG} \mathrm{SS}_{c,s,u,r}[1\text{-}\mathrm{LEX}_{c,s,u,r}] \tag{E.7}$$

$(i \in \mathrm{IND},\ \ s \in \mathrm{REG})$

where

$\mathrm{LEX}_{c,s,u,r}$ is the share of sales of commodity *c* from domestic source *s* to user *u* in region *r* that are GST exempt by law.

$\mathrm{REF}_{i,s}$ is the proportion of GST paid on intermediate inputs into production that is refunded.

$\mathrm{SO}_{c,i,s}$ is the share of regional industry *i,s*'s output accounted for by production of good *c*.

$\mathrm{SS}_{c,s,u,r}$ is the share of sales to user *u* in region *r* in total sales of domestic commodity *c* produced in region *s*.

For investment purposes, refund proportions are the same as those on intermediate inputs into production by the same industry. That is:

$$\mathrm{REF}_{k,r} = \sum_{i \in IND} \delta_{k,i} \mathrm{REF}_{i,r} \qquad (k \in INV) \tag{E.8}$$

where $\delta_{k,i}$ is 1 for *i* = *k* and 0 otherwise.

For households, there is no GST refund, hence $\mathrm{REF}_{\mathrm{households},r} = 0$. Government can claim all GST on their general expenditure, hence $\mathrm{REF}_{\mathrm{State\ gov},r} = \mathrm{REF}_{\mathrm{Fed\ gov},r} = 1$.

14.2.2 Modelling the GST on exports

For exports, we must simultaneously account for the zero rating of sales to offshore customers and the possibility that onshore sales to domestic non-residents, like foreign tourists and students, attract standard GST rates. Hence, we calculate GST collections on exports via:

$$\mathrm{GST}_{\mathrm{c,s,export}} = \mathrm{CR}_{\mathrm{c,s,export}} \times \left\{ \begin{array}{l} \left[\mathrm{LR}_{\mathrm{c,s,household}} \times \mathrm{SHNRES}_{\mathrm{c,s}} \times \mathrm{TRBASE}_{\mathrm{c,s,export}} \times (1-\mathrm{EEX}_{\mathrm{c,s,household}}) \times (1-\mathrm{REFEXP}_{c,s})\right] + \\ \mathrm{LR}_{\mathrm{c,s,export}} \times \left[(1-\mathrm{SHNRES}_{\mathrm{c,s}}) \times \mathrm{TRBASE}_{\mathrm{c,s,export}} \times (1-\mathrm{EEX}_{\mathrm{c,s,export}})\right] \end{array} \right\} \quad \text{(E.9)}$$

where:

$\mathrm{SHNRES}_{\mathrm{c,s}}$ is the share of total exports of commodity *c* from source *s* represented by on-shore sales to non-residents (like tourists).

$\mathrm{REFEXP}_{c,s}$ is the proportion of domestic sales of commodity *c* to non-residents in region *s* that is refunded under the Tourist Refund Scheme.

14.3 **Data**

In this section, we summarise the data required to parameterise VURMTAX's GST module. For a more detailed discussion, we refer the reader to Giesecke and Tran (2017). In summary, parameterisation of the VURMTAX GST module is based upon data from:

1. GST Act 1999 (ALII 2000). The Act is used to determine the GST base, GST rates and the level of input taxation for each product.

2. The Australian Taxation Office (ATO) GST webpage (ATO 2016a), particularly the GST food guide, and information on GST and residential premises. These provide detailed guidance on the taxable, tax-free and input-taxed status of food items and residential premises.

3. ABS supply, use and tax data for 1267 IOPC commodities for 2013-14 (ABS 2016a), and ABS input-output tables for 2013-14 (ABS 2016c).

4. ABS business count data (ABS 2015). These data are used to estimate the share of businesses that are registered for the GST for each industry in the model.

5. ABS data on the underground economy (ABS 2013). These data are used to estimate the share of activity that is not captured by the GST because of underground or informal activity.

6. Productivity Commission (2011) report on the retail industry. This report contains information on low value imports that are exempt from the GST.

7. ABS Tourism Satellite Account (ABS 2016b) and Tourism Research Australia (2017). These data are used to estimate the value of on-shore sales to visitors in Australia.

8. Department of Immigration and Border Protection (DIBP) webpage on Tourism Refund Scheme (DIBP 2017). This information is used to estimate the degree of GST refund for various tourism-related sales.

9. ATO Taxation Revenue (ATO 2016b), which reports GST revenues for the period 2001/02 to 2014/15. When brought together with the VURM database and VURM GST theory, the GST revenue data is used to calculate the economy-wide GST compliance rate.[72]

In general, we first calculate values for all variables at the 114 input-output commodity level (and in the case of legal rates and exemptions, at the 1267 input-output commodity level), before aggregating to VURM's 78 commodity level.

14.4 Simulation and macroeconomic impacts

The excess burden of the GST are calculated in VURMTAX using two experiments. Our MEB is estimated by simulating a A$100m rise in GST collections via GST rate adjustment, yielding a MEB of 15 cents per dollar of net tax revenue raised, while removal of the tax yields an AEB of 15 cents in the dollar.[73]

Table 14-2 describes long-run macroeconomic outcomes at the state and national levels under the AEB (complete removal of GST) and MEB ($100 m. rise in GST) simulations. While the direction and magnitude of the simulation results for any given variable differ, the relative impacts on the variables are similar between the two simulations. Hence, an explanation of results for one column serves as an explanation of results for the other column. As such, we focus on explaining the consequences of the full removal of the GST (column 2).

14.4.1 Macroeconomic impacts

We begin by noting that the consumer price level is the numeraire and thus its long-run deviation is zero (row 27). As discussed in Section 14.2, the GST is largely a tax on consumption. Hence, when we remove the GST, the consumer price index must fall relative to

[72] This rate comes out at 0.98. One interpretation of this figure is that our GST theory, when evaluated using the aforementioned data sources and integrated within VURMTAX and its database, does a remarkably good job of predicting actual ATO GST collections.

[73] The two excess burdens are identical to the nearest cent, however the marginal excess burden exceeds the average at the first decimal place (MEB: 15.2 cents, AEB: 14.7 cents).

other prices. This explains the rise in the real consumer wage (row 24). As discussed in section 3.1, our labour market theory carries a labour / leisure choice mechanism that renders the long-run labour supply schedule elastic to the real consumer wage. Hence, when the real consumer wage rises, so too does labour supply. In VURMTAX, gradual wage adjustment returns regional (and thus national) unemployment rates to baseline in the long-run. Hence, the long-run increase in labour supply is matched by a long-run increase in employment (row 22).

The long-run positive deviation in national employment (row 22), causes a positive deviation in the long-run national capital stock (row 21). If capital stocks were not free to adjust in the long-run, then the increase in national employment would cause the marginal physical product of capital to rise, and with it, the rate of return on capital. However, VURMTAX carries the assumption that investment in each industry in each region is a positive function of rates of return. This mechanism ensures that long-run capital stocks are free to adjust in order to maintain regional industry rates of return at or near normal levels. This explains why the long-run capital stock expands (row 21). In the absence of movement in the ratio of capital rental prices to wage rates, we would expect the expansion in the national capital stock to be very close to the value of the expansion in long-run employment. In Table 14-2 we see that the capital / labour ratio rises, with the capital stock deviation (+1.80%) exceeding the employment deviation (0.993%).

This rise in the national capital / labour ratio is the net outcome of two countervailing factors. First, the terms of trade decline (row 26, explained below). This damps the long-run deviation in the capital / labour ratio. However, this effect is more than offset by the removal of the GST. As discussed in in section 14.2, while the GST is largely a tax on consumption, elements of the GST fall on current production and capital formation. This occurs for two reasons. First, low levels of non-registration for GST purposes render all industries input-taxed to a small degree. Second, producers of GST exempt goods (like banking and finance) are fully input-taxed. This leads to some degree of production and investment taxation to the extent that these sectors sell their input-taxed production to producers and capital creators (who cannot reclaim GST embedded within the prices of goods produced by input-taxed sectors). Hence, when we remove the GST, while the main effect is to greatly reduce consumption taxation, we also remove small elements of production and investment taxation. For a given level of employment and given rates of return on capital, a reduction in taxation of production and investment raises the capital / labour ratio. This explains the increase in the long-run capital / labour ratio reported in Table 14-2.

With both the capital stock (row 21) and employment (row 22) above baseline, so too is real GDP (row 14). The positive deviation in GDP carries with it an expansion in demand for imports, both for input to production and capital formation, and for public and private current consumption. This causes the import volume deviation to be positive. As discussed in section 3.1, VURMTAX's modelling of net foreign liability accumulation ensures that the long-run balance of trade / GDP ratio remains close to its baseline value. Hence, the long-run positive deviation in the volume of imports must be matched by a long-run positive deviation in the volume of exports (rows 18 and 19). The positive deviation in the volume of exports explains the negative deviation in the terms of trade (row 26). The negative terms of trade deviation accounts for why the deviation in private and public consumption (rows 15 and 16) is less than the deviation in real GDP.

14.4.2 Industry impacts

We now turn to the outcomes for output by industry (Table 14-3). We begin by discussing the output deviations of the three top-ranked sectors, in particular: accommodation and foodservices; transport, postal and warehousing; and construction. As discussed in section 14.2, an unintended characteristic of the GST is that it falls upon export tourism. That is, when making on-shore purchases of commodities like hotel stays, restaurant meals, and taxi trips, foreign tourists must pay GST and cannot claim a refund on departure. Hence, when we remove the GST, the purchaser's price of export tourism falls, leading to an expansion in the volume of export tourism. The two sectors experiencing the largest positive deviation in output (accommodation and food services, and transport) are important providers of services to foreign tourists. This is also a factor in the positive output deviations for retail trade and communications. Generally, for both sectors, there is a strong propensity to track the GDP deviation (approximately half of communications output is used as intermediate input by other production sectors, and approximately one-third of retail margins facilitate intermediate input purchases). However, both sectors also have exposure to export tourism, which augments their output deviations relative to GDP. Retail margins attach to tourism-related exports sales of food, beverages, and other items that are subject to GST because the purchases are made on-shore. Hence, the removal of the GST raises retail trade activity relative to other sectors, because export sales of tourism commodities (like food and beverages) relying on retail margins are positively affected by the removal of the GST.

Approximately 7% of communications services are export sales, and of these, about 11% are on-shore sales to non-residents, and thus subject to the standard GST rate. Construction services is the third-highest ranked sector in terms of output deviation. Output of construction services is a key input to investment, and as a result, its output deviation is highly correlated with the deviation in aggregate investment. As discussed in the context of the macroeconomic outcomes, the long-run deviation in real investment exceeds the deviation in real GDP. Another factor supporting the deviation in construction output is the deviation in dwelling services output, which also exceeds the GDP deviation. This reflects the relatively high expenditure elasticity for dwellings.

We turn now to discuss the output deviations of the bottom-ranked sectors. As discussed above, the removal of the GST lowers the price of commodities related to export tourism (like accommodation and foodservices), causing an expansion in export volumes of these commodities. However, this in itself does not generate an expansion in aggregate export volumes, because aggregate export volumes are determined by the need to maintain a given balance of trade to GDP ratio (as discussed above in reference to Table 14-2). Hence, with one element of Australian export volumes expanding (foreign tourism) other elements must contract. This accounts for the contraction in the size of the mining sector (Table 14-3, row 2). It also contributes to the low ranking of the agriculture, forestry and fishing sector (Table 14-3, row 1). Among the remaining low-ranked sectors in terms of 2040 output deviation are health, education, and electricity, gas, water and waste services. Health, education, and water and drainage services are zero-rated under the GST. Hence, when the GST is eliminated, the relative price of these zero-rated commodities rises, inducing substitution away from these commodities. Another contributing factor to the low output ranking of health and education in particular is the relatively high share of their output sold to private and public consumption. As discussed above in the context of the macroeconomic results, the long-run deviation in private and public consumption is damped relative to GDP because of the negative deviation in the terms of trade.

14.5 Summary and conclusions

Our study suggests clear differences in the cross-state impact of removal of the GST. As is clear from a comparison of rows 5 and 14 of Table 14-2, removal of the GST causes the size of the NSW economy to expand relative to the nation as a whole. This is largely due to the importance of export tourism in NSW relative to Australia as a whole. As discussed above, removal of the

GST translates to a reduction in export taxation to the extent that the GST falls upon commodities purchased on-shore by non-residents, and to the extent that the GST collected in this way is not refunded upon departure. Using (E.10), a general measure of NSW's relative sensitivity to the export taxation elements of the GST can be calculated as the difference between the NSW and rest of Australian values for $\sum_c \left(\mathrm{TRBASE}_{\mathrm{c,s,export}} / \sum_i \mathrm{TRBASE}_{\mathrm{i,s,export}} \right) \cdot \mathrm{SHNRES}_{\mathrm{c,s}} \cdot (1 - \mathrm{REFEXP}_{c,s})$, that is, as the difference between the proportion of exports from each region that are subject to non-refunded GST. Using the VURMTAX database to evaluate these terms, we find that the difference between NSW and RoA is 0.081 (=0.176-0.095). Hence, we see that, relative to the rest of Australia, NSW exports are more weighted towards commodities that incur GST when purchased onshore by non-residents.

14.6 **Tables**

Table 14-1: Excess burden of the GST

	MEB	AEB
	GST	
National	15	15

Table 14-2: State and national level macroeconomic impacts in 2040, due to a A$100m rise in GST collections or removal of the GST in Australia

		Column [1] GST rate Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040	**Column [2]** Remove the GST Macroeconomic impacts % deviation from baseline (unless otherwise indicated), 2040
	NSW state-level results		
1	Price deflator, GSP	-0.003	1.533
2	Capital stock (rental weights)	-0.004	2.489
3	Real investment	-0.003	2.032
4	Employment	-0.002	1.415
5	Real GSP	-0.003	1.724
6	Real private consumption	-0.002	1.480
7	Real public (state) consumption	-0.002	1.480
8	Imports, volume	-0.004	2.191
9	Exports, volume	-0.007	4.839
10	Real consumer wage	-0.012	6.870
11	Real producer wage	-0.010	5.688
12	Tax base ($m)	-218.102	129450.000
13	Aggregate tax revenue ($m)	-7.640	4454.840
	National results		
14	Real GDP	-0.002	1.248
15	Real private consumption	-0.001	0.744
16	Real public (state and federal) consumption	-0.001	0.716
17	Real investment	-0.002	1.346
18	Real exports	-0.005	3.038
19	Real imports	-0.003	1.532
20	Real GNI	-0.002	0.945
21	Capital stock (rental weights)	-0.003	1.799
22	Employment	-0.002	0.993
23	Capital rentals (investment-price deflated)	0.000	-0.399
24	Real consumer wage	-0.012	7.096
25	Real producer wage	-0.009	5.266
26	Terms of trade	0.001	-0.773
27	Price deflator, consumption (CPI)	0	0
28	Price deflator, GDP	-0.003	1.740
29	Tax base (all states and federal, $m)	-696.102	410492.000
30	Aggregate tax revenue (all states and federal, $m)	96.372	-56880.310
	Change expressed as percent of GDP		
31	Balance of trade	0.000	0.123

Table 14-3: NSW industry impacts in 2040, due to a A$100m rise in GST collections or removal of the GST in Australia

		GST rate Effects on real industry output % deviation from baseline, 2040	Remove the GST Effects on real industry output % deviation from baseline, 2040
1	Agriculture, forestry and fishing	0.00	0.57
2	Mining	0.00	-0.34
3	Manufacturing	0.00	1.25
4	Electricity, gas, water and waste services	0.00	0.53
5	Construction	0.00	2.36
6	Wholesale trade	0.00	1.67
7	Retail trade	0.00	1.82
8	Accommodation and food services	-0.01	7.55
9	Transport, postal and warehousing	-0.01	4.30
10	Information media and communications	0.00	1.87
11	Financial and insurance services	0.00	1.16
12	Dwelling ownership	0.00	2.20
13	Business services	0.00	2.05
14	Public administration and safety	0.00	1.16
15	Education and training	0.00	0.59
16	Health care and social assistance	0.00	-0.26
17	Other services	0.00	1.69

15 Comparison with past work

In addition to the extensive analysis of the tax system presented herein, there have been three large CGE studies of Australian tax policy presented over the last decade; see KPMG (2010), Cao et al. (2015) and Murphy (2016). We have already discussed why excess burdens derived using VURMTAX may differ from previous studies for Australia (see sections 3.3 and 13.7 for a discussion of key parameter and other differences in cross-study methodologies). How do the breadth of the study we present, and our outputs beyond the company tax excess burden, compare to previous CGE studies of Australia's tax system? This is the topic of this section.

15.1 **Methodology**

In Table 15-1, we summarise the similarities and differences that exist between VURMTAX, and the CGE models used by KPMG (2010), Cao et al. (2015) and Murphy (2016). As the table highlights in column [2], the present study is distinguished from previous studies in that the model used, VURMTAX, is recursive dynamic; see Dixon and Rimmer (2002) for a discussion of dynamic CGE models. The benefits of dynamic modelling have also been discussed in section 13.7.

Column [3] highlights that differences between the models used in each study extend beyond parameter specifications and time dynamics, because the welfare measure used the assess the impact of tax policy changes also differs. While herein we use deviations in real gross national income to calculate the excess burden of a tax, the attribution analysis presented in section 13.7 suggests differences between real national income and equivalent variation [as applied in the study by Cao et al. (2015) and Murphy (2016)] as welfare measures, have little bearing on the final excess burden figures. For a comprehensive discussion of measuring welfare impacts using CGE models, we refer the reader to Dixon and Rimmer (2002).

In column [4] of Table 15-1, we also note that previous studies adopt an assumption of fixed real government consumption. Once again, we suspect this has little bearing on the final excess burden figures. Nevertheless, herein we assume a fixed ratio of public to private consumption throughout all our counterfactual policy simulations. In so doing, we keep the relative public and private expenditure shares of GDP fixed, to avoid the potential for spurious conclusions caused by compositional shifts in consumption shares.

Table 15-1: CGE studies of Australia's tax system

Study and year **Column [1]**	Model name and dynamic properties **Column [2]**	Welfare measure for excess burden **Column [3]**	Cost measure for excess burden **Column [4]**
KPMG (2010) *Henry review.*	KPMG-Econtech MM900. Long-run comparative static.	Compensating variation	Fixed *G*. Cost is change in aggregate revenue
Cao *et al.* (2015)	Independent Economics CGE model. Long-run comparative static.	Equivalent variation	Fixed *G*. Cost is change in aggregate revenue
Murphy (2016)	CGETAX. Long-run comparative static.	Equivalent variation	Fixed *G*. Cost is change in aggregate revenue
Nassios *et al.* (2019)	VURMTAX. Recursive-dynamic.	Real national income (leisure value adjusted)	Ratio *C* / *G* fixed. Cost is change in net operating budget position at all levels of Government.

15.2 Comparing breadth and results

Figure 15-1, Figure 15-2 and Figure 15-3 plot the marginal excess burdens for all taxes studied herein, and compare them to the marginal excess burdens reported in KPMG (2010), Cao *et al.* (2015) and Murphy (2016). For the readers convenience, we have ranked the excess burdens for the state taxes studied in decreasing order: The final three excess burdens on the left of each figure are the excess burdens for the three national taxes we study, which are also ranked in descending order. As is clear from the figures, the most distortionary state tax (based on VURMTAX) is residential transfer duties, while the least distortionary is NSW local council rates on unimproved land values. The personal income tax, with the distortions created between owner-occupied versus rented housing it generates via the owner-occupied housing exemption, is the most distortionary of the three national taxes, according to VURMTAX.

We include these comparison plots for two reasons. First, despite the differences that exist between parameter assumptions, welfare metrics, closure assumptions and the fact VURMTAX is dynamic, the outputs and rankings of key taxes across the studies show good agreement. The big differences exist in the estimate of the marginal excess burden of corporate income tax, where the magnitude and sign of the estimated excess burdens differ between the results presented herein, and those reported by KPMG (2010), Cao *et al.* (2015) and Murphy (2016). Section 13.7 attributes the reason for such differences in detail, and we refer the reader to section 13.7 for that discussion. Among the state taxes, KPMG (2010) and Murphy (2016) also report commercial property transfer duties as being the most distortionary state government tax. We suspect the larger commercial transfer duty excess burden in past studies arise because the tax is modelled as being entirely incident on new investment. This differs from the implementation adopted herein.[74] As we outline in section 6, we model commercial transfer duties as taxes on the use of moving services by industries, where those services are intermediate inputs to production. Increasing the load of the tax on investment in non-residential capital in VURMTAX, would likely place upward pressure on our estimated marginal excess burden. Similarly, shifting some of the load away from new investment in structures in KPMG (2010) and Murphy (2016), would place downward pressure on the estimates reported therein.

Second, in examining Figures 15-1 to 15-3, the breadth of the present study is apparent. We report excess burdens for 18 state, local and federal government taxes levied in Australia.[75] The rich detail our analysis affords exceeds previous works in this field: we report excess burdens for taxes such as the NSW health insurance levy, fire service levy, life insurance duties, general insurance levies, and taxes on new motor vehicle investment, which have not been explored to date. In summarising the national and state macroeconomic impacts, and the NSW industry impacts of each policy simulation, we also go well beyond previous works, by describing the economic mechanisms at play. Our bottom-up multiregional modelling framework is also better suited to analyse state and territory tax systems, which are highly disparate.

[74] We found data on the share of commercial and residential conveyancing duty collected on new versus existing properties difficult to collect. We were motivated by the rationale that the majority of stamp duty collections were undoubtedly sourced from existing property transfers, and therefore adopted the conservative assumption that all the commercial transfer duty was collected from moving services consumption as an intermediate input to production.

[75] We also report the excess burden for land tax on dwellings, which is not calculated elsewhere but is not summarised in any of Figures 15-1 to 15-3.

Figure 15-1: VURMTAX marginal excess burdens versus KPMG (2010).

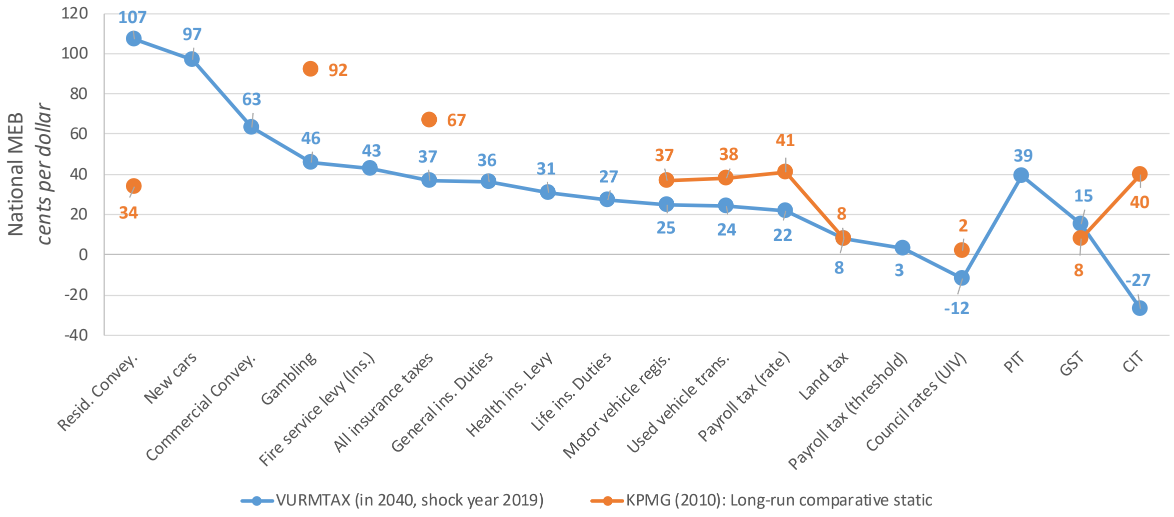


Figure 15-2: VURMTAX marginal excess burdens versus Cao *et al.* (2015).

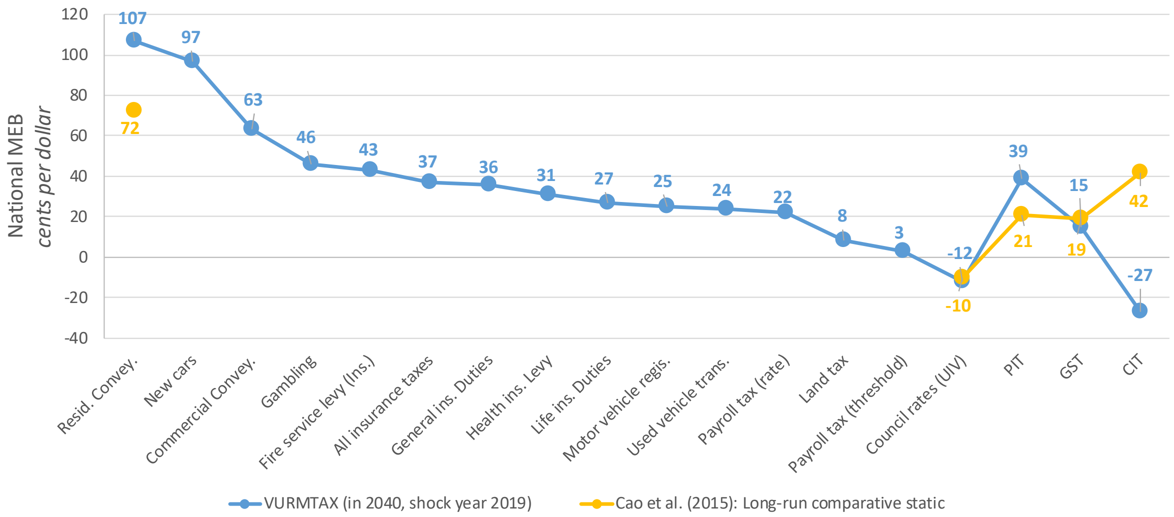
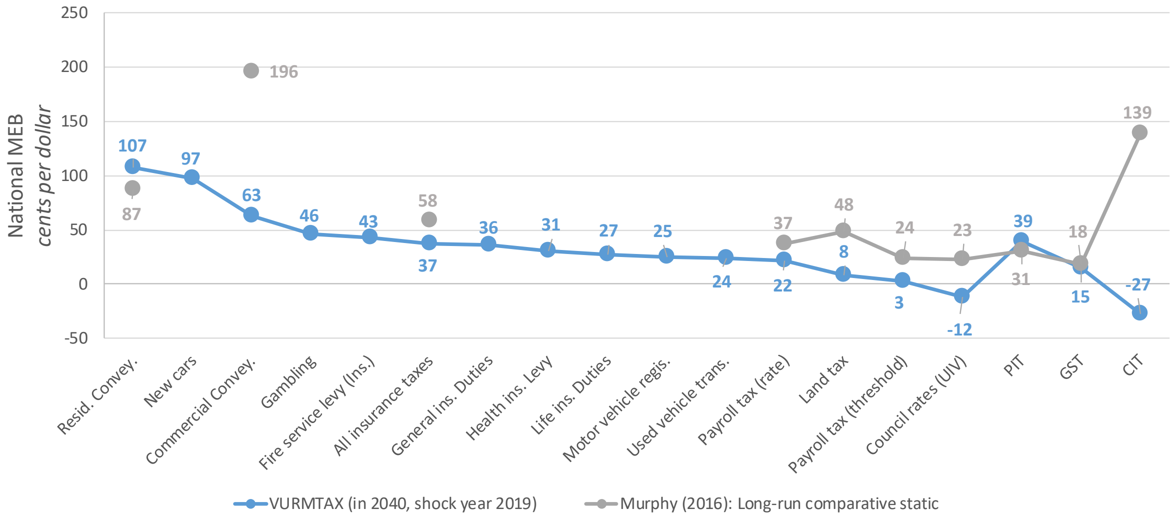


Figure 15-3: VURMTAX marginal excess burdens versus Murphy (2016).



16 Summary and concluding remarks

This study has investigated the economic costs and benefits of eight major state and three federal taxes in Australia. To our knowledge, this is the most comprehensive assessment of the state economic damage, national excess burdens, and broader economic consequences of state and federal taxes undertaken in Australia. Previous studies [for example, see KPMG (2010), Cao *et al.* (2015) and Murphy (2016)] have examined a more limited range of taxes. For example, while KPMG (2010) results for some motor vehicle taxes studied herein, the do not study the impact of new car taxes, and present no disaggregated results for the various types of Insurance taxes levied by state governments in Australia. In addition, no personal income tax results is simulated by KPMG (2010). Cao *et al.* (2015) study a limited number of taxes, generally those levied by the federal government, although they do explore the impact of a broad-based land tax on UIV. The study by Murphy (2016) does not report results for motor vehicle and insurance taxes to the level of granularity herein. Compared to these previous taxes, our study has investigated the relative impact of commercial and residential property taxes (which extends KPMG (2010) and Cao *et al.* (2015), but was covered by Murphy (2016)), while also providing a detailed account of the differential impacts of motor vehicle registration charges, used transfer duties, and registration and transfer duties on new motor vehicle purchases. We also provide a detailed set of results for the impact different insurance taxes have on economic output and allocative efficiency.

In addition to expanding the range of taxes investigated, our paper builds on previous work in a number of other important ways. First, our model is dynamic, while the aforementioned studies are based on a long-run comparative static CGE model of Australia. Not only does this allow us to elucidate the time paths of adjustment to tax policy changes, it also ensures that we capture important elements of the economic environment when the tax cut is implemented. The effects of this are most prominently displayed in our company tax modelling, where failure to account for tax revenue on the foreign-owned component of the current capital stock has a bearing on the excess burden of the tax.

Second, we have expanded the detail to which certain taxes are modelled, providing better treatment of salient elements of company tax, GST, insurance taxes, land tax, payroll tax.

Third, VURMTAX is a bottom-up multi-regional model of Australia’s states and territories. This allows us to study the economic costs and benefits of unilateral state tax policy reform scenarios, and calculate state-based measures of economic damage that are of concern to policy makers, such as our set of state economic damage indicators (SEDIs). This is particularly important, because past studies treat state government taxes as a single, uniform system of taxation. In reality, the system of taxation across Australia's states and territories is highly disparate. In studying payroll taxes, we that found no two states or territories levy payroll tax at the same rate, nor do any two states or territories apply the same threshold. We also found that, despite its efficiency as a means to raise revenue relative to other state/territory government taxes, the Northern Territory government did not impose a state land tax. Most notably, we recognise that the means by which local council rates are levied across Australia differs not only across industries, but also across regions. In some states, council rates are levied on capital-improved land values: a portion of the council rate load therefore acts as a tax on capital. Herein, we calculate the excess burden of local council rate adjustment in NSW, where the tax is levied on unimproved land values. In future studies, we plan to explore how the partial load on capital impacts the excess burdens we derive in VURMTAX.

In employing the VURMTAX model, we have ensured that all NSW state taxes, and the major federal taxes, are assessed within a single consistent modelling framework, using for each tax the same theoretical framework and database, including parameter values. For every tax, we employ the same baseline forecast for the period from 2016 to 2040, and adopt the same run-time assumptions when undertaking each tax policy simulation. Not only does this aid comparison of the excess burden measures across taxes, because readers can be confident that the same modelling assumptions have been employed across all simulations, it is analytically appropriate, because it allows the modelled effects of changing a given tax to be influenced by the way other taxes are structured and their load distributed across tax bases.

The paper is divided into two parts. First, in section 2, we provide an assessment of marginal and average state economic damage indicators (SEDIs) and national excess burdens for the 14 NSW state taxes and, for comparative purposes, the three major federal taxes. For each of the state taxes, we formulate SEDIs based on the impact of changes in tax rates or thresholds on NSW GSP (adjusted for changes in leisure value). We also calculate national excess burdens, which measure the impact of tax changes on leisure adjusted real national income, relative to the changes in federal and state government net tax revenues. In section 3, we provide a more detailed description of the key equations and assumptions underlying VURMTAX.

In sections 4 - 14, we consider each of the eight state tax categories and the three national taxes in turn. These case studies describe and quantify the effects on the national and NSW macroeconomies, and NSW broad industry categories, of both marginal changes and complete removal of each class of tax. A feature of our paper is a meticulous explanation of the major model mechanisms underlying the simulation results. This interpretation of results affords the reader a proper understanding of results in terms of the driving forces within the modelling framework (i.e. theoretical framework, database, closure assumptions and the economic shocks associated with the tax change).

Looking at the SEDIs and excess burden results summarised in section 2, it can be seen that SEDIs generally exceed national excess burdens. The clear exception is for those state taxes falling on land. In the case of council rates on unimproved land value, which has a broad tax base with little by way of exemptions nor wide departures from average rates for a municipality, the excess burdens turn out to be negative. This follows from our database recognising that some rate-payers are foreigners. The excess burden of land taxes is also reduced by foreigners making up a portion of tax payers, but this effect is more than offset by the excess burden resulting from the exemption of owner-occupied dwellings, but not rented dwellings.

With regard to future work directions, several have been put forward within this paper. We summarise three proposals here:

- In future work, it might be appropriate to disaggregate gambling supply across different gambling products. This would: (a) allow the modelling to distinguish those activities subject to regulated quantity generating scarcity rents, and those with no or limited supply restriction; (b) facilitate the addition of different rates of externality associated with problem gambling across different gambling products;
- Just as we augment our excess burden and SEDI calculations with valuations of changes in leisure time, in future research it would be appropriate to link changes in the quantity of gambling to a measure of change in the social cost of problem gambling. Tax-induced changes in the social cost of problem gambling could then feed into our excess burden calculations. This would be a valuable supplement to the calculation of the excess burden of all taxes that perturb relative consumption prices, like the GST;

- While VURMTAX facilitates a derivation of year-on-year excess burdens, in future work we envisage deriving a single dynamic excess burden based on the discounted present value of the economic (and social, based on our discussion above) costs of tax policy reforms. An interesting question would be to consider whether the relative impact of taxes, as measured using the dynamic excess burden, differs significantly from the classical long-run results derived and summarized herein. We suspect tax policies that exhibit considerable short-run effects, e.g., changes in payroll tax rates or the GST, may be regarded as more damaging under a dynamic excess burden than under the comparison reported here.

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