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Australian Government

The Treasury

ANALYSIS OF THE LONG TERM EFFECTS OF A COMPANY TAX CUT

Michael Kouparitsas, Dinar Prihardini and Alexander Beames¹

Treasury Working Paper²

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- 1 Macroeconomic Modelling and Policy Division, Macroeconomic Group, The Treasury, Langton Crescent, Parkes ACT 2600, Australia. Correspondence: department@treasury.gov.au. We acknowledge that the calibration discussion of this paper (Section 2 and Appendix A) draws heavily on the text in Cao, Hosking, Kouparitsas, Mullaly, Rimmer, Shi, Stark and Wende (2015). We thank Roger Brake, Graeme Davis, Amanda Hosking and Nigel Ray for their support, insight, guidance and drafting suggestions throughout this project. This project has also benefitted from the valuable research assistance of Robert Foley, Xavier Rimmer, Mosfequs Salehin, Jazmine Smith and Sebastian Wende. We also thank Matt Brine, Tanuja Doss, Sally Etherington, John Fraser, Rob Heferen and Nicole Mitchell for valuable comments and suggestions on an earlier draft.
 - 2 The views expressed in this paper are those of the authors and do not necessarily reflect those of The Australian Treasury or the Australian Government.



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ABSTRACT

For a small open economy, such as Australia, its living standards (per capita income) are determined by the level of its terms of trade, labour productivity, labour force participation and population. Australia's terms of trade, labour force participation and population growth are expected to be flat or declining in the foreseeable future which implies any improvement in Australia's living standards must be driven by a higher level of labour productivity. This paper shows that a company income tax cut can do that, even after allowing for increases in other taxes or cutting government spending to recover lost revenue, by lowering the before tax cost of capital. This encourages investment, which in turn increases the capital stock and labour productivity. Analysis presented here also suggests the long-term benefits accrue to workers and households via permanently higher after-tax real wages and consumption. The goal of this paper is to provide a clear exposition of the likely activity and welfare effects of simple company tax cut scenarios. The tax package announced in the 2016-17 Budget has more detailed funding components than analysed here so this paper does not provide specific estimates of the economic gains of that proposal.

JEL Classification Numbers: H21, H25, H30, E27

Keywords: optimal taxation; company tax; tax reform; policy simulation

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1. INTRODUCTION

For a small open economy, such as Australia, its living standards (per capita income) are determined by the level of its terms of trade, labour productivity, labour force participation and population. Australia's terms of trade, labour force participation and population growth are expected to be flat or declining in the foreseeable future which implies any improvement in Australia's living standards must be driven by a higher level of labour productivity.

Historical data reveal Australia's labour productivity growth has largely been driven by capital deepening. While a company tax will encourage domestic and foreign investment, the most efficient way of deepening the capital stock for a small open economy is to encourage increased foreign investment. Foreign investment is more efficient because domestic households do not have to sacrifice current consumption to fund the investment. A company income tax cut can do that, even after allowing for increases in other taxes or cutting government spending to recover lost revenue, by lowering the before tax cost of capital. This encourages investment, which in turn increases the capital stock and labour productivity.

Under the dividend imputation system employed in Australia some of the benefits of a company income tax will temporarily accrue to foreigners via higher after-tax returns. This windfall is dissipated in the long term, as increased capital flows drive down the before tax rate of return. In other words, foreign investors do not gain in the long run because their after-tax rate of return returns to the level before the company tax cut. Analysis presented here suggests the long-term benefits accrue to workers and households via permanently higher after tax wages and consumption.

Trade liberalisation analysis provides a useful insight into the analysis of the effects of a company tax cut for small open economies that have dividend imputation systems for residents. Under imputation, domestic capital owners earn franking credits. This means their capital income is taxed under the personal income tax system. Foreign investors are taxed under the company tax. The company tax can then be thought of as a tariff on foreign capital.

It is well known in the goods and services trade liberalisation literature (specifically, the optimal tariff literature) that a small open economy facing a fixed terms of trade (that is, an economy that cannot influence the price of its exports or imports) is better off under unilateral trade liberalisation. The results presented here suggest this result extends to a tariff on foreign capital for small open economies facing fixed terms of trade in the capital market. In a similar way to tariffs on goods, which raise the price of imported and domestically produced goods and reduce consumption, a higher company tax raises the before-tax rate of return required by foreign investors, which reduces investment. Lower investment means a smaller capital stock which in turn drives lower labour productivity, lower real wages for workers and lower consumption. The agents that benefit from the tariff are typically those in the import competing industry. In a similar vein, under dividend imputation a higher required before-tax rate of return for foreigners means domestic variable capital (that is, equipment and structures) owners enjoy a higher after-tax rate of return.

There are many approaches used in the published tax literature to estimate the activity and welfare effects of tax changes. Three broad approaches include: partial equilibrium analysis of one factor or goods market; micro simulation analysis; and general equilibrium analysis. The general equilibrium analysis approach can be further categorised into static or dynamic analysis, with either a representative household or heterogeneous households. Each of these modelling approaches has strengths and weaknesses. For example, micro simulation analysis is typically well-suited to studying the distributional effects of taxation on heterogeneous households, but provides limited information on the effects of taxation on aggregate levels of economic activity because the models typically do not account for second round effects on other markets.

This paper analyses the long term effects of a company income tax cut using a static representative household general equilibrium model under three funding assumptions: an increase in lump-sum taxes; an increase in the average personal income tax rate; and a cut in real government spending on goods and services. There are no scenarios involving cash transfers because a representative agent model cannot capture the detailed interactions of the tax and transfer that are important for welfare analysis. For the first two scenarios real government spending is held constant, while cash transfers are held constant in all three scenarios.

The goal of this paper is to provide a clear exposition of the likely activity and welfare effects of simple company tax cut scenarios. The tax package announced in the 2016-17 Budget has more detailed funding components than analysed here so this paper does not provide specific estimates of the economic gains of that proposal.

The model used in this paper reflects Treasury's current general equilibrium modelling capacity for tax analysis. Unlike partial equilibrium analysis, this widely used approach examines interactions between different taxes and captures the second round effects of taxes throughout the economy. Moreover, this approach analyses the economic effects of different funding sources within a consistent framework which, at the very least, enables a comparison of the relative efficiency of different funding mechanisms in broad terms.

Nevertheless, representative household general equilibrium models are necessarily a simplification of the economy that cannot account for all of the diverse effects of taxation on the Australian economy and society more generally. For example, a significant limitation with the model used in this paper (as well as previous Australian studies that compared the efficiency of different taxes) is that it includes a single representative household. This means that the impact of the progressive individuals' income tax scales (or targeted transfer payments) cannot be examined in this model.

Another limitation of the model is that it ignores dynamics, that is, the transition paths from the immediate point of change to the tax system to the new long-run equilibrium. The extent to which results presented here overstate or understate the welfare gain of tax cuts will depend on: the phasing of the tax cuts; the extent to which there is an increase in activity in the short run; and the size of resource and adjustment costs incurred along the transition path. This concern is mitigated to a large degree by adopting conservative assumptions which likely overstate the required return to foreign investors.

The remainder of the paper is organised as follows. Section 2 describes the methodology used to analyse the company tax cut, which includes: a summary of the economy wide model; a summary of the model calibration; and a brief discussion of how taxes have been captured in the model. Sections 3, 4 and 5 respectively analyse the effects of a company tax cut financed by a hypothetical lump-sum tax, a higher average personal income tax rate and a cut in government spending. Section 6 summarises the key results and limitations of the analysis.

2. METHODOLOGY

There are many approaches used in the published tax literature to estimate the effects of a tax change on economic activity. This paper examines the effect of a company tax cut using a static representative household computable general equilibrium (CGE) model. The main advantage of a CGE model over a partial equilibrium model is its ability to capture some of the main second round effects of taxes on households, firms and investors. Another advantage of a CGE model is that it can capture interactions between different taxes. This paper analyses the economy-wide effects of a company tax cut on expenditure, income and welfare. The results from this CGE modelling exercise are used to illustrate how different agents in the economy are affected by a company tax cut in the long run and the ultimate gain to Australian households, summarised by estimates of the welfare gain.

Structure of the economy-wide model and key assumptions³

The analysis reported here uses a revised version of the Independent Economics Computable General Equilibrium (IECGE) model, which is a static model of the Australian economy originally developed by Independent Economics. The version of the model used in this paper incorporates revisions to the original model by Treasury and Independent Economics in 2012 to capture more aspects of company income taxation.⁴ Details of that model and analysis are reported in Rimmer et al. (2014). More recently, Treasury has made further revisions to this model. These revisions are described in the sections below on the economic agents, tax coverage and calibration of the model.⁵

There are four economic agents or decision makers represented in the model: a representative household; firms; government; and the foreign sector.

3 This sub-section draws heavily on material from Cao et al. (2015).

4 Independent Economics designed the overall economic structure of the model. In 2012, Treasury in collaboration with Independent Economics, incorporated more aspects of the company income tax system and calibrated the model to match 2012 business tax data for modelling commissioned by the Business Tax Working Group (BTWG).

5 The work presented in this paper was undertaken by the Treasury and should not be attributed to Independent Economics. Since the development of the original IECGE model, Independent Economics has separately undertaken model development. Independent Economics' updated model is titled the Enhanced IECGE model.

Household

For analytical tractability, Australian households are modelled via a single representative household which is calibrated to match the expenditure, income patterns, and taxes faced by aggregate Australian households. This approach does not capture heterogeneous household types. Importantly, this assumption limits the modelling of the personal (or individual) income tax to a stylised flat rate equal to the effective average tax rate and the average labour supply elasticity. Therefore, the model does not capture heterogeneous labour supply responses across different groups of taxpayers and the progressive tax rates scale on individuals' income. This may underestimate the welfare cost of the personal income tax.

The representative household derives welfare (or utility) from leisure and consumption. Household utility is maximised subject to a budget constraint, which is a function of after-tax labour and capital income; franking credits; and lump-sum government transfers. They are assumed to face a constant elasticity of substitution (CES) utility function between leisure and a consumption bundle, with the consumption bundle comprising an aggregation of a variety of goods and services which is also based on a CES function, where each good and service consumed is a CES bundle of locally produced and imported products. The household sells its labour services to firms (labour supply) and owns all domestically-owned capital including fixed factors (for example, land), location-specific factors (for example, natural resources) and firm-specific factors (for example, intellectual property) and variable capital (for example, structures and equipment). Households are subject to taxation on labour and capital income, as well as consumption of goods and services. For analytical tractability households are assumed to have a fixed saving rate.

Firms

The model identifies 111 different sectors, each of which produce a different good or service. The objective of each firm is to maximise profits, given the price of its output and all of its inputs. Production technology varies across sectors based on an assumed multi-layered nested production structure, and an appropriately specified elasticity of substitution at each level of the nest. Firms can employ up to 12 different primary factors: labour, eight types of produced capital and three fixed factors which are owned by domestic or foreign households.

Similar to Australian households, firms are modelled via a single representative firm for each of the 111 different sectors. For industries where firms are largely homogeneous (that is, firms with similar production functions) this simplification has little effect. However, for industries where firms are of different sizes and have different production functions, this simplification will potentially have a bearing on the results of the modelling.

Government

All layers of government (that is, federal, state and local) are combined into a single general government sector which collects all taxes and uses the revenue for its consumption of goods and services and cash transfers to households. Without a transition path it is difficult to account for the accumulation of debt, so for simplicity the government is assumed to have no debt and maintain a zero primary budget balance.

Government deficits over the transition period can to a large extent be mitigated by announcing company tax cuts well in advance of implementing them. Because firms base investment decisions on the present value of the firm, an anticipated company tax cut will raise the return to investment, which can bring forward investment activity and tax revenue ahead of the company tax cut.

This paper considers three company tax scenarios, with the company tax financed by a lump-sum tax, an increase in the average personal income tax rate and a cut in real government spending on goods and services. There are no scenarios involving cash transfers because a representative agent model cannot capture the detailed interactions of the tax and transfer that are important for welfare analysis. For the first two scenarios real government spending is held constant, while cash transfers are held constant in all three scenarios.

In this modelling exercise, government spending is assumed not to affect directly the welfare of households or the private marginal productivity of capital. For scenarios in which real government spending is held constant, adding it to the household utility or sectoral production functions would not make any difference to the welfare calculations reported here. In the case where government spending is cut, the implicit assumption is that the spending is wasteful. While this is a common modelling assumption, it ignores the fact that: government spending provides goods and services that would otherwise not be provided by the market sector; households derive direct utility from government spending; and infrastructure spending can improve market sector productivity. This suggests the modelling may overstate the economic gains from this scenario.

Foreign sector

Australia is assumed to be a small open economy in capital markets. Australia can access the global market for funds, so long as the after-tax rate of return on capital equals the global rate of return. This is considered to be a reasonable assumption for a static analysis of the long-run impacts of taxes on welfare. Foreign households own part of Australia's variable capital and fixed factors.

Similarly, the model assumes Australia is to a large extent a small open economy in the goods markets. Specifically, Australia is assumed to be a price taker for imports, meaning that changes in the Australian economy do not influence the price of imports. Australia is effectively a price taker for exports, with a standard value for the export price elasticity of demand of -12. For some industries such as coal and iron ore, where Australia has some market power, a lower value of elasticity of -6 is used.

Financial markets

Capital is financed by a mixture of equity and debt in fixed proportions. The after-tax return required on both debt and equity is equal to the global rate of return. The cost of capital for firms takes into account deductions for the cost of debt financing. It is therefore important that the mix of debt and equity is appropriately estimated for each industry. As such, a debt-to-equity ratio has been estimated using ATO Taxation Statistics data (Australian Taxation Office, 2014). This ratio is assumed to be fixed (see Appendix A for further detail).

Equilibrium

All markets are assumed to clear: wages adjust to clear the labour market; capital supply, via inflows or outflows of foreign capital, adjusts to ensure the after-tax rate of return on capital employed for domestic production is equal to the global required rate of return; and expenditure prices adjust to clear goods and services markets.

The CGE model used here is a comparative static framework. This means it provides analysis of the change in the economy from its current long-run equilibrium or steady state (calibrated to actual data) to a new long-run equilibrium under the new tax regime (that is, when capital, labour and goods markets have fully adjusted to the policy change). As such, it does not provide an indication of the time it takes to achieve the new equilibrium or the short run activity response or adjustment costs incurred along this transition path.

Company tax analysis undertaken by Kudrna and Woodland (2010) using a dynamic model suggests that roughly half of the adjustment (reflected by the rate of capital accumulation) to a capital tax change is completed in 10 years, with the full adjustment largely completed in 20 years. It is reasonable to expect faster adjustment to tax changes that imply relatively small changes to investment (or the capital stock) and relatively large changes to consumption.

All consumption and investment outcomes must be sustainable in the long run. In particular, the level of net exports must be sufficient to fund the foreign income account. Households are assumed to have a fixed saving rate. Combined with the model's perfect international capital mobility assumption, the model implies domestic capital income is somewhat invariant to changes to the income tax system. Crucially, this assumption allows a static model to estimate the change in net foreign liabilities implied by the foreign capital inflow necessary to achieve the expansion of the domestic capital stock. Similar approaches have been adopted in previous Australian studies (KPMG, 2010 and 2011; and Independent Economics, 2014) that have examined the long-run economic costs of small changes in taxes using a static, economy-wide model.

A possible concern with static analysis is that it may overstate the welfare gain of company tax cuts because it does not account for any resource and adjustment costs incurred along the transition path. In a growing economy the steady state net exports (trade balance) to GDP ratio is equal to the gap between the required rate of return on foreign liabilities and the nominal growth rate of the economy multiplied by the net foreign liability to GDP ratio. This ratio is significantly smaller than the net foreign income to GDP ratio because a growing economy can run a current account deficit and maintain a stable net foreign liability to GDP ratio. Importantly, the smaller the return/growth differential, the smaller the steady state trade surplus required to fund the net foreign liabilities incurred over the transition period. That is, the smaller amount of consumption given up by the household. Concerns regarding an overstatement of the activity or welfare effects of a company income tax are mitigated in this paper by adopting conservative long-run economic assumptions that likely overstate the expected gap between the required return to foreign investors and the growth rate of the economy.

Tax coverage and calibration⁶

The economy-wide model incorporates six of Australia's major taxes. It captures the complexity of these taxes to varying degrees. The taxes examined comprise:

- company income tax, incorporating some complexities in the company income tax system;
- a stylised flat income tax on individuals' labour and capital (termed 'personal income tax' throughout this paper) which ignores heterogeneity in labour supply across different groups of taxpayers and the progressive individuals' income tax scale;
- the goods and services tax (GST) on the current base, with fresh food, health services, education, childcare, as well as water, sewerage and drainage services, GST-free;
- other indirect taxes are also captured in the model: indirect taxes on production are levied on the value of production in each industry; indirect taxes on final demand are modelled as a single indirect tax for each economic agent (that is, households, firms and foreigners); and include tobacco, alcohol and fuel excise;
- a hypothetical broad-based land tax, similar to municipal rates levied by local governments (and the Australian Capital Territory), but not reflective of the current state land tax regimes; and
- stamp duty on conveyances.

Company income taxation

The model reflects many features of the company tax system, including: deductibility of interest payments; revenue clawback through dividend imputation; depreciation allowances that reflect an historical cost basis and other aspects of tax laws; expensing of certain investments; and foreign tax credit arrangements. As such it captures the effects of the company tax system on: the size of the capital stock in each industry; the mix of capital types; labour supply (for a single representative household); the location of multinational profits; and the location of multinational firm-specific assets, such as intellectual property.

Profit-shifting is also incorporated in the model. This is done by allowing companies to reduce their business tax liability by shifting profits from Australia to countries with lower rates of business tax. Following De Mooij and Devereux (2011) the modelling of profit shifting captures both transfer pricing and tax havens. All else equal, the existence of profit shifting implies a smaller company income tax base. Achieving a given amount of revenue, therefore, requires a higher company income tax rate under profit-shifting because of the stronger incentives for multinationals to shift profits offshore with a higher company tax rate. This implies a higher marginal excess burden for the company income tax.

6 This sub-section draws heavily on material from Cao et al. (2015). See Appendix A for details of non-tax parameters and sensitivity of results to key parameters assumptions.

Personal income taxation on labour and capital

Personal income tax is modelled as a flat rate equal to the effective average tax rate on household income. This simplification is a by-product of the design of the CGE model, which includes a single representative household. A limitation with the modelling is that it does not capture the progressive income tax scales in Australia. Progressivity would be expected to reduce the efficiency of personal income taxation. The transfer system and the impact of the withdrawal of payments on effective marginal tax rates is also beyond the scope of this paper, but is nevertheless important in broader discussions about the economic effect of different taxes.

Both the labour income and capital income component of the personal income tax system is modelled, with a common flat tax rate applied to labour and capital income. Because the model is static there are effectively no 'retained capital earnings' with capital gains essentially returned every period to capital owners (domestic and foreign households) in the form of dividends or a share buy-back and immediately reinvested. The household utilises franking credits against tax paid under the company income tax, with the balance taxed at the flat personal income tax rate. The model does not capture deductions claimed against assessable income or the concessional tax treatment of some forms of income. This means that the average flat tax on labour and capital income calculated within our model is lower than the observed average tax rate on taxation income in administrative data. The model incorporates income received in the form of transfer payments from Government and assumes that these payments are not subject to personal income tax.

The distortions and efficiency costs arising from tax planning and minimisation are also outside the scope of this analysis.

The general government's primary budget balance is achieved in the baseline calibration by using personal income tax as the balancing item.⁷ This approach slightly overstates the personal income tax receipts in the base year by around \$5 billion, which compares with reported total personal income tax revenue of around \$160 billion in the ABS Taxation Revenue, Australia 2012-13 (ABS Cat. No. 5506.0). The model-derived average tax rate on personal income is estimated to be 16.7 per cent in the baseline.

Goods and services taxation

The model separately identifies the goods and services tax (GST) from general indirect taxation.⁸ The effective GST rates are based on product-based tax receipts from the ABS Input-Output tables (ABS Cat. No. 5209.0.55.001). These tables cover taxed intermediate inputs, household final consumption expenditure and private gross fixed capital formation. This treatment allows analysis of the effect of both rate changes and base-broadening.

7 Other taxes are calibrated to administrative or statistical data.

8 The earlier version of the model used for the BTWG included the GST as a general indirect tax.

Hypothetical broad-based land tax

Land taxes are modelled as a stylised broad-based land tax which is calibrated to include municipal rates on all properties and a broad-based land tax on all investment properties levied on the unimproved value of land. The model recognises that the value of land is determined by the flow of services from its use, which means the broad-based land tax can be modelled in the long run as a tax on the rental income from land. Working towards that end, the current version of the model has been extended to include a broad-based land tax in the form of a rental income tax on land which is collected before company income tax.

The model has two types of land: residential and non-residential land.⁹ Residential land is only used by the Ownership of Dwellings sector, while non-residential land is used by all other industries. While the total supply of each type of land is fixed, the utilisation of land can be increased through greater investment in structures. Finally, the supply of non-residential land at the sectoral level can vary, with land allocated via the rental market to its most productive use.

The effective rate of the broad-based land tax is calculated based on land and municipal tax revenue, with different effective tax rates for residential and non-residential land. The rate of the non-residential broad-based land tax is uniform across all industries because more detailed data do not exist. The model incorporates foreign ownership of non-residential land, but there is currently no allowance for foreign ownership of residential land. The foreign ownership share of total factor income from land is estimated to be around 10 per cent. The after-tax rate of return on land is invariant to the tax change. Hence, it is assumed that foreign and domestic land owners do not alter their holdings in response to a tax change.

Stamp duties on conveyances

Stamp duties are a tax paid on the value of an asset when ownership is transferred, often inclusive of the value of any capital improvements. Stamp duty on conveyances is currently levied on the transfer of motor vehicles, insurance, and land and structures. The analysis reported here only focuses on stamp duty on conveyances levied on the transfer of land and structures.

It is inherently difficult to capture this type of capital transaction tax in a model with a single representative agent. The approach adopted here treats real estate services as an investment good which improves the productivity of the firms, including the housing sector. One way of thinking about this is that real estate agents play a valuable role in finding producers that value the capital the most. Therefore a potential owner will be willing to pay a real estate fee equal to the profit they will enjoy over the previous owner. Within this setting the conveyance duty is treated as a tax on the value of investment and subsequent productivity gains facilitated by the transfer of land and structures. Cao et al. (2015) demonstrate that the return on investment is the same for a tax on investment or a tax on capital income (for example, company income tax) with the same rate. The investment tax will collect less revenue than the capital income tax and is therefore less efficient (that is, implies a larger marginal excess burden).

9 Residential land includes owner occupied housing land and rented residential land, while non-residential land includes urban land for commercial use and land for primary production.

It is important to keep in mind that the approach taken here captures some of the efficiency costs of stamp duties associated with the distortion to value creating transactions. As such, the analysis aims to illustrate the potential efficiency impacts of stamp duties.

Measuring the welfare effects of tax changes

The representative household captured in the model maximises its utility by consuming a variety of goods and services (hereafter their consumption bundle) and leisure time subject to a budget constraint. Figure 1 demonstrates the typical utility maximising solution for the representative household. The household effectively faces the budget constraint represented by: the vertical segment XY equal to the sum of the household's net transfer receipts and after-tax capital income less saving, with the total expressed in terms of after-tax consumption prices; and the inclined segment YZ, which reflects after-tax labour income, with the slope equal to the after-tax real wage:

$$\frac{w(1 - \tau_N)}{p_C(1 + \tau_C)} \quad (1)$$

where: w is the wage; p_C is the price of consumption goods and services; τ_N is the flat labour income tax rate payable by the household; and τ_C is the consumption tax rate payable by the household.

The optimal consumption-leisure bundle is given by the tangency of the highest feasible indifference curve U_0 and the household's budget constraint, with the utility maximizing outcome given by A. At this point the household's consumption is equal to C_0 and leisure is equal to L_0 .

The value of the household's consumption-leisure bundle in terms of consumption units can also be measured via the household's expenditure function. The expenditure function, denoted by $E(P_0, U_0)$, gives the minimum value of the optimal consumption-leisure bundle (that is, A) associated with price vector P_0 and utility level U_0 .¹⁰ The value is expressed in terms of the model's numeraire which is the after-tax consumption price.

10 For more detailed discussion of the properties of the expenditure function, see Mas-Colell, Whinston and Green (Section 3, 1995).

Figure 1: Measuring the welfare effects of tax changes

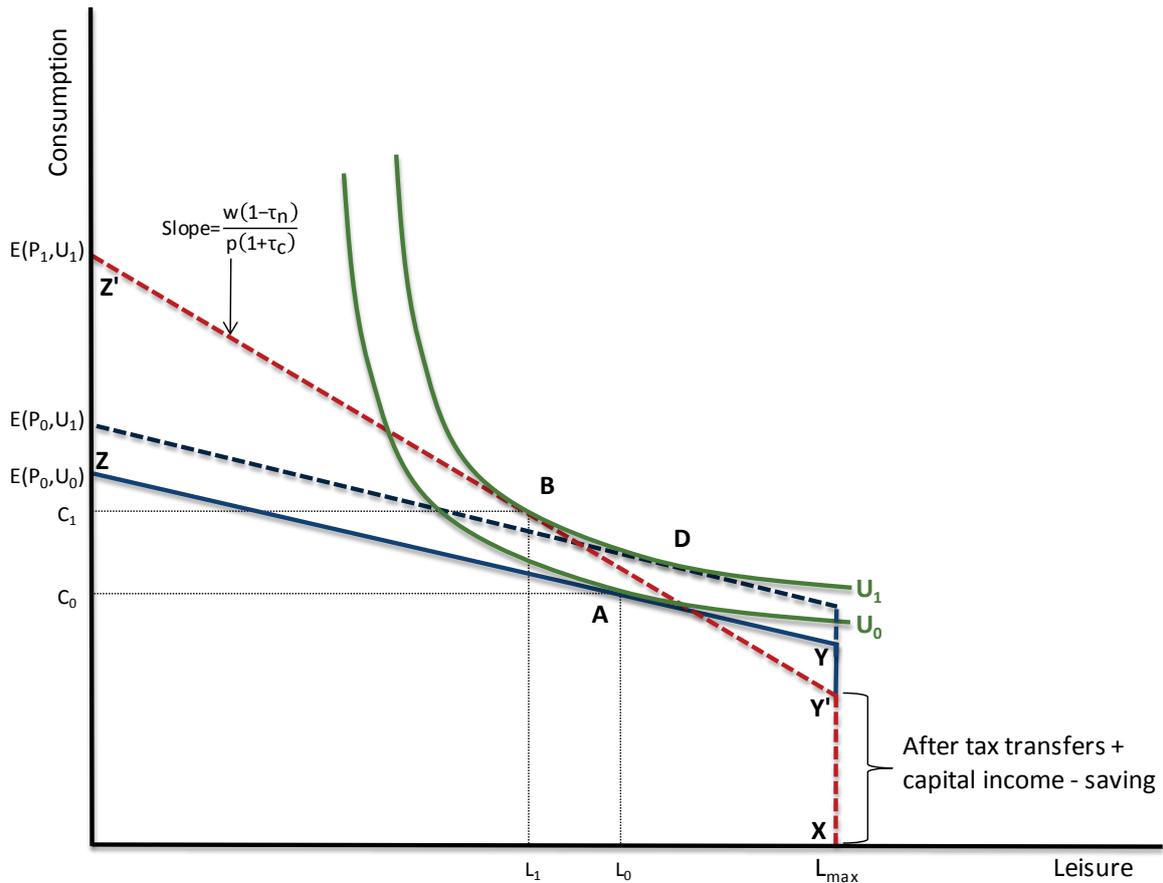


Figure 1 can be used to analyse the effects of a tax change on household welfare. The typical tax change scenario in this paper implies a fall in after-tax capital income less saving, which decreases the vertical segment of the household's budget constraint, while the typical tax change causes the household's after-tax real wage to rise. These effects are captured in the budget constraint given by XY' and $Y'Z'$, with the consumption axis intercept at $E(P_1, U_1)$. The optimal consumption leisure bundle under the tax change is given by the tangency of the highest feasible indifference curve U_1 and the household's budget constraint (that is, XY' and $Y'Z'$), with the utility maximizing outcome given by B . Under the tax change the relative price of leisure (that is, the after-tax real wage) rises, so the household substitutes away from leisure (that is, leisure falls from L_0 to L_1) towards consumption (that is, consumption rises from C_0 to C_1). The value of this consumption leisure bundle in terms of consumption units is $E(P_1, U_1)$, with P_1 denoting the price vector after the marginal tax change.

The gain in utility is typically referred to as the welfare gain. This is a fundamentally different concept to government transfers to households. Following the CGE tax analysis literature the welfare gain is measured by the equivalent variation (EV) which is defined as follows:

$$EV = E(P_0, U_1) - E(P_0, U_0) \quad (2)$$

where: P_0 is the vector of prices, including taxes, before the tax change; U_0 is the maximum level of household utility achieved before the tax change; and U_1 is the maximum level of utility achieved after the marginal tax change.

The equivalent variation can be thought of as the amount (in consumption units) that the household would be indifferent about receiving in lieu of the tax change.

The change in welfare can be represented graphically. The value of the expenditure function $E(P_0, U_1)$ is reflected by the consumption axis intercept of the dashed blue line, which is parallel to the pre-tax change budget constraint (that is, the expenditure function is evaluated at the pre-tax change prices P_0) and tangent to the post-tax change indifference curve at D (that is, the expenditure function is evaluated at the post-tax change utility U_1). The welfare gain associated with the tax change is then the vertical distance between $E(P_0, U_1)$ and $E(P_0, U_0)$. To avoid reporting meaningless values, the welfare analysis reported in the following sections expresses the equivalent variation as a percentage of the initial expenditure $E(P_0, U_0)$.

3. COMPANY TAX CUT FINANCED BY A LUMP-SUM TAX INCREASE

In this section, results are presented from the modelling of a reduction in the company tax rate from 30 to 25 per cent, financed by an increase in non-distortionary lump-sum taxes. Pure lump-sum taxes are considered to be hypothetical, with the nearest approximation in Australia being a broad-based land-tax. While this may not be a realistic example, it provides a useful benchmark for the welfare and activity analysis involving more realistic funding mechanisms. This is also a common approach taken in the wider tax literature. The legal incidence of the company income tax is on firms who own both variable capital and fixed factors of production such as land and economic rents.¹¹ Under a company income tax firms pay a percentage of their profits, allowing for various deductions, to government. Firms themselves are owned by both domestic residents and foreign investors. Domestic residents receive franking credits for company income tax paid on dividends, which means company income tax is essentially a withholding tax for domestic capital owners.

Theory and key assumptions

Australia is assumed to be a small open economy with a constant household saving rate. Importantly, Australia is assumed to face a perfectly elastic supply of international capital at the global required rate of return (r_w). This is considered to be a reasonable assumption for a static analysis of the long run impacts of taxes on welfare. Combined with the model's perfect international capital mobility assumption, the model implies domestic capital pre-tax income is somewhat invariant to changes to the income tax system.¹²

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- 11 The model has two types of land: residential and non-residential land. Residential land is only used by the Ownership of Dwellings sector, while non-residential land is used by all other industries. While the total supply of each type of land is fixed, the utilisation of land can be increased through greater investment in structures. Finally, the supply of non-residential land at the sectoral level can vary, with land allocated via the rental market to its most productive use.
 - 12 Sensitivity analysis reported in Cao et al. (2015) shows that the rival assumption of a fixed level of domestic saving employed in earlier BTWG version of the IECGE model yields a similar outcome.

The company income tax (τ_k) drives a wedge between the before-tax rate of return (r_{bt}) and the after-tax rate of return. In the case of a small open economy subject to perfect capital flows, the before-tax rate of return will be high enough to ensure the after-tax rate of return equals the global required rate of return:

$$r_{bt} = \frac{r_w}{(1 - \tau_K)} \quad (3)$$

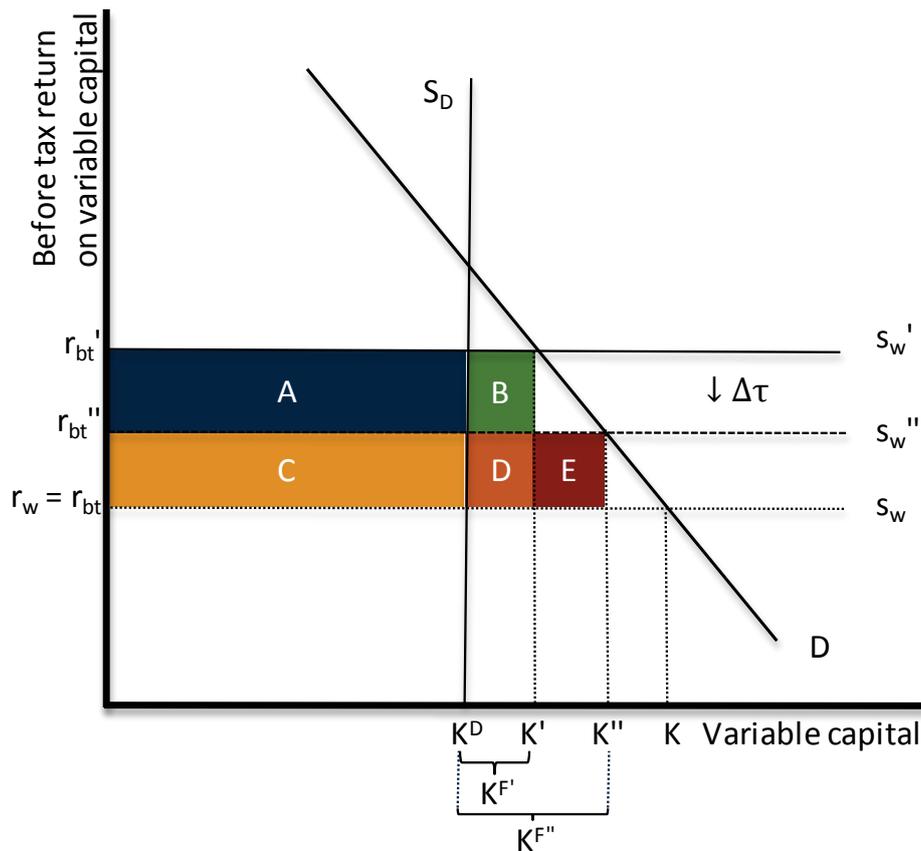
In other words, the after-tax return of foreign investors is always the global rate of return. This effect is captured in Figure 2. Starting at the global supply curve without a company tax S_w , the before-tax rate of return r_{bt} is equal to r_w with total capital equal to K . For ease of exposition assume the capital stock held by Australian residents does not change. The domestic savings schedule is captured by S_D , with the domestically owned capital stock equal to K_D . This implies foreign owned capital is equal to $K - K_D = K_F$.

Imposing a tax sufficient to cause the required before tax return to be r_{bt}' the global supply curve shifts to S_w' . At this required rate of return the total variable capital stock will be $K' < K$ and foreign-owned capital will fall to $K_F' < K_F$.

In this case the gross company tax revenue will be equal to the sum of A, B, C and D. It is important to keep in mind that the company income tax revenue from domestically owned capital is largely returned in the form of franking credits, with the resulting income taxed at the personal income tax rate. Holding the personal income tax rate constant, this analysis implies a lower company income tax rate lowers the return to domestic owners of variable capital. Assuming company tax accrued on domestic owned capital is fully returned to domestic owners through franked dividends the change to net company tax revenue is equal to B plus D.

Figure 2 also plots the response of the Australian variable capital market to a lower company tax rate. A company tax cut causes the after-tax rate of return of Australian capital to rise above the global rate of return. This will cause a capital inflow. Assuming diminishing returns to variable factors, the increased capital stock will result in lower productivity of capital and a lower after-tax rate of return. The capital inflow will end when the after-tax rate of return is equal to the global rate of return required by foreigners, which implies a lower before-tax rate of return r_{bt}'' at the new equilibrium capital stock of $K'' > K'$. The net company tax revenue under this lower tax rate is equal to the sum of D and E, with the change in net company tax revenue equal to E minus B. For later reference, it is important to note that B captures the direct effect of a lower company tax rate on tax revenue, while E captures the second round effect of the increased capital stock on tax revenue. Finally, holding personal income tax rates constant, the after-tax income earned by domestic variable capital owners will fall because their before-tax income falls by A.

Figure 2: Company income tax — Variable capital market response

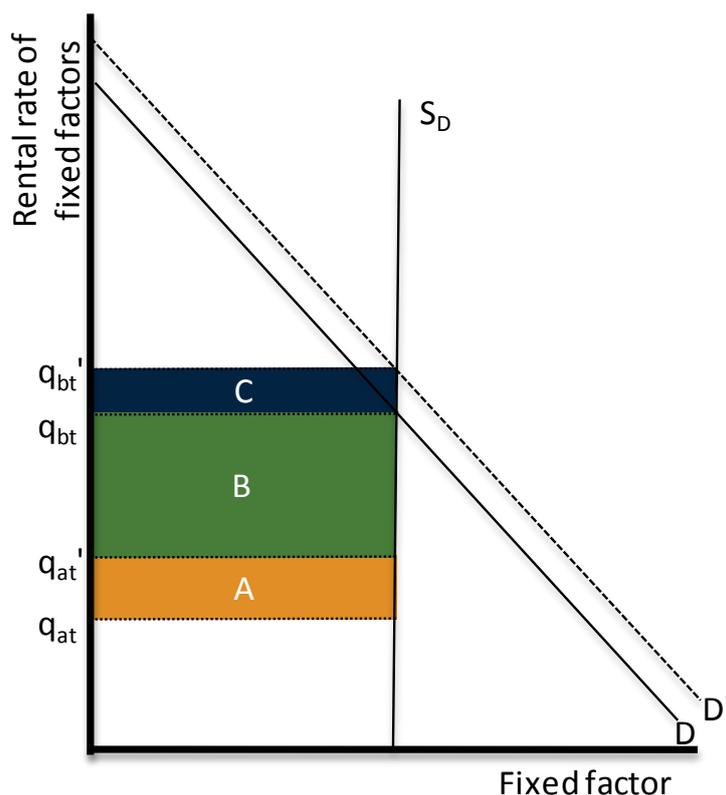


Consistent with the variable capital analysis reported here, Johansson et al. (2008), in their survey of taxation and economic growth note that raising sourced-based capital income (such as the company income tax) in an open economy tends to reduce and distort domestic investment. In contrast, they note that resident-based capital income tax (such as the franked company income tax through the personal income tax system) may discourage saving without affecting domestic investment. They go on to state that taxes on personal income may affect investment decisions by small firms that can only access domestic saving. Given that most investment is undertaken by large firms with access to international funds, changes to personal income taxes are likely to have a small effect on investment. At the same time, they note that empirical evidence on the sensitivity of saving to the change of the after-tax rate of return on capital is inconclusive. This suggests that the assumption of a fixed domestic saving rate is reasonable.

Firms also use fixed factors such as land, firm-specific and location-specific factors.¹³ The fixed factor markets are affected by a change in the company income tax rate in two ways: directly by driving a wider wedge between the before-tax and after-tax rental rates; and indirectly by lowering the demand for fixed factors.

13 These factors are assumed fixed in the long run. Factors such as the firm-specific factor could vary in the short run.

Figure 3: Company income tax — Fixed factor market response



The increase in the variable capital stock, caused by a lower rate of company income tax, raises the productivity of fixed factors and thus the demand for fixed factors. The change in demand is captured in Figure 3 by the shift in the demand curve from D to D' . This leads to an increase in the before-tax rental rate with equilibrium restored at $q_{bt}' > q_{bt}$. The owners of fixed capital are also subject to the capital income tax. At the initial before-tax rental rate of q_{bt} the revenue collected by the government is equal to A and B , implying an after-tax rental rate of q_{at} . Capital income will rise with the tax change, with the new after-tax rental rate of $q_{at}' > q_{at}$. The change in company tax revenue is equal to C minus A , with total revenue equal to C plus B . Again, it is important to keep in mind that the company income tax paid by domestic capital owners is largely returned through franking credits. In the absence of changes to personal income tax rates, domestic owners will earn higher after-tax income on fixed factors.

While the company income tax is directly levied on firms the second round effects in the labour market are generally important for economic welfare.¹⁴ The larger capital stock following the tax change raises the productivity of labour and therefore the demand for labour, which is captured in Figure 4 by the shift in demand from D to D' . Equilibrium is restored in the labour market at a higher real wage given by $w' > w$, which in turn causes labour supply to rise to $H' > H$.

Empirical studies find that labour supply is relatively inelastic, which implies the rise in real wages will be proportionately larger than the rise in total hours. Overall, the gain in labour income is represented by the sum of A and B in Figure 4. In terms of the welfare effect on the labour market, the increase in hours implies a decrease in leisure.

14 See, for example, the seminal closed economy study by Lucas (1990) and open economy analysis of Mendoza and Tesar (1998).

Figure 4: Company income tax — Labour market response

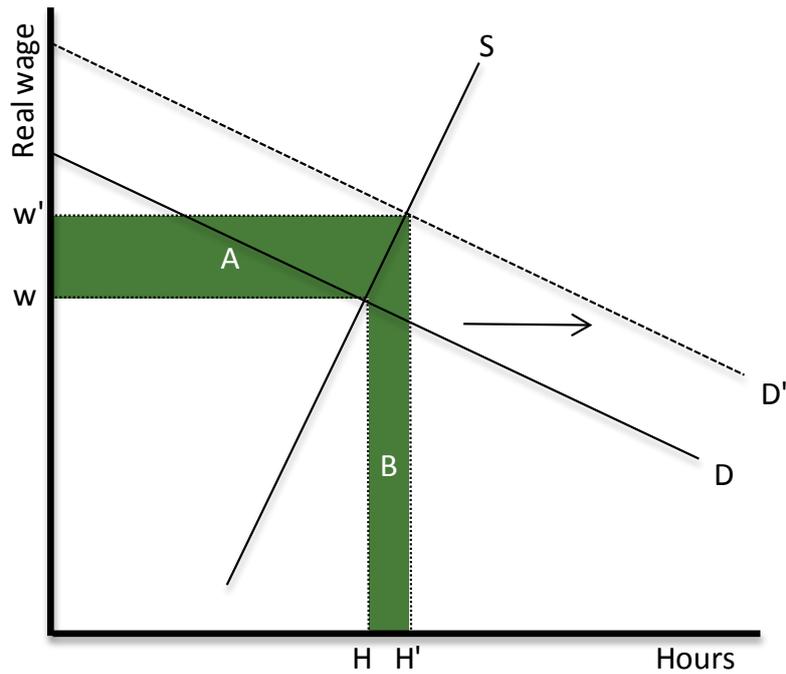
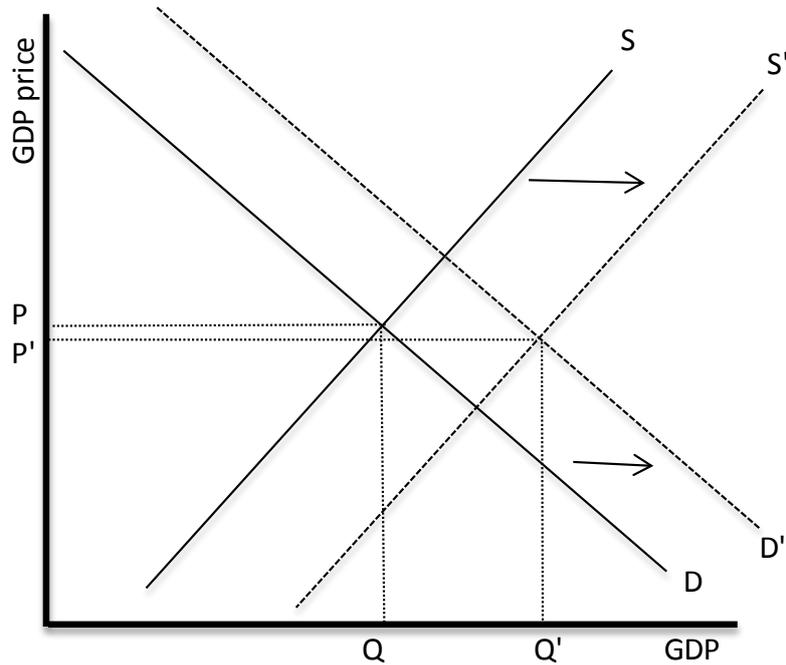


Figure 5: Company income tax — Goods market response



In aggregate a capital tax change such as a cut to the company income tax would be expected to cause an increase in both the overall supply of and demand for goods and services as shown in Figure 5. This implies an aggregate expansion of activity and therefore GDP. As detailed above the increased supply is caused by a larger capital stock and also greater working hours, while the increased demand is caused by a higher labour income. Given that both supply and demand increase, the aggregate price effect is uncertain. Figure 5 assumes a slight decrease in the aggregate output price (relative the aggregate expenditure price), which is consistent with the results reported below and suggests the supply effect is larger than the demand effect.

This discussion demonstrates the complex nature of identifying incidence in an economy-wide setting, with a direct tax on capital income having different effects on variable and fixed capital as well as affecting labour income and ultimately the supply and demand of goods and services.

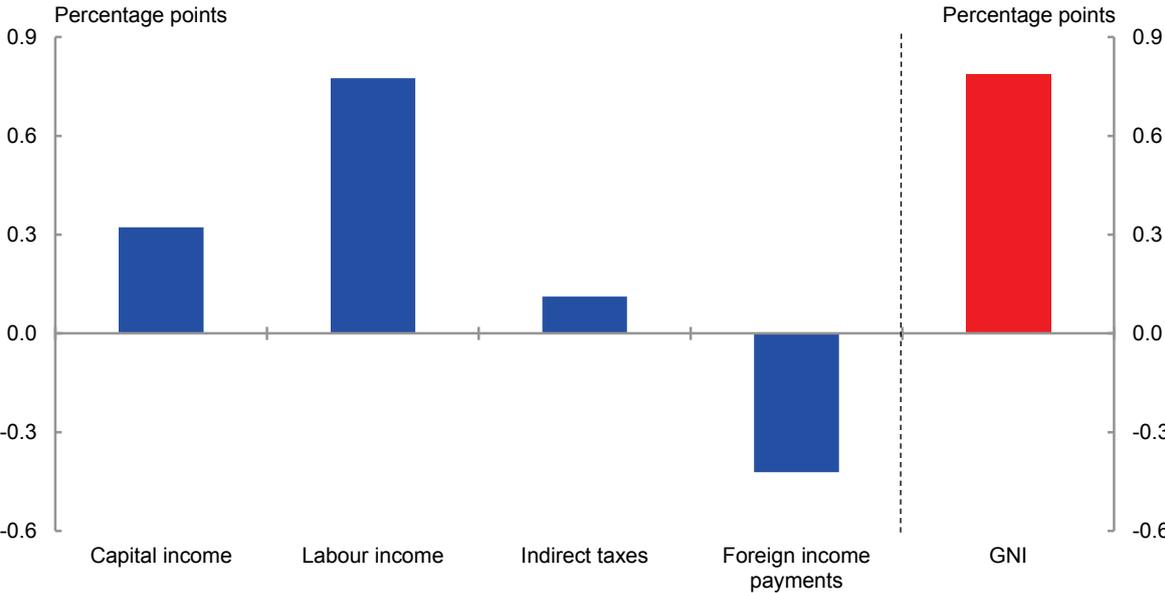
Results

This subsection reports the findings of model-based simulation of a company income tax rate cut from 30 to 25 per cent, leaving all other tax rates unchanged and allowing any shortfall in revenue to be financed by a lump-sum tax increase.

Activity

Chart 1 plots the contribution of domestically generated capital and labour income, and foreign income payments to the change in real gross national income (GNI) from the company tax cut.¹⁵ Under this scenario, gross national income is expected to rise by 0.8 per cent in the long run. The model’s measure of before-tax capital income is gross operating surplus (GOS). In the long run, a lower company income tax rate causes the capital stock to increase by more than the fall in the before-tax rental rate. This raises GOS and contributes around 0.3 percentage points to GDP. The expanded capital stock is to a large extent owned by foreign investors, which results in increased payments to foreigners. This deduction from real gross national income is estimated to be around 0.4 percentage points.

Chart 1: Contribution to real GNI response — CIT financed by Lump-sum tax



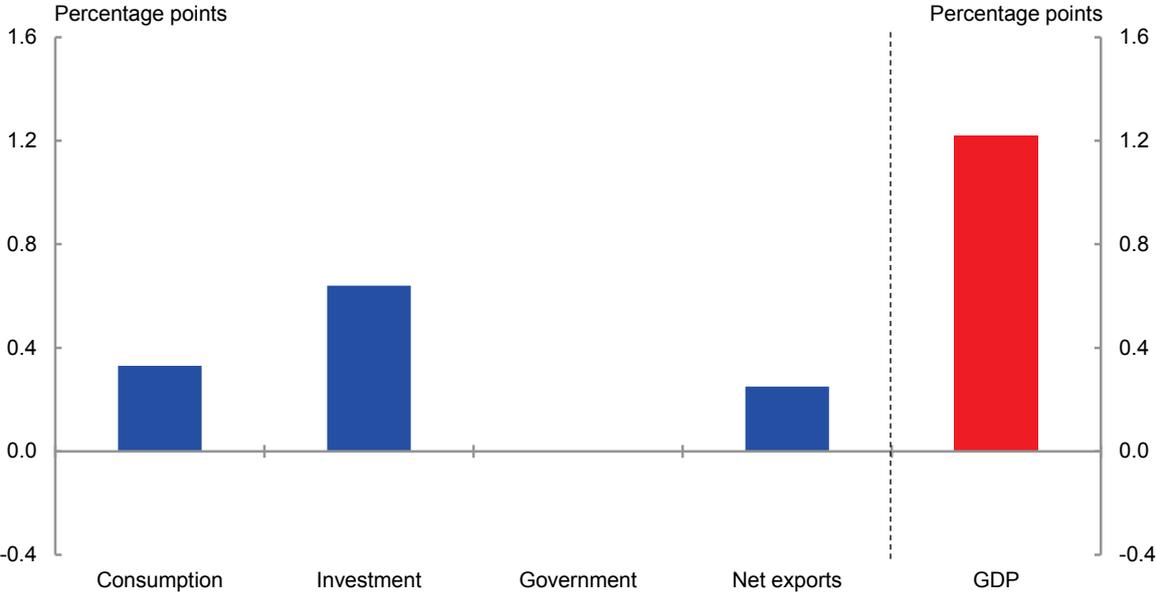
Source: Treasury estimates.

15 Following ABS convention, real gross national income is calculated as nominal gross national income deflated by the gross national expenditure deflator. Consistent with ABS methodology, gross national income includes indirect taxes.

As noted above, the increased capital stock drives up the productivity of labour. This raises the demand for labour and results in higher before-tax real wages and higher employment (see Figure 4). Before-tax real wages are estimated to rise by around 1.1 per cent, with employment rising by 0.4 per cent. Before-tax labour income, measured by the compensation of employees (COE), contributes around 0.8 percentage points to the improvement in GNI. Indirect taxes contribute a further 0.1 percentage points, which suggests the improvement in real GNI is entirely due to the gain in labour income.

On the expenditure side, roughly half of the increase in real gross domestic product (GDP) flows from higher investment. Investment increases by 2.8 per cent, and contributes around 0.6 percentage points to the overall GDP gain of 1.2 percentage points (see Chart 2). This reflects the fact that a higher level of investment is required to maintain the expanded long-run capital stock. Consumption rises by around 0.6 per cent, and contributes around 0.3 percentage points to GDP over the long-run. As noted above, net exports must rise to stabilise the ratio of net foreign liabilities to GDP, with the contribution to GDP from net exports around 0.3 percentage points.

Chart 2: Contribution to real GDP response — CIT financed by lump-sum tax



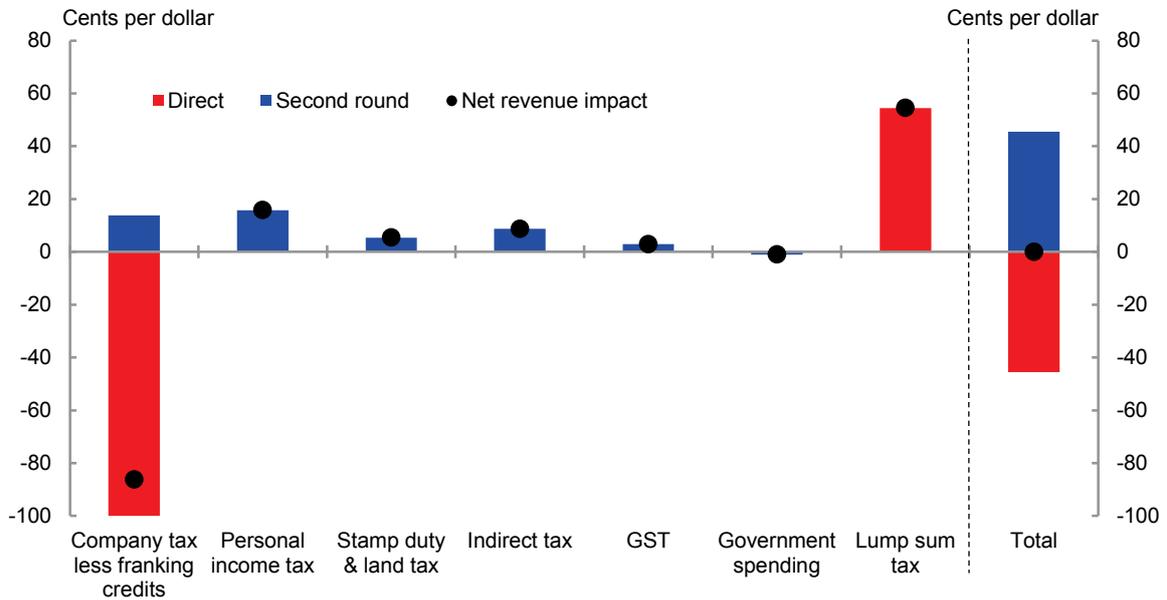
Source: Treasury estimates.

Government budget

Chart 3 reports model-based estimates of the long run effect on tax revenue and government spending per dollar of direct cut in net company tax (that is, gross company tax less franking credits). For example, after gains in revenue from other sources of taxation due to higher economic activity induced by the reduction in the company tax rate (labelled as second-round effects), it is estimated that the lump-sum tax must rise by 55 cents for every dollar of direct net company tax cut. It is also estimated that 16 cents of every dollar cut is recovered through higher personal income tax receipts, while 14 cents of every dollar cut is recovered through higher company income tax receipts. The total revenue loss from the company tax cut that is recovered in the long run through second-round effects

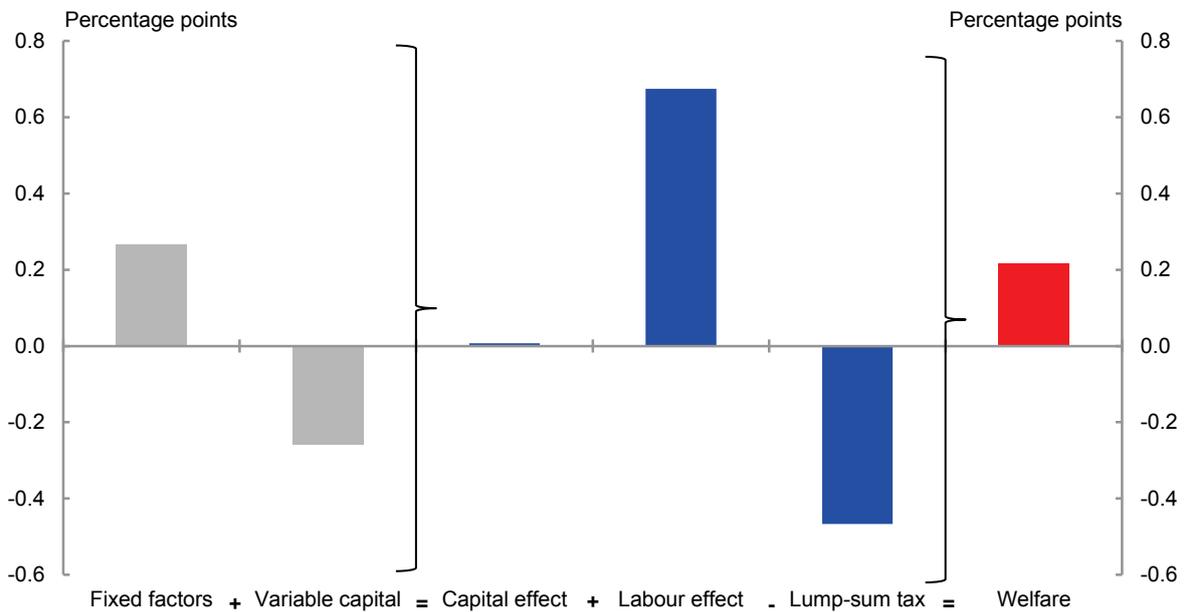
is estimated to be around 45 cents per dollar of net company tax cut, with 8 cents accruing to sub-national governments and 37 cents to the federal government.¹⁶

Chart 3: Government budget response — CIT financed by lump-sum tax



Source: Treasury estimates.

Chart 4: Household welfare — CIT financed by lump-sum tax



Source: Treasury estimates.

16 These recovery rates are consistent with estimates reported by HM Treasury (2013) in their dynamic CGE analysis of a company tax cut.

Household welfare

Household welfare is derived from the consumption of goods and services, and leisure. Consistent with Section 2, changes to leisure are measured by pricing leisure at the baseline after-tax wage. A decrease in the company income tax rate implies an overall welfare gain of around 0.2 percentage points (see Chart 4). As anticipated in the theoretical discussion, when viewed from the standpoint of the notional owners of the factors of production, the welfare gain is largely due to a significant improvement in labour income due to higher after-tax real wages.¹⁷ The contribution from labour is estimated to be around 0.7 percentage points, which more than offsets the detraction from higher lump-sum taxes of 0.5 percentage points. Domestic capital owners enjoy a small welfare improvement from a slight increase in after-tax capital income net of saving.

After-tax capital income, whose contribution is slightly greater than zero, can be further decomposed into returns to variable capital and returns to fixed factors. Incomes accruing to fixed factors contribute about 0.3 percentage points to the overall welfare gain. The lower return to variable factors decreases income accruing to variable capital owners, with the detraction from overall welfare of around -0.3 percentage points.

4. COMPANY INCOME TAX CUT FINANCED BY A PERSONAL INCOME TAX INCREASE

In this section a reduction in company tax rate from 30 to 25 per cent is financed by an increase in the average rate of personal income tax.

Theory and key assumptions

The personal income tax system includes the taxation of both labour and capital income. It is difficult to incorporate progressivity in a model with a single representative household, so the modelling reported here assumes a single effective tax rate (hereafter average personal income tax) that is applied to labour income and capital income after franking credits. Progressivity potentially raises the excess burden of a tax, which implies the modelled average personal income tax increase may understate the welfare cost of raising revenue via the actual personal income tax system.

As noted in Section 3, the perfect capital market and fixed domestic saving rate assumptions imply the capital income component of the personal income is largely invariant to changes in personal tax rates. Therefore, the distortionary part of the modelled personal income tax is effectively the labour income tax component.

17 See Freebairn (2015) and references therein for an extended discussion of the incidence of the company tax.

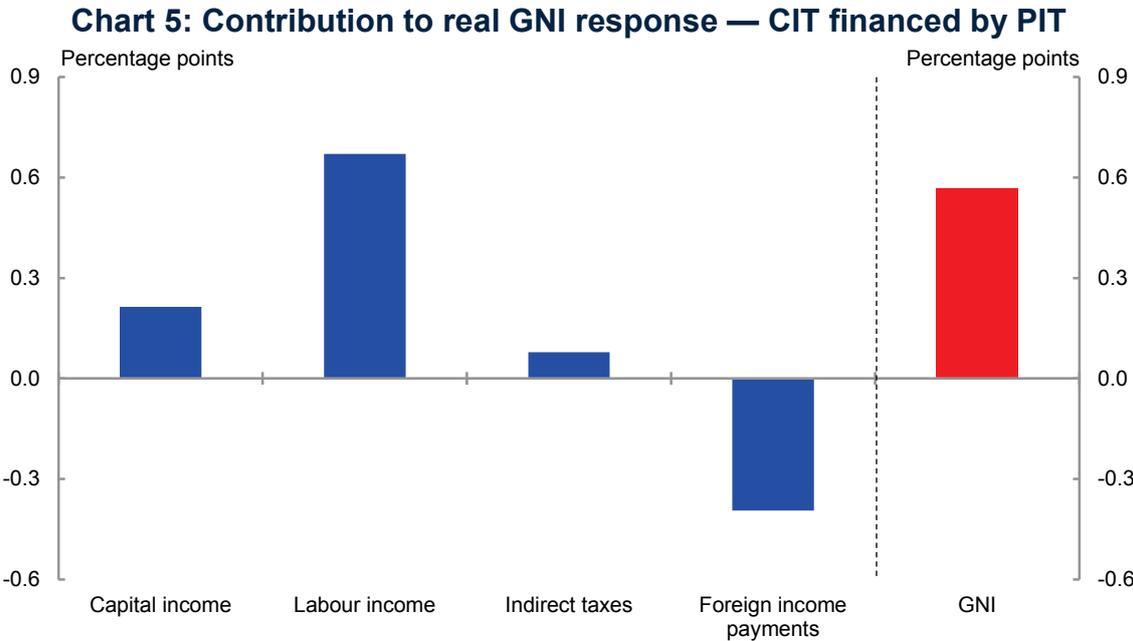
Financing a company income tax cut via a higher personal income tax will impose the following effects over a lump sum tax: lower the after-tax real capital income which is captured in Figure 1 by a fall in the vertical section of the household’s budget constraint (that is, XY’); and cause the real after-tax wage to fall which is captured in Figure 1 by the inclined section of the household’s budget constraint (that is, Z’Y’) rotating towards the origin. As such, it is expected to lead to lower steady state consumption, employment and household welfare compared with the lump-sum tax funding approach. Simply put, the imposition of higher personal income taxes will eat into some of the economic gains from the company tax rate reduction.

Results

This subsection reports the findings from the model simulation of a company income tax rate cut from 30 to 25 per cent, with other tax rates unchanged and assuming any shortfall in revenue across all jurisdictions is financed by an increase in the model’s average person income tax rate.

Activity

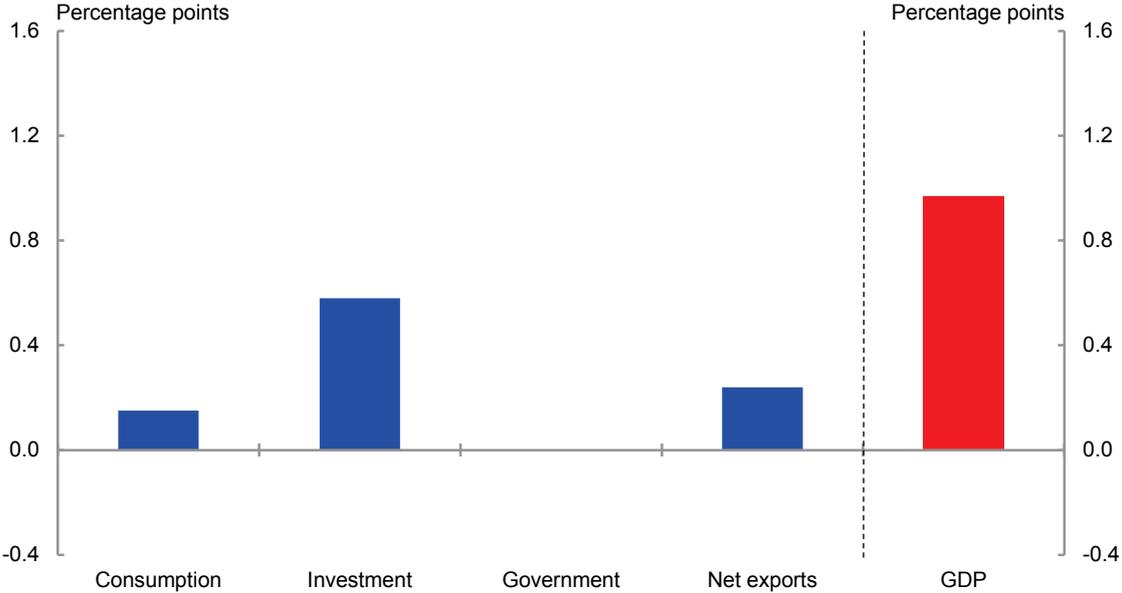
Chart 5 plots the contribution of domestically generated capital income, labour income and foreign income payments to the change in real GNI that results from the company tax cut. Under this scenario, GNI is expected to rise by 0.6 per cent in the long run. This is 0.2 percentage points lower than under the lump-tax. This reflects a lower contribution from capital income, with GOS now contributing 0.2 percentage points and from labour income, with COE now contributing around 0.7 percentage points to the improvement in GNI. Underlying the gain in COE is a rise in before-tax real wages of around 1.2 per cent and a rise in employment of 0.1 per cent. Payments to foreigners continue to detract around 0.4 percentage points, while indirect taxes contribute 0.1 percentage points, which suggests the improvement in real GNI are again entirely due to the gain in labour income.



Source: Treasury estimates.

More than half the increase in real GDP flows from higher investment. Investment increases by 2.6 per cent which contributes around 0.6 percentage points to the overall GDP gain of 1.0 percentage points (see Chart 6). Consumption rises by around 0.3 per cent implying a significantly smaller long-run contribution to GDP of around 0.2 percentage points. As noted above, net exports must rise to stabilise the ratio of net foreign liabilities-to-GDP. The contribution from net exports is around 0.3 percentage points.

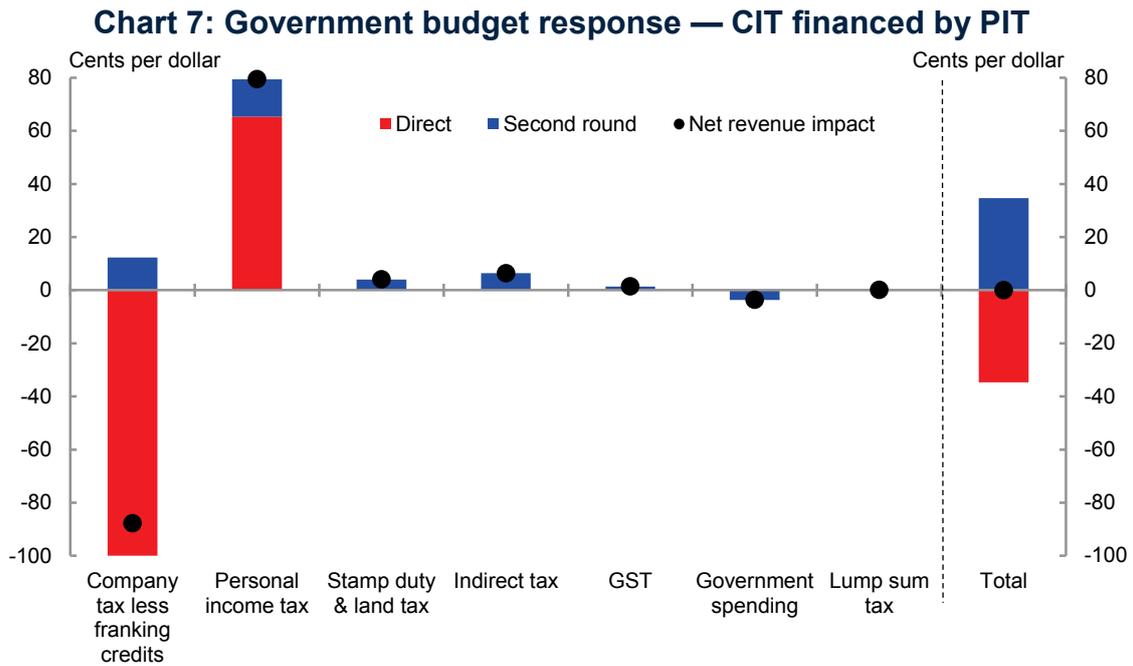
Chart 6: Contribution to real GDP response — CIT financed by PIT



Source: Treasury estimates.

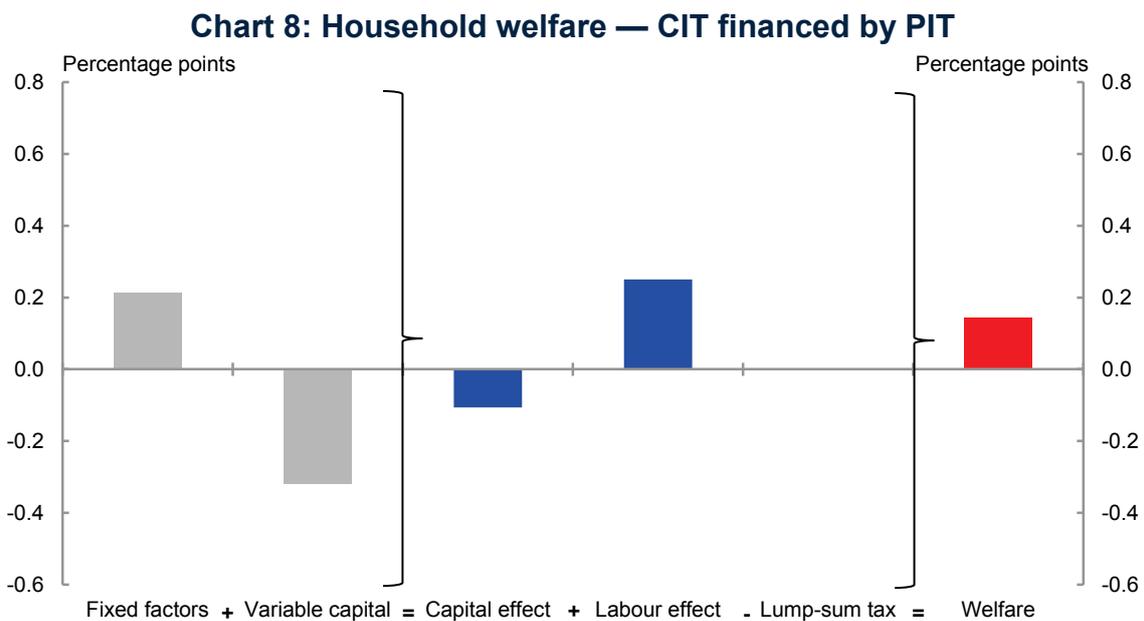
Government budget

Chart 7 reports model-based estimates of the long run effect on tax revenue and government spending per dollar of direct cut in net company tax. After second-round effects, it is estimated that the personal income tax must rise by an additional 65 cents to fund the initial company tax cut. The total long-run revenue dividend from the company tax cut under this scenario is estimated to be around 35 cents per dollar of net company tax cut, with around 5 cents accruing to sub-national governments and around 30 cents to the federal government.



Household welfare

A cut in the company income tax rate financed by an increase in the effective personal income tax rate implies a welfare gain of around 0.1 per cent (see Chart 8), which is lower than when the company tax cut is financed by lump-sum taxes. Underlying this is a decline in welfare accruing to domestic capital owners. This is because after-tax capital income net of saving falls, with capital income now detracting 0.1 percentage points. The contribution from labour is estimated to be around 0.2 percentage points, which is about the same net contribution as the labour effect combined with lump-sum taxes in the previous scenario. Again, when viewed from the standpoint of the notional owners of the factors of production, the welfare gain is due to an improvement in labour income from higher after-tax real wages.



5. COMPANY TAX CUT FINANCED BY A GOVERNMENT SPENDING CUT

In this section a reduction in the company tax rate from 30 to 25 per cent is financed by a cut to government spending.

Theory and key assumptions

Government spending is assumed not to affect directly the welfare of households. In the previous two scenarios real government spending was held constant so adding it to the household utility function would not have made any difference to the welfare calculations reported there. In the current scenario, the implicit assumption is that all government spending that is cut is wasteful. While this is a common modelling assumption it ignores the fact that: government spending provides goods and services that would otherwise not be provided by the market sector; households derive direct utility from government spending; and infrastructure spending can improve market sector productivity. This suggests the model will overstate the benefits of this funding alternative. This scenario is expected to yield significantly higher welfare gains than the previous two scenarios because an additional assumed distortion is removed from the economy.

Results

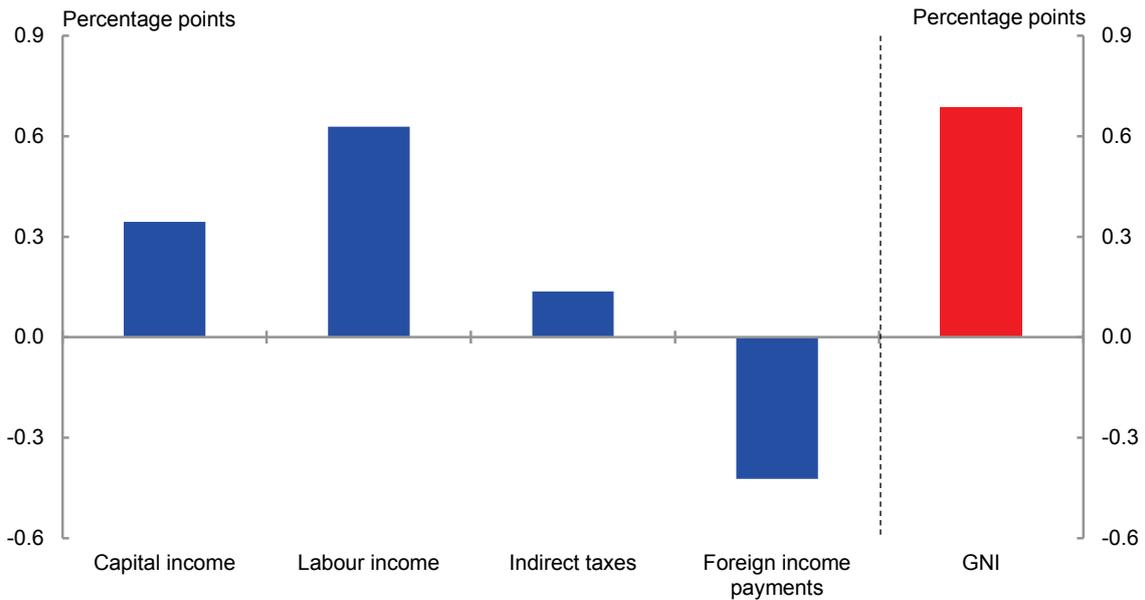
This subsection reports the findings from the model simulation of a company income tax rate cut from 30 to 25 per cent, leaving all other tax rates unchanged and assuming any shortfall in revenue across all jurisdictions is financed by a cut in government spending.

Activity

Under this scenario, GNI is expected to rise by 0.7 per cent in the long run (see Chart 9). Underlying this is a GOS contribution of slightly more than 0.3 percentage points and a COE contribution of around 0.6 percentage points. Again, the expanded capital stock is to a large extent owned by foreign investors, which results in increased payments to foreigners. This detraction from real gross national income is estimated to be around 0.4 percentage points. Indirect taxes contribute 0.1 percentage points, which suggests the improvement in real GNI is largely due to the gain in labour income.

Underlying the gain in COE is an estimated rise in before-tax real wages of around 1.1 per cent and a rise in employment of 0.1 per cent.

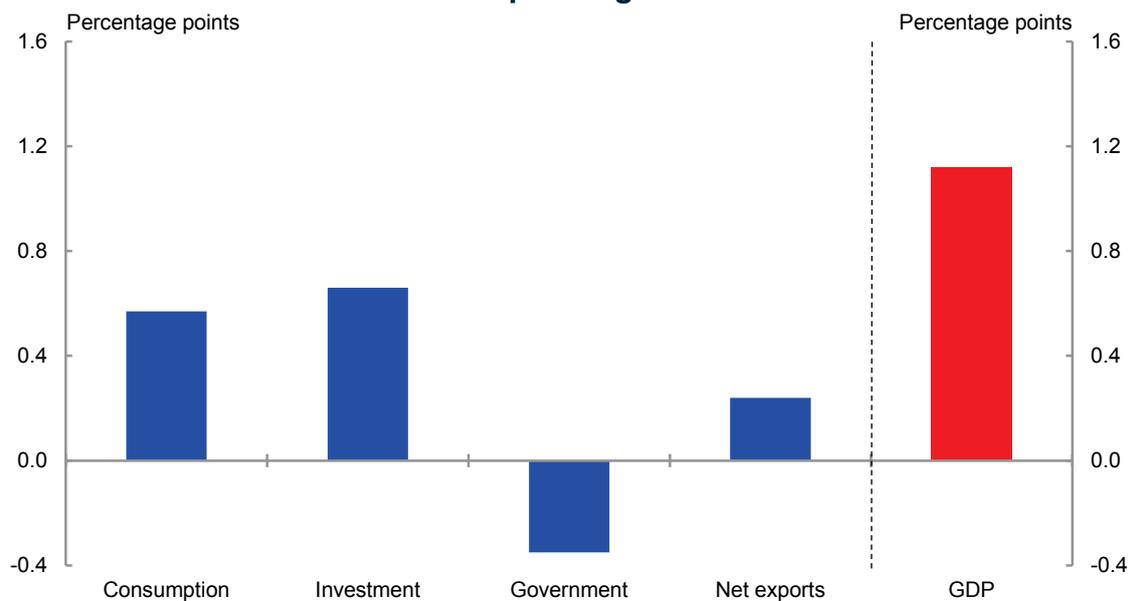
Chart 9: Contribution to real GNI response — CIT financed government spending



Source: Treasury estimates.

Again, more than half the increase in real gross domestic product flows from higher investment. Investment increases by 2.9 per cent which contributes 0.6 percentage points to the overall GDP gain of 1.1 percentage points (see Chart 10). Consumption is significantly higher than the previous scenarios, with an estimated rise of around 1.0 per cent, implying a long-run contribution to GDP of 0.6 percentage points. The contribution to GDP from net exports is estimated to be around 0.3 percentage points, while the cut to government spending detracts around 0.4 percentage points from GDP.

Chart 10: Contribution to real GDP response — CIT financed by government spending

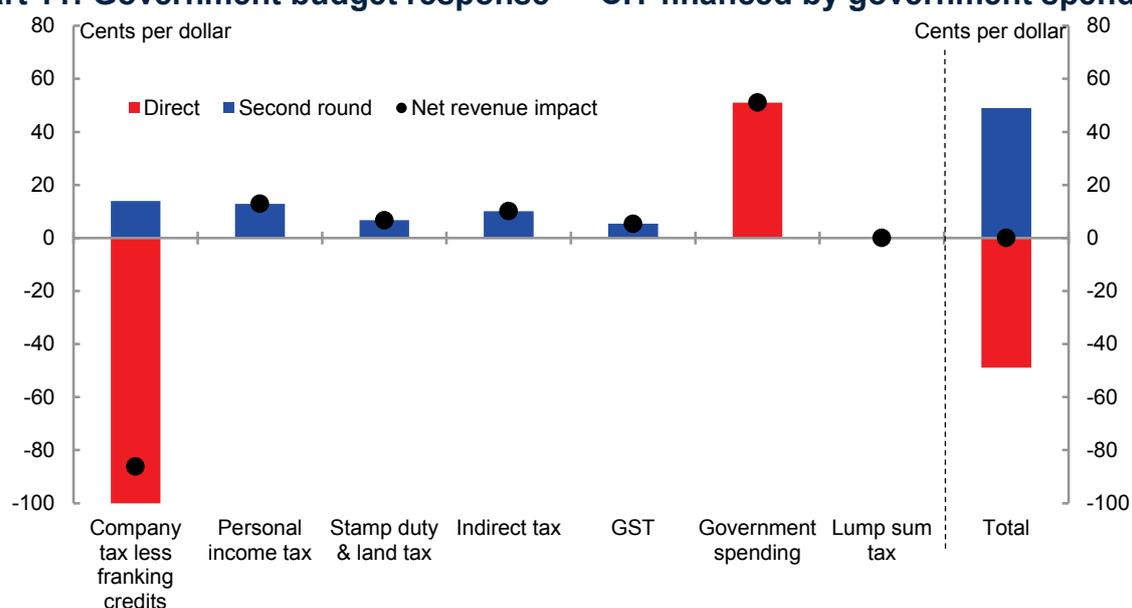


Source: Treasury estimates.

Government budget

Chart 11 reports model-based estimates the long-run effect on tax revenue and government spending per dollar of direct cut in net company tax. After second-round effects, it is estimated that government spending must be cut by 51 cents for every dollar of direct net company tax cut. It is also estimated that 13 cents of every dollar cut is recovered through higher personal income tax receipts in the long run, while 14 cents is recovered through higher company income tax receipts. In the long run, the total revenue dividend from the company tax cut is estimated to be around 49 cents per dollar lost through the company tax cut, with 12 cents accruing to sub-national governments and 37 cents accruing to the federal government.

Chart 11: Government budget response — CIT financed by government spending



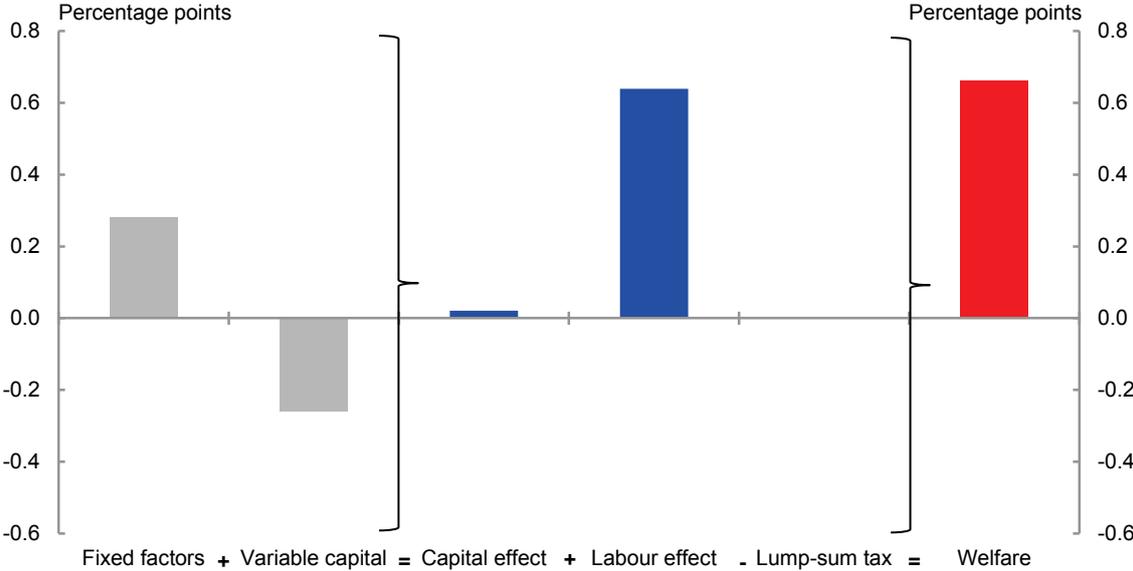
Source: Treasury estimates.

Household welfare

A decrease in the company income tax rate financed by lower government spending implies a significantly higher overall welfare gain when compared with the previous scenarios of around 0.7 percentage points (see Chart 12). As anticipated in the theoretical discussion, when viewed from the standpoint of the notional owners of the factors of production, the welfare gain is largely due to a significant improvement in labour income due to higher after-tax real wages. The contribution from labour is estimated to be around 0.7 percentage points, while domestic capital owners enjoy a slight welfare improvement from a slight increase in after-tax capital income net of saving. After-tax capital income, which in net terms is slightly greater than zero, reflects a rise in incomes accruing to fixed factors. This rise contributes about 0.3 percentage points to the overall welfare gain. The lower return to variable factors reduces income accruing to variable capital owners, with the detraction from overall welfare of around -0.3 percentage points.

It is important to recall that the modelling of government spending is assumed not to affect directly the welfare of households. While this is a common modelling assumption it ignores the fact that: government spending provides goods and services that would otherwise not be provided by the market sector; households derive direct utility from government spending; and infrastructure spending can improve market sector productivity. This suggests the results reported in this section overstate the benefits of this funding alternative.

Chart 12: Household welfare — CIT financed by government spending



Source: Treasury estimates.

6. SUMMARY AND CONCLUSION

For a small open economy, such as Australia, per capita income is determined by the level of its terms of trade, labour productivity, labour force participation and population. Australia’s terms of trade, labour force participation and population growth are expected to be flat or declining in the foreseeable future which implies any improvement in Australia’s living standards must be driven by a higher level of labour productivity.

This paper shows that a company income tax cut can do that, even after allowing for increases in other taxes or cutting government spending to recover lost revenue, by lowering the before tax cost of capital. This encourages investment, which in turn increases the capital stock and labour productivity.

The goal of this paper is to provide a clear exposition of the likely activity and welfare effects of simple company tax cut scenarios. The tax package announced in the 2016-17 Budget has more detailed funding components than analysed here so this paper does not provide specific estimates of the economic gains of that proposal.

Table 1: Summary of key results (per cent deviation from no policy change)

Variable	CIT-Lump-sum	CIT-PIT	CIT-Government spending
Real GDP	1.2	1.0	1.1
Real GNI (GNE deflator)	0.8	0.6	0.7
Consumption	0.6	0.3	1.0
Public final demand	0.0	0.0	-1.7
Investment	2.8	2.6	2.9
Exports	2.2	2.0	2.1
Imports	1.1	0.9	1.1
Employment	0.4	0.1	0.1
Real wage (before tax)	1.1	1.2	1.1
Real wage (after-tax)	1.1	0.4	1.1
Welfare (equivalent variation)	0.2	0.1	0.7

Source: Treasury estimates

Model-based analysis presented here suggests the long-term benefits accrue to workers and households via permanently higher after tax wages and consumption. Some results are sensitive to the method of financing. Table 1 summarises the paper's main results:

- Aggregate domestic activity (GDP) is somewhat invariant to the funding source.
- Investment expenditure is somewhat invariant to the funding source. As such, the expansion of the capital stock and rise in foreign liabilities is similar across scenarios, which implies roughly unchanged deduction to GNI from foreign payments, with changes in GNI outcomes mirroring changes to GDP.
- Improvements to GNI are largely (and in some cases entirely) due to improvements in real wages.
- Consumption, because it depends on after tax income, is somewhat sensitive to the funding source.
- Employment, like consumption, depends on after tax income so it is sensitive to the funding source.
- Because consumption and employment are sensitive to the funding source, it follows that welfare also depends on the funding source.
- Households are better off under all three scenarios. Financing the company tax cut via a government spending cut yields the greatest welfare gain, while the personal income tax funded scenario yields the lowest welfare gain.
- An important caveat is that government spending is assumed not to affect directly the welfare of households. While this is a common modelling assumption it ignores the fact that: government spending provides goods and services that would otherwise not be provided by the market sector; households derive direct utility from government spending; and infrastructure spending can improve market sector productivity. This suggests the analysis overstates the benefits of this funding alternative.

- Model-based estimates suggest a significant proportion (ranging from 35 to 50 per cent) of the direct cut in company tax revenue is recovered through higher tax receipts from increased economic activity.

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APPENDIX A: BASELINE CALIBRATION AND SENSITIVITY ANALYSIS

Model calibration and key economic parameters

To a large extent the model used in this paper relies on the calibration of the model used for the BTWG. Details of that calibration are reported in Independent Economics (2012). As with all analysis based on parameterised theoretical models, the results presented above are sensitive to parameter assumptions (see Gunning et al., 2007, and references therein for further detail). Where possible the baseline calibration of the model is consistent with estimates of Australian economic activity and industry structure reported by the Australian Bureau of Statistics (ABS). There remains a degree of uncertainty around some assumptions, in particular those that relate to elasticities of substitution.

The model is calibrated to reflect the structure of the Australian economy in 2013-14. The basic industry structure and expenditure patterns of the economy are initially calibrated to match ABS Input-Output Tables (ABS cat. 5209.0) for 2007-08. The model is calibrated based on the 2007-08 level of the terms of trade and incorporates a range of other data including other ABS data and unpublished Australian Tax Office (ATO) tax statistics. These data are then updated to allow for growth in wages, prices, productivity and labour supply from 2007-08 to 2013-14, using ABS national accounts (ABS cat. 5206.0), consumer prices (ABS cat. 6401.0) and labour force data (ABS cat. 6291.0.55.003). Finally, the supply of land and fixed factors, the size of the world market, general government final demand and Australian asset ownership are grown in line with Australian real GDP.

The sensitivity analysis presented below suggests that the key results of this paper are robust to a wide range of parameter assumptions which encompass empirically plausible estimates.

Parameters governing household behaviour

The elasticity of substitution between consumption and leisure

The activity and welfare effects of a tax policy change typically depend on the compensated (or Hicks) labour supply elasticity. Compensated elasticities are difficult to identify empirically so the econometric literature typically reports estimates of the uncompensated (or Marshallian) labour supply elasticity with respect to the after-tax wage (see Table 2). The compensated elasticity of labour supply and CES elasticity are then calculated conditional on expenditure shares and the split between working and leisure time.

Table 2: Australian estimates of the uncompensated elasticity of labour supply

Population group	Studies	Estimates	Range	Mean	Median	Standard Deviation
Married men	5	14	-0.19 to 0.26	0.00	0	0.13
Married women	11	27	-0.19 to 1.3	0.30	0.18	0.35
Single men	1	1	0.28	0.28	0.28	-
Single women	1	1	0.34	0.34	0.34	-
Lone parents	3	6	-0.15 to 1.48	0.52	0.2	0.75

Source: Dandie and Mercante (2007)

Specifically, the elasticity of substitution between consumption and leisure in the CES utility function is given by:

$$\sigma = \frac{1}{(1-\beta)} \left[\frac{(1-\gamma)\varepsilon}{\gamma} - \left(\beta - \frac{H}{(H+M)} \right) \right] \quad (4)$$

where σ is the elasticity of substitution between consumption and leisure in the CES utility function, γ is the share of total hours devoted to leisure (equal to 33 per cent in the baseline), β is leisure's share of utility (equal to around 30 per cent), H is the after-tax value of total household hours, M is other income from capital and transfers and ε is the uncompensated elasticity of labour supply. The analysis assumes an uncompensated elasticity of labour supply of 0.15, which is slightly lower than the 0.2 assumed in Independent Economics (2014). Conditional on this and the other model parameters, the consumption-leisure elasticity is 1.2.

To test the sensitivity of the results to changes in this elasticity, two alternatives are considered: a low elasticity of 0.6; and a high elasticity of 1.8. Given the central role of this elasticity it is unsurprising that the activity and welfare analysis is sensitive to this elasticity, with a higher elasticity implying a higher responses (see Table 3). Again, the key conclusions of the paper are robust to this range of consumption-leisure substitution elasticities.

Parameters governing firm/foreign investment behaviour

Share of factor income earned by fixed factors

The model includes both location- and firm-specific fixed factors of production in addition to land. The firm-specific fixed factor reflects the rents generated by intangible assets, such as brand names, patents and market power. Location-specific fixed factors are inputs that are fixed in supply to any particular industry, such as natural resources. Each industry uses a different type of location-specific fixed factor. For example, each industry within the mining sector will use a different type of natural resource — the coal industry requires coal resources and the iron-ore industry requires iron-ore resources. Fixed factors generate location-specific economic rents, which are unable to be obtained unless they are exploited within Australia.

Generally, returns to location- and firm-specific fixed factors are those that are not able to be attributed to other forms of capital. Hence these fixed factors are often referred to as excess returns or economic rents.

Excess returns on the measured stock of capital require an estimate of the normal returns, with any remaining returns assumed to be due to the location- and firm-specific fixed factors. The normal return is estimated to be the model consistent economy-wide after-tax required rate of return. This is used to calculate the before-tax required rate of return for each industry. The before-tax required rate of return differs across industries because their capital structure and debt levels vary.

Estimating the magnitude of excess returns for different industries and in the whole economy is difficult. Furthermore, the existence of rents in any particular year may be due to temporary factors. This effect is somewhat mitigated by calculating the excess returns over a 20 year period.

Based on detailed industry data reported in ABS Estimates of Multifactor Productivity (ABS cat. 5260.0.55.002), location-specific fixed factors are estimated to account for just over 5 per cent of GDP or around a seventh of the total gross operating surplus in the baseline calibration. For comparison, land accounts around 3 per cent of GDP.

Table 4 presents two sensitivity analyses: a lower bound where the importance of fixed factors is reduced by 50 per cent; and one where the importance of fixed factors is increased by 50 per cent. The GDP contribution of labour is held constant, so reducing the importance of fixed factors increases the importance of other capital types.

Reducing the importance of fixed factors (or raising the importance of variable factors) raises the activity and welfare responses to a company tax cut, while increasing the importance of fixed factors lowers activity and welfare responses to a company tax cut.

Share of foreign ownership of firms

The share of foreign ownership of firms in the model is calibrated using gross foreign ownership of businesses. This requires an estimate of foreign liabilities excluding households and government. This is done by estimating the indirect liabilities of households and governments to foreigners through banks, securitises and central borrowing authorities using historical data from ABS National Financial Accounts (ABS Cat. No. 5232.0).

Gross foreign liabilities excluding those of households and government are estimated to be \$637 billion at June 2008. Given a total capital stock of roughly \$3 trillion, this implies that 20.7 per cent of domestic firms were owned by foreigners.

The framework assumes homogenous foreign ownership shares of firms across the economy due to data limitations.

The share of foreign ownership of domestic assets, especially with respect to land and economic rents, has important implications for the efficiency of the company income tax. If the share of land and rents owned by foreigners is greater, raising the company tax rate will give a larger wind fall gain to domestic capital owners.

Sensitivity analysis presented in Table 5 provides insight into the implications of higher or lower foreign ownership by simulating the model assuming: a lower bound where the share of foreign ownership is reduced by 50 per cent; and one where the share of foreign ownership is increased by 50 per cent. The results appear to be somewhat insensitive to this range of parameters.

Degree of international capital mobility

The mobility of capital refers to how easily financial capital (debt and equity) flows into and out of a country. Greater capital mobility will shift more of the burden of taxation from capital to labour through larger changes in the domestic capital stock, and hence in domestic labour productivity and wages (Grubert and Mutti, 1985; and Gravelle, 2010). Under perfect capital mobility, an increase in the company tax rate will result in an outflow of foreign capital to ensure that there is no material difference between the after-tax (risk adjusted) rate of return on investment in Australia and the global rate of return. If capital is not perfectly mobile, an increase in the company tax rate will result in a smaller outflow of foreign capital relative to the perfect capital mobility assumption.

The model's baseline parameterisation assumes perfect international capital mobility. This is consistent with the typical approach of long-run CGE analysis. Analysis presented in Table 6 tests the sensitivity of the results to this assumption by imposing lower international capital mobility. Imperfect capital mobility has been implemented in the model by placing a variable premium on the domestic returns to capital required to attract foreign investment. This premium is a positive function of foreign investment: as the stock of foreign investment grows, the premium drives an increasing wedge between the domestic after-tax rate of return and the required rate of return, which moderates capital flows associated with changes in the company income tax rate. The change in risk premium is determined via a premium elasticity which raises the required rate of return with respect to a change in the foreign value of foreign owned capital.

Following Cao et al. (2015) the sensitivity analysis assumes that a 50 basis points increase in the rate of return is required to double the share of foreign ownership of total assets. Activity and welfare responses are slightly smaller under this assumption.

Propensity to shift capital overseas

The model takes into account that companies may seek to reduce their business tax liability by shifting profits from Australia to countries with lower rates of business tax. De Mooij and Devereux (2011) model this profit-shifting in two forms: transfer pricing; and tax havens. They find that tax havens are more important.

Following De Mooij and Devereux (2011), the representative firm in each industry is assumed to maximise its after-tax profit by choosing the proportion of its tax base to shift to a tax haven. This takes into account the costs and benefits of profit-shifting. De Mooij and Devereux also estimate the extent to which the tax base is eroded when differential tax rates in the home country and the tax haven create an incentive for profit-shifting. They estimate the base-erosion elasticity with respect to the tax rate to be -0.5.

In the baseline the profit shifting elasticity is calibrated to -0.5. Table 7 presents the results of sensitivity analysis assuming: lower bound profit shifting elasticity of -0.25; and an upper bound profit shifting elasticity of -0.75. The results are sensitive to this assumption, albeit slightly. The direction depends on the funding source. Under the lump-sum and government spending scenarios, raising the profit-shifting elasticity (in absolute terms) implies a smaller reduction of distortion to the economy which decreases the activity and welfare responses, while lowering the profit-shifting elasticity (in absolute terms) implies a greater reduction of distortion to the economy which increases the activity and welfare responses. While the personal income tax scenarios exhibit a similar pattern for non-labour market activity to the lump-sum and government spending scenarios, they exhibit different after-tax wage and welfare responses. Under the personal income tax scenarios, raising the profit-shifting elasticity (in absolute terms) implies a lower personal tax increase which increases the after-tax wage and welfare responses, while lowering the profit-shifting elasticity (in absolute terms) implies a greater personal tax increase which decreases the after-tax wage and welfare responses.

Debt equity ratio

The model incorporates a different tax treatment for debt and equity financed investment. In particular, the current tax system allows for deductions on the interest paid on debt financed investment, with no similar allowance for equity financed investment.

While in practice firms receive deductions for interest paid on all debt, or on their gross debt position, some of these are offset by the additional tax liability faced as a result of holding debt of other entities. The deductions on debt repayments reduce tax liability while interest received on debt held increases it. As a result, the net debt position of a firm or industry is used as the base from which the effect of deductions can be calculated. The net debt position for each broad industry is calculated from unpublished ATO administrative data.

Substitutability of capital and labour

The elasticity of substitution between capital and labour governs the sensitivity of these factors to changes in their own-price. Labour is nested with non-structures capital, and the firm specific fixed factor. Non-structures capital is made up of six capital types: transport equipment; plant machinery and equipment; mineral exploration; research and development; information technology; and other capital.

With an elasticity of 0.9, labour and non-structures capital are modelled as gross complements. This means that a one per cent increase in the rental rate of non-structure capital relative to the wage rate will result in a reduction in the demand for both non-structure capital and labour. This elasticity falls within the range of estimates reviewed by Gunning et al. (2007).

In order to test the sensitivity of the results to this elasticity a reasonable empirical range is assumed with a lower bound of 0.4 and an upper bound of 1.4. The results of this sensitivity analysis reported in Table 8 suggest the activity and welfare analysis is sensitive to this elasticity, with a higher elasticity implying greater responses. The key conclusions of the paper are robust to this range of capital-labour substitution elasticities.

Table 3: Sensitivity analysis – Consumption-leisure substitution

	<u>Low elasticity (0.6)</u>			<u>Base case (1.2)</u>			<u>High elasticity (1.8)</u>		
	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending
Real GDP	1.0	0.9	0.9	1.2	1.0	1.1	1.4	1.0	1.3
Real GNI (GNE deflator)	0.6	0.5	0.5	0.8	0.6	0.7	0.9	0.6	0.8
Consumption	0.4	0.2	0.9	0.6	0.3	1.0	0.8	0.4	1.2
Govt. spending	0.0	0.0	-2.0	0.0	0.0	-1.7	0.0	0.0	-1.5
Investment	2.6	2.5	2.8	2.8	2.6	2.9	3.0	2.6	3.1
Exports	2.0	1.9	2.0	2.2	2.0	2.1	2.3	2.0	2.3
Imports	1.0	0.9	1.0	1.1	0.9	1.1	1.2	1.0	1.3
Employment	0.2	0.0	-0.1	0.4	0.1	0.1	0.5	0.2	0.3
Real wage (before-tax)	1.2	1.2	1.1	1.1	1.2	1.1	1.0	1.2	1.0
Real wage (after-tax)	1.2	0.4	1.1	1.1	0.4	1.1	1.0	0.4	1.0
Welfare	0.2	0.1	0.7	0.2	0.1	0.7	0.3	0.2	0.7

Table 4: Sensitivity analysis – Share of factor income earned by fixed factors

	<u>Low share (base case0.5)</u>			<u>Base case</u>			<u>High share (base case1.5)</u>		
	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending
Real GDP	1.6	1.3	1.5	1.2	1.0	1.1	0.9	0.7	0.8
Real GNI (GNE deflator)	1.0	0.8	0.9	0.8	0.6	0.7	0.6	0.4	0.5
Consumption	0.8	0.5	1.2	0.6	0.3	1.0	0.4	0.1	0.9
Govt. spending	0.0	0.0	-1.5	0.0	0.0	-1.7	0.0	0.0	-1.9
Investment	3.4	3.2	3.5	2.8	2.6	2.9	2.3	2.1	2.4
Exports	3.0	2.8	3.0	2.2	2.0	2.1	1.6	1.4	1.5
Imports	1.6	1.4	1.6	1.1	0.9	1.1	0.8	0.6	0.8
Employment	0.4	0.2	0.2	0.4	0.1	0.1	0.3	0.0	0.0
Real wage (before-tax)	1.4	1.5	1.4	1.1	1.2	1.1	0.9	1.0	0.8
Real wage (after-tax)	1.4	0.8	1.4	1.1	0.4	1.1	0.9	0.1	0.8
Welfare	0.3	0.3	0.7	0.2	0.1	0.7	0.1	0.1	0.6

Table 5: Sensitivity analysis – Share of foreign ownership

	<u>Low share (base case0.5)</u>			<u>Base case</u>			<u>High share (base case1.5)</u>		
	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending
Real GDP	1.2	1.0	1.1	1.2	1.0	1.1	1.2	1.0	1.1
Real GNI (GNE deflator)	0.8	0.6	0.7	0.8	0.6	0.7	0.8	0.5	0.7
Consumption	0.6	0.3	1.1	0.6	0.3	1.0	0.5	0.2	1.0
Govt. spending	0.0	0.0	-1.7	0.0	0.0	-1.7	0.0	0.0	-1.8
Investment	2.8	2.6	2.9	2.8	2.6	2.9	2.8	2.6	2.9
Exports	2.1	1.9	2.1	2.2	2.0	2.1	2.3	2.0	2.2
Imports	1.2	1.0	1.2	1.1	0.9	1.1	1.1	0.9	1.1
Employment	0.4	0.1	0.1	0.4	0.1	0.1	0.4	0.1	0.1
Real wage (before-tax)	1.1	1.2	1.1	1.1	1.2	1.1	1.1	1.2	1.1
Real wage (after-tax)	1.1	0.4	1.1	1.1	0.4	1.1	1.1	0.3	1.1
Welfare	0.3	0.2	0.7	0.2	0.1	0.7	0.2	0.1	0.6

Table 6: Sensitivity analysis – Capital mobility

	<u>Perfect capital mobility (base case)</u>			<u>Imperfect capital mobility</u>		
	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending
Real GDP	1.2	1.0	1.1	1.1	0.8	1.0
Real GNI (GNE deflator)	0.8	0.6	0.7	0.7	0.5	0.6
Consumption	0.6	0.3	1.0	0.5	0.2	1.0
Govt. spending	0.0	0.0	-1.7	0.0	0.0	-1.8
Investment	2.8	2.6	2.9	2.5	2.3	2.6
Exports	2.2	2.0	2.1	2.0	1.8	2.0
Imports	1.1	0.9	1.1	1.0	0.8	1.0
Employment	0.4	0.1	0.1	0.3	0.1	0.1
Real wage (before-tax)	1.1	1.2	1.1	1.0	1.1	0.9
Real wage (after-tax)	1.1	0.4	1.1	1.0	0.3	0.9
Welfare	0.2	0.1	0.7	0.2	0.1	0.6

Table 7: Sensitivity analysis – Profit shifting

	<u>Low elasticity (0.25)</u>			<u>Base case (0.5)</u>			<u>High elasticity (0.75)</u>		
	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending
Real GDP	1.3	1.0	1.2	1.2	1.0	1.1	1.1	0.9	1.1
Real GNI (GNE deflator)	0.8	0.6	0.7	0.8	0.6	0.7	0.7	0.6	0.7
Consumption	0.6	0.3	1.1	0.6	0.3	1.0	0.6	0.3	0.9
Govt. spending	0.0	0.0	-2.0	0.0	0.0	-1.7	0.0	0.0	-1.5
Investment	3.0	2.7	3.1	2.8	2.6	2.9	2.7	2.4	2.8
Exports	2.4	2.1	2.3	2.2	2.0	2.1	2.0	1.8	2.0
Imports	1.2	1.0	1.2	1.1	0.9	1.1	1.1	0.9	1.1
Employment	0.4	0.1	0.1	0.4	0.1	0.1	0.3	0.1	0.1
Real wage (before-tax)	1.2	1.3	1.1	1.1	1.2	1.1	1.0	1.1	1.0
Real wage (after-tax)	1.2	0.3	1.1	1.1	0.4	1.1	1.0	0.4	1.0
Welfare	0.2	0.1	0.7	0.2	0.1	0.7	0.2	0.1	0.6

Table 8: Sensitivity analysis – Capital-labour substitution

	<u>Low elasticity (0.4)</u>			<u>Base case (0.9)</u>			<u>High elasticity (1.4)</u>		
	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending	Lump-sum	PIT	Government spending
Real GDP	1.0	0.8	0.9	1.2	1.0	1.1	1.4	1.2	1.3
Real GNI (GNE deflator)	0.7	0.4	0.6	0.8	0.6	0.7	0.9	0.7	0.8
Consumption	0.6	0.2	1.1	0.6	0.3	1.0	0.6	0.3	1.0
Govt. spending	0.0	0.0	-1.9	0.0	0.0	-1.7	0.0	0.0	-1.6
Investment	2.2	1.9	2.3	2.8	2.6	2.9	3.4	3.2	3.5
Exports	1.8	1.6	1.8	2.2	2.0	2.1	2.5	2.3	2.5
Imports	0.9	0.7	0.9	1.1	0.9	1.1	1.3	1.2	1.3
Employment	0.4	0.1	0.2	0.4	0.1	0.1	0.3	0.1	0.1
Real wage (before-tax)	1.2	1.3	1.1	1.1	1.2	1.1	1.0	1.1	1.0
Real wage (after-tax)	1.2	0.4	1.1	1.1	0.4	1.1	1.0	0.4	1.0
Welfare	0.2	0.1	0.7	0.2	0.1	0.7	0.2	0.2	0.6

APPENDIX B: DATA SOURCES

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