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An Inequality Deflator for Australia

TTPI - Working Paper 5/2017
July 2017

Peter Varela
Research School of Economics, Australian National University

Abstract

This paper estimates an Inequality Deflator for the Australian economy, which represents the distributional trade-offs that exist within the current tax and transfer system. These trade-offs can be used to evaluate policy alternatives where equity is an important consideration, as well as provide a normative evaluation of the trend towards increased inequality in Australia. This normative evaluation can be justified in two ways. First, it can be argued that the government has revealed a preference for distributional trade-offs through the tax system, which should be followed in other policy analysis. Second, this approach is equivalent to altering the standard Kaldor-Hicks welfare criterion such that compensating payments are made through the existing tax system (rather than as lump sum payments). As such, implementing policy in this way, along with adjustments to the tax and transfer system, can be thought of as identifying realisable pareto improvements. In order to estimate an Inequality Deflator in the Australian setting, this paper develops an estimation method using The Melbourne Institute Tax and Transfer Simulator (MITTS). This methodology also allows for an Inequality Deflator to be estimated at the household level, and for different family types. Finally, the Inequality Deflator is applied to the Australian economy over the period 1994-2013 and finds that if the tax system was used to spread growth equally across the population, growth would be around 18 percent lower than recorded.

JEL Codes: H21, H22, H24.
Keywords: Inequality, tax incidence, cost benefit analysis, microsimulation, Kaldor-Hicks

**I wish to thank Maria Racionero, Nicolas Herault, Guyonne Kalb and Nathaniel Hendren for helpful comments and edits on the draft. All remaining errors are of course my own.*

Tax and Transfer Policy Institute

Crawford School of Public Policy

College of Asia and the Pacific

+61 2 6125 9318

tax.policy@anu.edu.au

The Australian National University

Canberra ACT 0200 Australia

www.anu.edu.au

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1 Introduction

The aggregation of welfare effects across individuals is a long-standing problem in economics. While many solutions have been proposed, there is far from a consensus as to the appropriate way to trade off welfare gains and losses of different individuals. That this type of question causes such debate amongst economists is particularly troubling, as a significant proportion of policy decisions require trade-offs of this kind.

Traditional responses to this issue include ignoring the distributional effects of policies and simply summing the relative welfare effects across individuals (Harberger 1971 and Parish 1976). This is equivalent to the standard Kaldor-Hicks criterion with lump sum transfers, and is often justified on the basis that distributional concerns are best handled through the tax and transfer system, thereby freeing other policymakers to focus solely on efficiency. While this may provide a useful rule of thumb in some circumstances, concerns regarding a fair distribution of income cannot be left to the tax and transfer system in a general sense,[1] as the tax and transfer system has costs associated with redistribution, and doing so might miss more efficient means of redistribution (Dreze and Stern 1987, Stiglitz 1988).

Others have argued for the use of distributional weights as part of the cost benefit process that replicate an underlying social welfare function. Distributional weights have a long tradition in academic debates,[2] were endorsed by the World Bank for a short period (Little and Mirrlees 1994), and are currently endorsed by the UK Treasury for government cost benefit analysis. Australian government guidelines for Cost-Benefit Analysis (Department of Finance and Administration 2006) discuss the option of using distributional weights, but provide little guidance as to how to practically estimate the appropriate weights.[3]

While distributional weights allow distributional concerns to directly en-

[1] Although, as discussed in Section 2, there are certain situations in which equal weighting is a well-justified approach.

[2] For example, Boadway and Bruce (1984); Brent (1984); Cowell and Gardiner (1999); Creedy (2006); Dasgupta and Pearce (1972); Dasgupta, Sen and Marglin (1972); Dreze (1998); Dreze and Stern (1987); Harberger (1978); Johansson-Stenman (2005); Liu, (2006); Little and Mirrlees (1974); Ray (1984); Squire and van der Tak (1975); Weisbrod (1968) and Yitzhaki (2003).

[3] The Productivity Commission (2011) include distributional weights in their analysis of the National Disability Insurance Scheme, although this approach was criticized in Harrison (2013).

ter the decision making process, the approach has been heavily criticized on the basis that the choice of weights is somewhat arbitrary, and that one person's preference for redistribution is no more 'correct' than another person's.[4] Moreover, even if each individual's preferences for redistribution could be easily observed, it is not obvious how to aggregate these preferences to create social preferences.[5]

Given the difficulty of determining the correct distributional weights, another approach is to simply report how the policy affects different groups, and allow politicians (or other decision makers) to make the relevant interpersonal trade-offs[6] (Boadway 1976). This approach is recommended by recent guidance provided by the Australian Government (OBPR 2014).

An appealing alternative, and the approach taken in this paper, is to use the distributional trade-off that exists in current policy to guide future policy. In other words, if we can estimate the trade-offs that are observed in the existing tax and transfer system, and that are available as policy options to the current government, then this can be used as a benchmark to assess any new policy proposal. This allows the policy analyst to provide guidance with regard to distributional trade-offs without the subjectivity inherent in the social welfare function approach. It also allows for the relative trade-offs between different groups to be equalised across policies, resulting in efficiency gains.[7]

One way to implement this idea is to attempt to identify the revealed preference of government based on observed policy decisions, and then replicate this trade-off when looking at new policies. Early approaches along these lines, such as Stern (1977), Piggott (1982) and Cowell and Gardiner (1999) rely on the strong assumption that the tax system places an equal absolute sacrifice on different taxpayers. More recent work has typically involved inverting formulas from the Mirrlees optimal income tax framework, such as proposed in Diamond (1998) and Saez (2001) and implemented by Bourguignon and Spadaro (2010), Bargain et al. (2014) and Lockwood and

[4]See Adler (2013) for a summary of these critiques.

[5]This is a direct consequence of Arrow's Impossibility Theorem (Arrow 1950).

[6]In practice, reporting the distributional impacts separately to the efficiency findings is very similar to just using the standard Kaldor-Hicks approach, as cost-benefit analysis is generally interpreted based on the headline figure.

[7]This is analogous to the cost-effectiveness approach commonly employed in cost-benefit analysis literature, where the goal is to achieve a given equity-based goal in the most cost-effective way.

Weinzierl (2014).

An alternative approach is to implement policy proposals along with an adjustment to the existing tax and transfer system that removes any distributional incidence. This approach is equivalent to implementing the standard Kaldor-Hicks criterion, making compensation payments through the tax system rather than lump sum transfers. As pointed out in Hendren (2014), this was an approach envisaged in the original work by Kaldor and Hicks, and developed in a theoretical setting by Bruce and Harris (1982), Diewert (1983), Kaplow (2004, 2008) and Coate (2000). Hendren (2014) developed an empirical framework to identify the costs of making transfers through the tax and transfer system, but significantly, did so in a way that once estimated, could be implemented as a set of shadow weights, allowing assessments to be made across multiple projects without having to re-estimate the cost of the distributional transfer. This paper was also the first to use the term 'Inequality Deflator'.

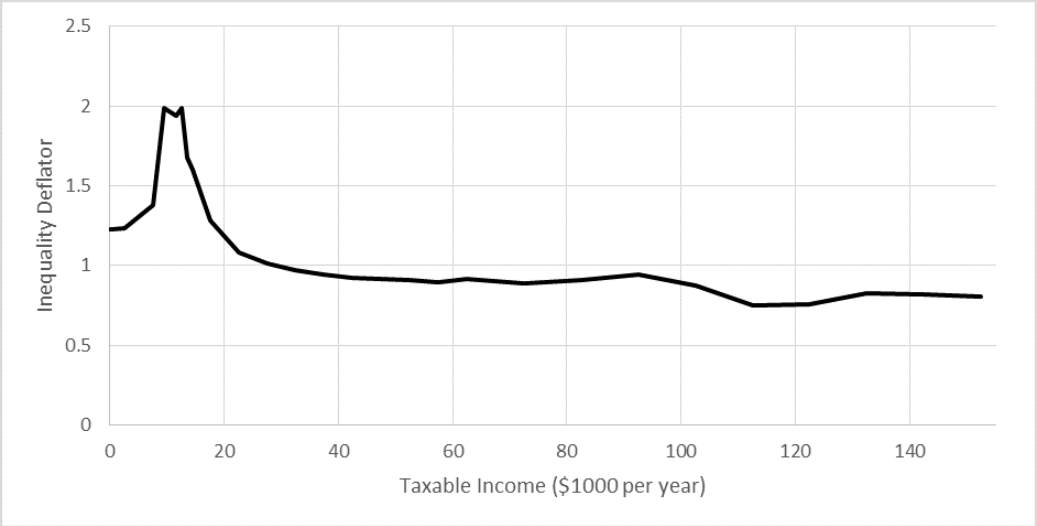
This paper follows the spirit and design of Hendren (2014), but estimate the Inequality Deflator using the Melbourne Institute Tax and Transfer Simulator (MITTS) – a behavioural microsimulation model (Creedy and Kalb 2004). This divergence in methodology is motivated partially by a lack of comparable elasticity estimates for the Australian economy. However, the microsimulation methodology does provide a number of advantages (and disadvantages) relative to Hendren's methodology. Notably, the microsimulation model provides for much more variation in behavioural response across the income distribution and by individual characteristics (such as family type) as the labour supply of each individual in the model is modelled separately. The MITTS framework also provides a natural way to look at distributional trade-offs at the household, rather than individual level. The richer picture that is obtained through the structural labour supply model comes at the cost of having to specify the labour supply model. Any results that are obtained are only as good as the labour supply response obtained through MITTS. The relative merits of the microsimulation approach will be discussed in detail in the proceeding sections.

Figure 1 presents the main estimates of the Inequality Deflator for the Australian economy. The y-axis of this chart should be interpreted as the cost, in terms of government revenue, of transferring one dollar to people at this income level through the tax and transfer system.[8] Therefore, in order

[8]Note that this uses a slightly different definition of the Inequality Deflator to the

to increase the welfare of people earning $120,000 by $1, it would only cost around 80 cents of government revenue. Alternatively, to increase the welfare of people receiving unemployment benefits by $1 costs around $2 of government revenue. These figures vary as a direct result of the different labour supply responses to payments at different parts of the income distribution.

Figure 1: Australian estimates of the Inequality Deflator



Following the intuition above, this chart can also be interpreted as the revealed preference for redistribution that exists in the current Australian tax system. In other words, if we assume that the existing tax system is maximising Australian social welfare, then the marginal value of a dollar for someone earning $17,000 is 2.7 times as high[9] as the marginal valuation of a dollar for someone earning $120,000.

The remainder of this paper proceeds as follows. In Section 2, the Inequality Deflator is formally introduced, along with a motivating example and a discussion of the issues that arise when implementing the Deflator in a real world setting. Section 3 provides details on the empirical strategy,

Hendren paper, which defines the Deflator as the cost of transferring one dollar equally across the population. The definition used in this paper is more intuitive, but is not revenue neutral. For most applications, the two measures will be equivalent as applications are typically concerned with comparing the Deflator between different levels of income.

[9]Calculated as 2 (the Deflator evaluated at $17 000)/0.75 (the Deflator evaluated at $120 000).

including details of the MITTS model, and a comparison with the empirical approach of Hendren (2014). Section 4 provides empirical results, along with a range of secondary output from the model to aid with interpreting the main results. This section also includes results by subgroup, as well as estimation of the household level Deflator. Section 5 uses the estimates of the Inequality Deflator for the Australian economy to evaluate the joint impact of increased growth and increased inequality in the Australia economy since 1994, finding that in the period 1994-2013, 18 per cent of Australian growth would be lost if the Australian tax system was used to spread this growth equally across the income distribution. Section 6 concludes, and discusses a number of future potential applications of the Inequality Deflator.

2 The Inequality Deflator

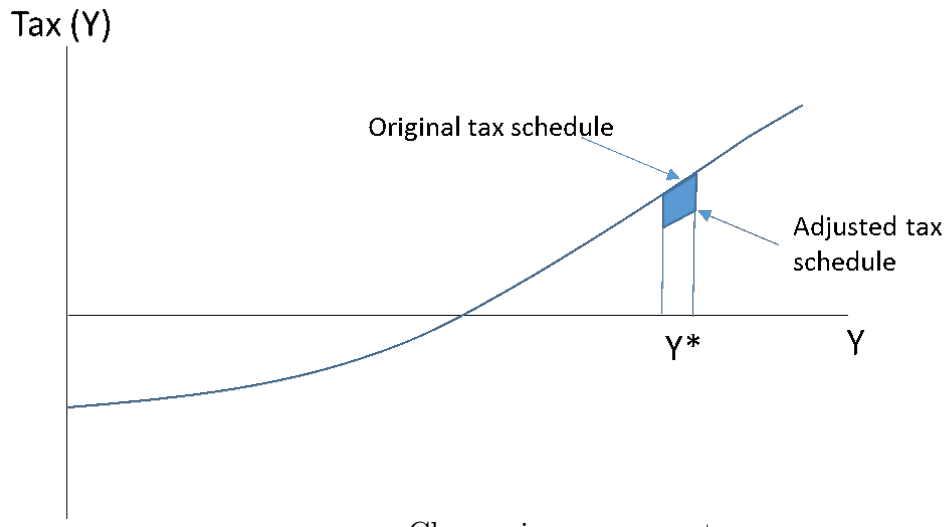
The Inequality Deflator is found by altering the existing tax and transfer system to provide a small amount of money ($\$\varepsilon$) to people in the local region of income (Y*), as shown in Figure 2. The Deflator will be equal to the change in government revenue resulting from this adjustment, divided by the change in individual welfare (measured as the equivalent variation of the policy). It can be interpreted as the cost (in terms of government revenue) of transferring a dollar to people in a particular income interval.

In a static situation in which people did not respond to the tax change, the Inequality Deflator would be equal to one, as the n people who were originally earning Y* will now each be better off by $\$\varepsilon$, and the government will lose n x $\$\varepsilon$ in revenue.

However, changing the tax system will encourage people to change their income in order to receive the tax benefit. If people earn more as a result of the tax change, it will offset some of the fiscal cost of the policy. As a result, the Inequality Deflator will be less than one. If people earn less as a result of the tax change (for instance, if people reduce their income to receive the targeted payment), it will increase the fiscal cost of the policy and the Deflator will be greater than one. Note also that for small changes in the tax system, the welfare effects for the group that is moving will be second order, which means that the change in the government revenue will determine the change in the Inequality Deflator.[10]

[10]This result relies on the envelope condition. Effectively, if the cash transfer is small, there can be no first order welfare effects to individuals who change labour supply.

Figure 2: Stylised depiction of an adjustment to the tax and transfer schedule



$$\text{Inequality Deflator} = \frac{\text{Change in government revenue}}{\text{Change in individual welfare (the sum of EVs)}}$$

Another way to think about the Inequality Deflator is that most workers have a large marginal effective tax rate, even if they have a low or negative average tax rate (Ingles and Plunkett 2016). This means that, at the margin, the social benefit of an additional hour of work is typically more than the private benefit, and increasing the work hours of any individual by a small amount will result in a fiscal externality that will increase social welfare.

This provides the basic intuition for where the Inequality Deflator will be high and where it will be low. It will be low when an adjustment to the tax system (as in figure 2) leads to an increase in the hours that people work. Where a similar change to the tax system decreases the hours that people work, the Inequality Deflator will be high. Tracing the determinants one step further, changes in labour supply responses are high where there is a) high labour supply elasticity, and b) a large number of workers who are able to move to take advantage of the tax change. The importance of the second point can be seen by examining the lower end of the income distribution. By definition, a cash transfer to people with zero market income cannot result in people increasing their labour supply to receive the payment. We therefore expect to see high values of the Inequality Deflator for low income levels.

Following Hendren (2014), the Inequality Deflator as defined above can

be used directly as a weight in cost-benefit analysis with three appealing rationales. First, the Inequality Deflator is equivalent to the social welfare weights that would rationalise existing government policy. In other words, if we assume that the government is acting rationally to optimise some general social welfare function, then the Inequality Deflator represents the social welfare weights of that function. This also has the appealing policy intuition that the high-level trade-off between equity and efficiency is set using the income tax and transfer system, and this trade-off is repeated in subsequent policy decisions.

The second interpretation of the Inequality Deflator is that regardless of whether we think that existing government policy is optimal, implementing policies based on the Inequality Deflator, along with small changes to the existing tax system, will result in actual pareto improvements. The basis of this argument is to modify the existing Kaldor-Hicks criterion so that compensation payments are made through the tax system (rather than as lump sum payments). In this way, the distributional incidence of a new policy can be undone through changes to the existing tax and transfer system, with a policy being worthwhile if there is still leftover surplus once everyone has been compensated.

Finally, the Inequality Deflator can be interpreted as a way to test whether a policy is the most efficient way to achieve a stated equity-based goal, or whether that same outcome could be achieved through an adjustment to the tax system.

2.1 A simple example

To motivate the idea behind the Inequality Deflator, it is instructive to consider a simple example. Consider a world in which there are three people; Alan who works in a high paying job, Bill, who is unable to work (perhaps due to age or disability), and Colin who has two young children and works part-time in a low wage job.

The tax and transfer system affects each of these individuals differently. First, Alan pays an income tax, which reduces the incentive for him to work. We will assume that this tax has a constant excess burden of 20 per cent. In other words, in order to raise a dollar of government revenue, it must decrease the welfare (measured as the Equivalent Variation (EV)) of Alan

by $1/0.8 = 1.25$.[11] Bill receives a transfer payment, but as he is unable to work, this can be considered a lump sum payment. Finally, Colin receives a welfare payment that varies with his final income. This transfer payment has an efficiency cost, as it provides him with a financial incentive to work fewer hours. For this exercise, we will assume that this cost is 40 per cent. In other words, in order to raise $1 of government revenue by reducing this payment, Colin's welfare would only need to be reduced by 60 cents.

In this example, the Inequality Deflator is the cost of transferring money from each individual to the government, measured as the EV loss to each individual.

- For Alan, this is equal to 0.8.
- For Bill, this is equal to 1.
- For Colin, this is equal to $1/0.6 = 1.67$.

Now, consider a new project that is funded out of government revenue that costs $100, has a benefit for Alan of $10, a benefit for Bill of $40, and a benefit for Colin of $40. Using the Inequality Deflator approach, this project is valued at:

$$\begin{aligned}\text{Alan's Value} + \text{Bill's Value} + \text{Colin's Value} &= 0.8 * \$10 + 1 * \$40 + 1.67 * \$40 \\ &= \$114.67\end{aligned}$$

Following this methodology, this project has a surplus of $14.67 and should go ahead.

We will now show that using the Inequality Deflator in this way is equivalent to implementing the Kaldor-Hicks criterion using changes to the existing tax and transfer system. Consider a policy in which each individual has the benefit of the project removed through changes to the tax system.

- For Alan, the income tax is increased to reduce his welfare (measured as an EV) by $10, which results in $8 of government revenue.
- For Bill, the lump sum payment he receives is reduced by $40.

[11] The literature uses different definitions to define the efficiency cost (or excess burden) of taxation. Through this example, measures of efficiency are defined as the efficiency cost without returning income lump sum to the person being taxed.

- For Colin, the transfer payment is reduced such that it reduces his welfare by $40. However, given that this payment currently reduces his incentive to work, lowering the payment also removes some of the distortionary impact, and consequently increases government revenue by $40 x 1.67 = $66.67

Added together, this has raised $114.67 of government revenue, of which $100 is used to implement the program. Note that because everyone is just as well off as when they started, and the government has collected additional revenue, this policy (including the changes to the tax system to raise the revenue) represents a realisable pareto improvement.

2.2 Four important issues when applying the Inequality Deflator

Extending the Inequality Deflator to a population faces a number of practical and conceptual challenges. Understanding the nature of these challenges is essential for interpreting how the Deflator can be implemented in a real world setting. Along with the empirical issues associated with estimation (discussed in Section 3), this section will examine four main issues – namely, how to deal with the fact that different people face different tax systems, how well the Inequality Deflator approach applies to non-marginal changes, how to interpret policies that have a different impact for people with the same income and whether the Deflator can be used when a publicly provided good affects labour supply incentives.

First, while it is convenient to think of transferring money to or from an individual earning a particular income, in a realistic tax setting individuals do not face a common tax and transfer system. Rather, the tax rates and transfer payments that each individual faces will depend on a wide range of personal characteristics, such as whether or not they have a partner, the income of that partner and the age and number of children that they have. This provides some flexibility to the Inequality Deflator, as compensation payments made through the tax system can now be made just to a particular group of people (e.g. the cost of transferring a dollar to a single parent with three children) rather than to the entire population.

However, this flexibility also adds to the empirical complexity. In principle, the Inequality Deflator could be defined for each possible tax schedule. However, it is implausible to estimate labour supply responses for each of

these groups,[12] and within the MITTS framework dividing the cohort up into such small groups would leave too few observations to conduct a reliable modelling exercise. Nevertheless, it is important to separate the Inequality Deflator into different categories in order to capture the main variation within the tax and transfer system. In this paper, individuals were separated into four groups; singles with children, couples with children, singles without children and couples without children. This subgroup analysis is presented in Section 4.

The second implementation issue comes from the marginal nature of the Inequality Deflator. The results are based on small (infinitesimal) changes to the existing tax systems, so care should be taken when extending the results to interpret large policy changes. However, in order to practically implement the Deflator in a cost-benefit setting, it is useful to understand what counts as a 'small' policy change. One advantage of the MITTS modelling technique used in this paper is that it allows transfers of different sizes to be modelled, which can provide some insight regarding how much money can be efficiently transferred through the tax system. The MITTS model showed that the larger the transfer was, the higher the efficiency cost of the transfer, but that the results were relatively smooth for values less than $1000 per annum. Further discussion of this topic is contained in Appendix 2A.

The third implementation issue is determining what to do when surplus generated by a project is not equal for people at the same income level. For instance, if two people have the same income, and a policy benefits one person by $1 and hurts the other by $1, it is impossible to make changes to the income tax that result in compensating payments to both parties. Intuitively, the tax system is not flexible enough to reverse the policy impact. To some extent, more tailored policies can be implemented based on changes to different tax/transfer payments. For instance, thresholds for family income in the family tax benefit system could be changed to target families with children, while thresholds for individual income could be changed to target individuals with children. However, this process can only go so far, and there will still be variation of welfare amongst similar people.

In this case, implementing a cost-benefit process using the Inequality Deflator will not return a potential pareto improvement using the Kaldor-

[12] As an example, the Family Tax Benefit Part A supplement has 30 different income test thresholds that vary according to the combination of children of different ages, (Centrelink 2009) meaning that a Deflator could in principle be defined for each of these combinations of child ages.

Hicks interpretation. Rather, it will ensure that the expected compensation for people at a given income level is greater than or equal to zero (while some people will be worse off and some people will be better off). As a result, this process no longer yields a pareto improvement.[13]

This style of analysis may still be justified on the basis of the revealed preference interpretation. This interpretation would say that for small policy impacts, the welfare gained by a person of a particular income level is offset by another person's loss at the same income level. However, this requires an additional assumption that the government is indifferent between people who are indistinguishable through the tax system. In other words, if two people share the same income, and the same characteristics used to define tax and transfer liabilities (such as relationship status and number of children), then the government would be indifferent between one gaining a dollar and the other losing a dollar.

The validity of this assumption is unclear, but it is more reasonable for small policies,[14] and for policies that affect people somewhat randomly. On the other hand, the assumption is less likely to be valid for large policies, or where the policy affects a group systematically based on a criterion that is not part of the tax system, such as a policy that favoured all men, or all people of a particular age.

In order to maintain the Kaldor-Hicks interpretation of using the tax system to implement a pareto improvement, it is necessary to make an adjustment to the process. In this case, $\underline{S}(y)$ is defined (following Hendren's notation) to be the lowest level of surplus for any individual at a given income level. Implementing the Inequality Deflator with $\underline{S}(y)$ will guarantee a pareto improvement, but is a more difficult benchmark. Essentially, it results in overcompensating all individuals with $S(y) \geq \underline{S}(y)$, which will make it difficult to find welfare improving policy proposals, and will result in a strong status quo bias.

A final implementation issue is that this type of analysis is the concern that policies with distributional effects may create an incentive or disincentive to work in exactly the same way as an income tax. For instance, if a publicly provided good is available only to those who earn less than a certain wage threshold, there is a disincentive to earn more than that wage threshold.

[13] Instead it yields what Ng (1984) calls a quasi-pareto Improvement.

[14] Larger impacts would violate both the small policy assumption used in this paper, as well as notions of horizontal equity in the tax system.

In this case, the incentives to earn must be incorporated into the final calculation. In fact, as shown in Kaplow (2004), if the policy being considered affects work decisions in exactly the same way as a tax, then under general assumptions,[15] equal welfare weighting should be used for all individuals in the policy analysis.

The key distinction in determining whether to evaluate a policy using weights based on the Inequality Deflator or equal weights is whether the benefit provided by the good occurs because they are poor, or whether enjoyment of the good is just higher amongst low-income people, who would continue to benefit from the good even if they had higher incomes.

To see the difference between the two cases, consider the following examples. In the first case, a means tested subsidy for health care that is only available to people with low incomes. In this case, a low-income individual who receives the subsidy will be concerned that they will lose this subsidy as they earn more money. Following the logic of Kaplow (2004), this policy should be evaluated using equal weights, rather than the Inequality Deflator. In the second case, a one-off policy that affects a small number of people, such as the decision to build a local park, or disaster relief to a small town, are unlikely to affect long-term incentives to earn money. In this case, the policy should be evaluated using the Inequality Deflator.

In practice, many types of policies and public goods will be a combination of the two examples above. For instance, the provision of a public good may have no effect on work incentives in the short-term, but viewed in the long-term, such policies may slightly increase the desirability of a low-income lifestyle. Alternatively, a policy may increase a marginal effective tax rate, but because it is less salient than the income tax, it is less likely to affect work incentives. In this situation, a more general analysis is required in which the benefits of the policy are estimated using the Inequality Deflator, and the costs of the policy include any fiscal externalities resulting from people earning more or less as a result of the policy. Where these two effects are equal, the case reverts to an equal weighting result as in Kaplow (2004).

In summary, in order to evaluate policy using the Inequality Deflator, it is important to consider the following issues:

- Which group is being affected, and is it appropriate to use a population level Deflator, or a Deflator defined for a population sub-group?

[15] The main assumption is weak separability of leisure and consumption in the utility function.

- Is the policy being examined small? The Inequality Deflator is a marginal concept, so care must be taken in evaluating large changes.
- Does the policy affect people differently conditional on income, and if so, is there a reason to think that this group should be treated differently by the tax system?
- Does the policy being considered have a large effect on people's incentive to work and earn money? If so, there is an additional term to consider in welfare calculations. In the specific case where the policy being considered acts like part of the tax system, and utility is weakly separable, then equal weights should be used to evaluate the policy.

3 Estimation using MITTS

Estimation of the Inequality Deflator is performed in this paper using the Melbourne Institute Tax and Transfer Simulator (MITTS), which is a behavioural labour microsimulation model developed over a period of time by researchers at the Melbourne Institute of Applied Economic and Social Research. MITTS has been used in a large number of research projects to examine the impacts of changes to Australia's tax and transfer system in both a positive and normative manner.[16,17] The MITTS project that is most closely related to this work is Creedy and Herault (2011), which looks at whether small tax changes to the existing tax system can be found that increase social welfare. However, it bases this analysis on the assumption of various social welfare functions, which is an approach that the current paper is designed to avoid.

The MITTS model is composed of two distinct parts, MITTS-A and MITTS-B. MITTS-A is a static microsimulation model and can calculate net incomes for each household in a cross sectional household survey (for this paper the 2009/10 Survey of Income and Housing is used as the base data). This calculator includes a significant amount of detail regarding the existing

[16]The Melbourne Institute has a full list of projects completed using MITTS on their website: https://www.melbourneinstitute.com/labour/research-topics/microsimulation/mitts.html.

[17]More broadly, behavioural microsimulation is being increasingly used to look at issues of optimal tax changes and redistribution. See for instance, Bessho and Hayashi (2013) and Spadaro (2007).

tax and transfer system and is used to calculate post tax/transfer income for different levels of labour supply. Tax liability at the household level is then scaled up to the population level using the sample weights from the underlying survey. This process also requires knowledge of each individual's wage, which are either observed in the data, or imputed using the process described in Kalb and Scutella (2002).

MITTS-B is based on a structural labour supply model as estimated in Kalb (2002). The model is neoclassical, with each household maximising a quadratic utility function over income and leisure. Households have a joint utility function and couples make joint labour force decisions. Household utility functions are estimated for four distinct groups; couples without children, couples with children, single individuals without children, and sole parents. Labour supply is not modelled for children, people over the age of 65, the self-employed, students, or people eligible for a disability pension.

Simulated household level utility functions are derived through a calibration process, by which an error term is added to the estimated utility function that returns the individual to the observed hours of labour supply. As there are a number of error terms that would be consistent with the observed labour supply point, the model takes one hundred draws of the error term that would be consistent with the observed level of labour supply. Labour supply is computed for each of the one hundred utility functions, which means that labour supply predictions are probabilistic.[18]

Once the household specific utility function is estimated, and the net income is known at each possible labour supply point, MITTS-B can directly calculate utility at each possible labour supply point. The observed response is simply the labour supply point that maximises utility. Equivalent (and compensated) variations are generated following the methodology of Creedy et al. (2010) by finding the cash payment required to generate an equivalent utility gain/reduction for each utility function generated.

Estimates of the Inequality Deflator are generated using MITTS by manually changing the existing tax system in a way analogous to Figure 2 above. This is done by altering the tax calculator component of MITTS to increase net income by $10 per week if their observed taxable income is within a given $5000 range. A similar calculation is performed where the tax system is used to transfer $10 away from people in a $5000 income range with the preferred

[18]For instance, an individual in the model may be observed to enter the labour force with a 5 per cent probability in response to a change in the tax rate.

estimate the average value generated by these two figures. The rationale behind the choice of these values is given in appendix 2.A.

The Inequality Deflator is calculated as the ratio of government revenue to personal welfare that is generated by such a tax change. One important implication of this approach is that transfer payments are not perfectly targeted. When the policy change is infinitesimal (as in Hendren (2014)), people may change labour supply in order to receive the payment, but in the limit, they will have an equivalent variation of zero. In contrast, in the modelled response, the equivalent variations will be greater than zero for this group. This can be interpreted as an approximation of a true Inequality Deflator, or it can be seen as a practical limitation as to how accurately a payment can be targeted through the tax system.

Labour supply responses generated by the MITTS framework are the key to the identification exercise in this paper. A comparison of elasticities generated by MITTS with other elasticity estimates for the Australian economy is found in Creedy and Kalb (2004). They conclude that the elasticities implicit in the MITTS model are consistent with the international literature.

3.1 A comparison with the Hendren methodology

The modelling exercise in this paper is based largely on the work of Hendren (2014). While the difference in approach is motivated primarily by the lack of a developed body of estimates of the elasticity of taxable income for the Australian economy,[19,20] the microsimulation approach does have some noticeable advantages and disadvantages relative to the Hendren (2014) approach.

Hendren (2014) is an example of the sufficient statistics approach to empirical public finance.[21] The paper identifies the desired value (the Inequality Deflator) and writes this as a function of empirically estimated elasticities. Specifically, the Inequality Deflator is defined as 1+FE (Fiscal Effect),[22] where FE is defined as:

[19] An exception is Johnson and Breunig (2016).

[20] Note that it is not possible to use international estimates to assist with an Australian estimate as the elasticity estimates are population/economy specific, and rely heavily on the existing tax system, rather than structural parameters.

[21] Chetty (2009a) provides a summary of the sufficient statistics approach in public finance, in which welfare consequences of various policies are written as functions of reduced-form elasticities rather than requiring full model specification.

[22] As discussed in footnote 7, this paper uses a slightly different definition of the Inequal-

$$FE(y) = -\epsilon^P(y)\frac{T(y) - T(0)}{y - T(y)} - \zeta(y)\frac{T(y)}{1 - \frac{T(y)}{(y)}} - \epsilon^C(y)\frac{\tau(y)}{1 - \tau(y)}\alpha(y) \quad (1)$$

$$= \text{extensive margin effect} + \text{income effect} + \text{intensive margin effect}$$

Where:

- T(y) is the total tax function
- $\tau(y)$ is the marginal tax rate
- ϵ^P is the extensive margin elasticity of taxable income with respect to the net of tax rate
- ϵ^C is the intensive margin elasticity of taxable income with respect to the net of tax rate
- $\zeta(y)$ is the income elasticity of earnings
- $\alpha(y)$ is the elasticity of the income distribution, which is a measure of the shape of the underlying income distribution

To implement this formula, it is possible to use tax records to find the total and marginal tax rates as well as $\alpha(y)$, which defines the shape of the income distribution. Hendren then uses elasticity estimates from a variety of sources to provide elasticities for three groups: those eligible for the Earned Income Tax Credit, those paying the top income tax rate, and all others.

This approach used in Hendren (2014) is subject to two potential critiques. First, there is an extensive literature that has come up with a wide range of estimates for the Elasticity of Taxable Income (ETI), with point estimates for the ETI ranging from zero to more than 1 (Chetty 2012).[23] The sufficient statistics framework is only valuable if those statistics can be accurately identified.

Second, it is unclear why the ETI would only vary by income for 3 distinct income groups. This assumption is necessary as it is difficult to obtain an

ity Deflator. This formula corresponds to the definition used in this paper, whereas the definition in Hendren (2014) is the Inequality Deflator = (1 + FE)/E(1+FE).

[23]Although Chetty (2012) paper provides one potential explanation for why this variation exists, there is still far from a consensus on the appropriate measure for the ETI.

elasticity estimate that varies by income. In contrast, the MITTS framework allows the elasticities to vary fully across the income distribution as a result of observed characteristics such as family, size and age.

Another useful advantage of the MITTS model is that it is able to provide Inequality Deflator estimates at the household, rather than individual level. This is a useful tool for looking at inequality as household income is a better measure of wellbeing than individual income. The Household Level Deflator is also useful for looking at elements of the Austalian welfare system which is generally based on household income. Estimates of the Inequality Deflator at the household level are provided in Section 4.5.

A further advantage of the structural modelling approach is that it allows for some idea of how well the marginal policy assumption holds. As discussed in Chetty (2009a), sufficient statistics are a function of the existing policy parameters, and as a result they provide local efficiency results. It is therefore unclear how well this approximation holds if we wished to transfer more than an infinitesimal amount of money to individuals. Appendix 2.A contains a series of estimates on an Inequality Deflator based on transfer of different sizes.

A final advantage of this approach is that the Inequality Deflator is still a relatively new concept, and it is unclear how accurately it can be estimated. As the microsimulation methodology here is quite different to that of Hendren, it can be used as a form of triangulation to increase confidence in the Hendren results.

The advantages of the structural modelling approach come at a cost. Most importantly, it is always difficult to fully test the reliability of the modelled response on which all of the results are built. Another significant drawback is that the model excludes a significant proportion of the population. It only estimates a labour supply response for working age population (over 18 years and under 65 years) and excludes those who are self-employed, eligible for the Disability Support Pension or who are students. As a result, the model can provide no insight with respect to these groups.

Another possible concern is that the MITTS framework is built upon survey data, which has significantly fewer observations than tax record data. As a result, it will perform less well than the ETI approach in parts of the income distribution with fewer observations (such as the top of the income distribution, or when looking at single parents).[24] The upside of using survey

[24]This is a common problem in studies looking at trends in income distributions, and is

data is that it provides information on individuals with very low income who may not file a tax return.

Finally, the MITTS model only looks at one specific aspect of labour supply response, the change in hours of work to a change in the tax rate. It is unable to look at how people might change the way that they report their income to avoid taxation, which is incorporated in the Hendren approach.[25]) This is particularly important for high-income individuals for whom this type of response is more likely.

4 Results

The main results of the model combines all types of individuals together and estimates the Inequality Deflator based on changes to taxable income.[26] The results are based on the tax and transfer system in place in 2009, and the results are shown in Figure 3. In this chart, the blue series represents the results from the policy experiment where $10 per week is given through the tax system, and the red dots represent the experiment where $10 per week is taken away through the tax system. The points are marked at the centre of the $5000 income range (so the $20,000-25,000$ range is shown at $22,500).

Following the different interpretations of the Inequality Deflator above, there are two ways to read the Deflator on the vertical axis of this chart. The first is that the value is equal to the marginal utility of income of individuals that would rationalise existing government policy. The second is that the vertical axis measures the cost (in terms of government revenue) of transferring a dollar to people in a particular income range.

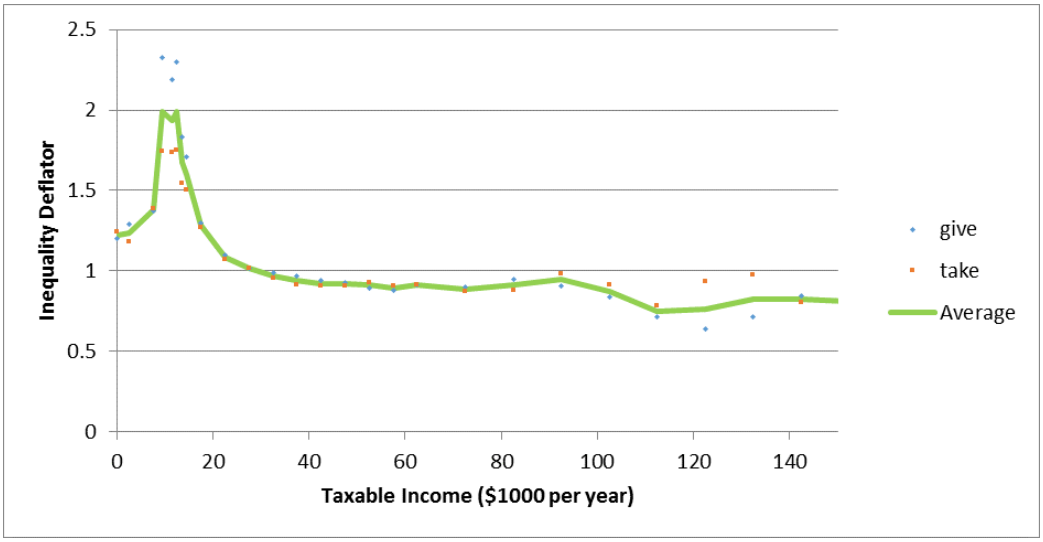
There are several important features to this figure. First, there is a spike at $15,000 where the Inequality Deflator reaches around two. This corresponds with the level of income that is received by people on unemployment benefits and represents zero market income (people with income less than $15,000 are typically secondary income earners). The rest of this figure is split into two distinct groupings. First, there is a relatively consistent weight

one of the primary advantages of using administrative tax records when looking at income trends for high income earners (Wilkins 2015).

[25]This follows the argument of Feldstein (1999) that a rational agent would equalize the costs of reducing taxes across different channels (such as working fewer hours, and tax avoidance, and increasing deductible activities). However, as discussed in Saez et al. (2012) and Chetty (2009b), there are limitations to how far this argument can be applied.

[26]Taxable income is equal to market income plus taxable payments and pensions.

Figure 3: Australian estimates of the Inequality Deflator



given to any individual earning between $40,000 and $100,000. Next, there is a slightly lower value for people earning between $100,000 and $150,000.

Note also that the results are that implied social weights are decreasing with income (for income more than $15,000), and are everywhere positive (a negative value would imply that we are on the wrong side of the Laffer curve).

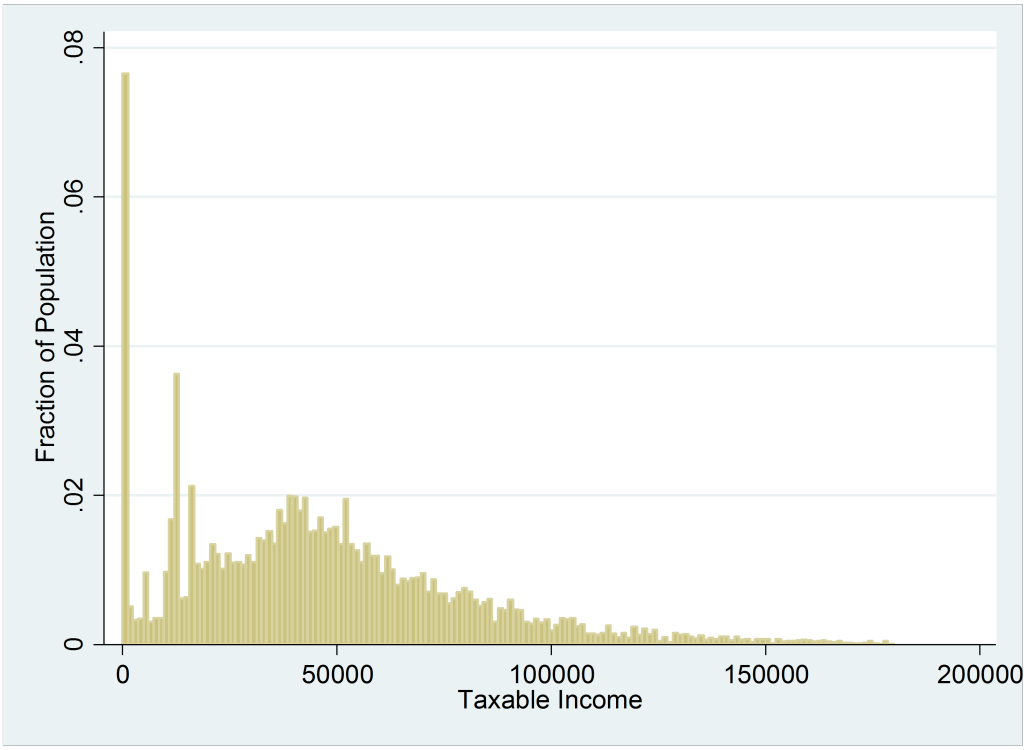
4.1 Understanding the results

In order to better understand the mechanisms working inside the MITTS model, the following section breaks down the above results into its various components. In doing so, it is useful to refer to equation 1, which shows that the Inequality Deflator can be written as the sum of the intensive margin effect, the extensive margin effect, and the income effect. These values, in turn can be written in terms of the shape of the income distribution, the marginal and effective tax rates, and various labour supply elasticities.

A useful place to start is the underlying income distribution (Figure 4), remembering this only includes individuals modelled in the MITTS framework (excluding those aged under 18, aged over 65, those receiving a disability

pension, students and the self-employed).[27] This figure shows that there are significant masses of individuals at $0 income, but also significant masses between $10,000 and $15,000 that correspond to the base payment rates for various Australian government payments.[28]

Figure 4: The Australian distribution of income



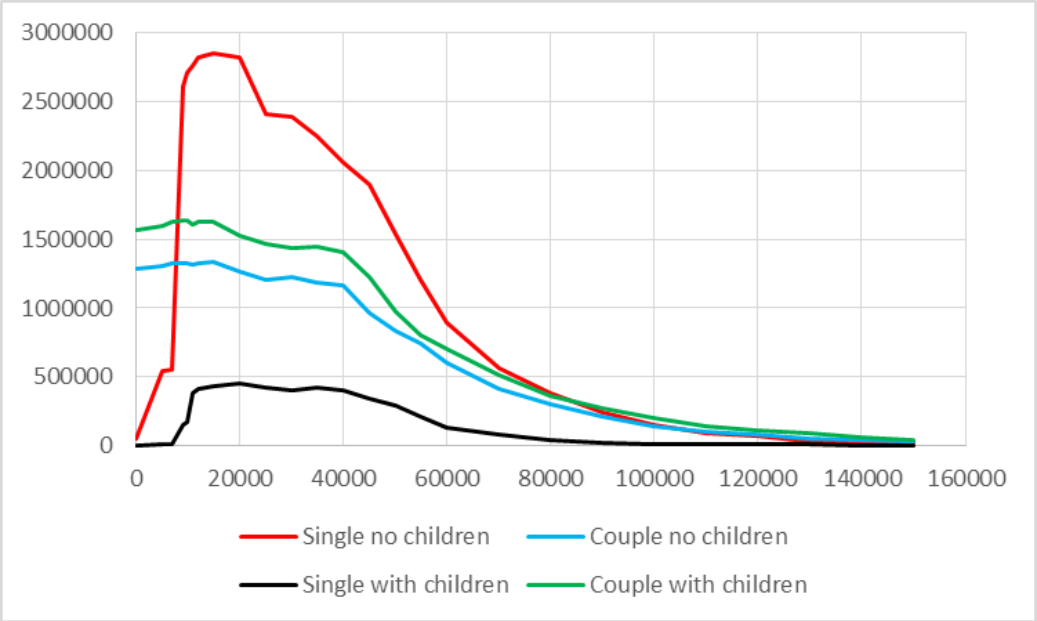
The chart also shows that there are relatively few people represented in the model above $100,000. This means that figures estimated for this group should be viewed with caution.

[27]This population underrepresents low income earners as younger people, older people and students are all likely to be amongst lower income earners. How to account for this population when implementing the Deflator is discussed in Section 5.

[28]The payment rates for government payments vary with a person's individual characteristics, such as whether or not they have children, and whether they have a partner, which explains why there are a number of point masses in this range. For instance, in 2009 the base rate of Newstart for singles with no children was $11,856 per year, the rate for singles with children was $12,826 and for couples was $10,699.

As well as the baseline income distribution, shown above, it is useful to look at the distribution of potential incomes within the MITTS framework. Within the MITTS model, individuals can only choose from eleven discrete labour supply points (six for married men) at a given wage. Within this framework, individuals are unable to achieve income levels outside of these eleven points (even if very large incentives are placed on earning this income). Figure 5 shows the number of people who could possibly receive incentive payments, and is based on the $5000 ranges used in the modelling process.

Figure 5: Labour supply possibilities

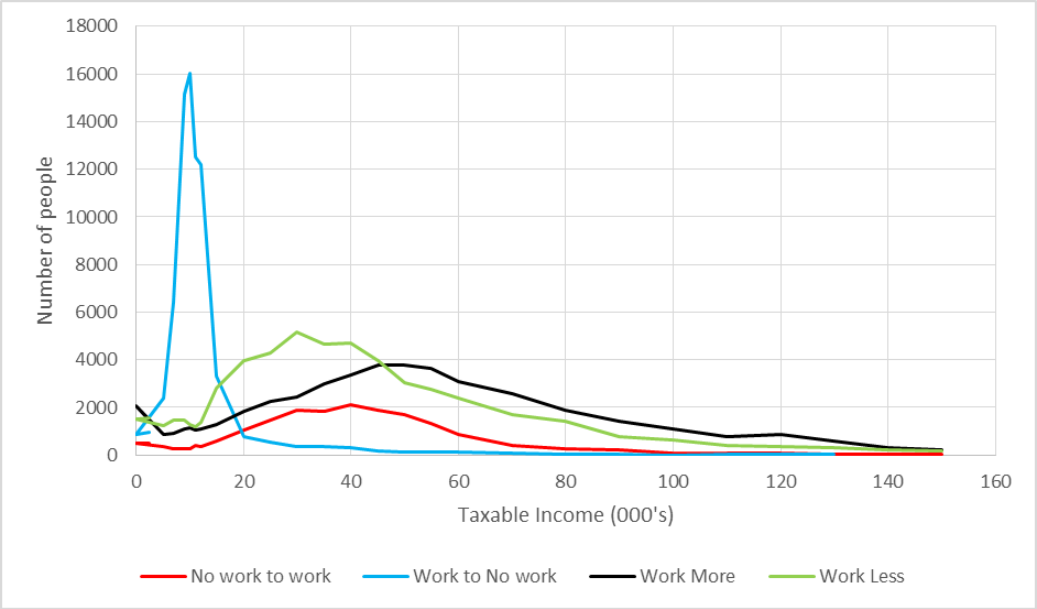


This shows that in the MITTS model, singles (with and without children) are generally unable to earn below the income support levels, meaning that they are unaffected by incentive payments in this low-income range. We also see that there are still relatively few observations at high-income levels. This means that even if people worked the maximum number of hours (which is top coded at 50 hours), the majority of people are unable to earn more than $100,000.

A final method for understanding what is driving the main results for the Inequality Deflator is to identify the size of the intensive and extensive margin effect at different points of the income distribution, which are shown

in Figure 6. The y-axis shows the expected number of people who change labour supply. The figure excludes those who receive the payment and have no response, and those who don't receive the payment and have no response, as both categories are significantly larger than the values below.

Figure 6: Responses to giving $10



The most striking aspect of this chart is the large intensive margin effect at around $15,000 that corresponds with the largest value of the Inequality Deflator. This shows that the result is being driven by a large extensive labour supply response – i.e when unemployment benefits are increased by $10 per week, 16000 people drop out of the labour force. This is equivalent to an elasticity of labour force participation with respect to the unemployment benefit rate of approximately 1.5. This is towards the top end of a range of comparable international estimates, although significant variation exists amongst estimates from this literature.[29]

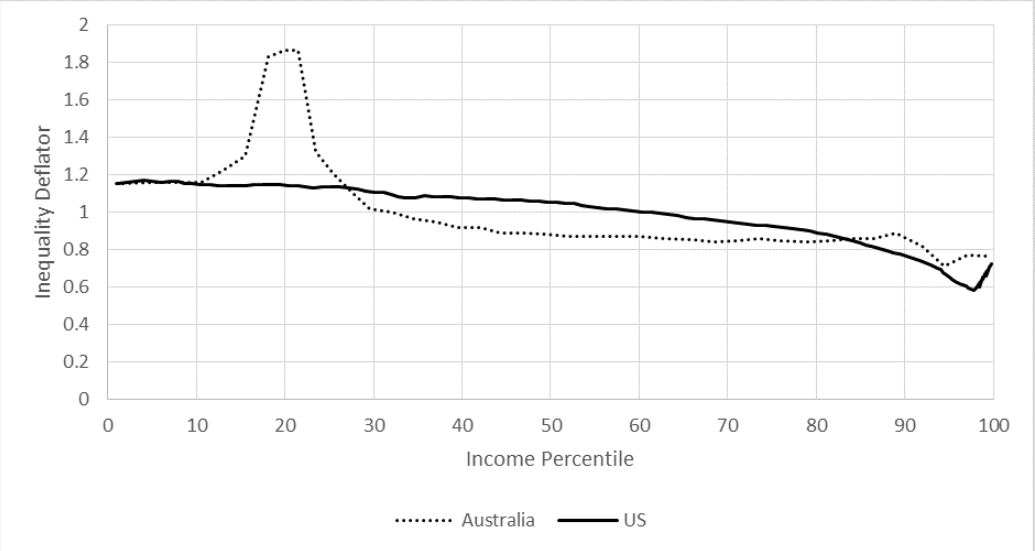
[29]For instance, Nickel (1998) performs a cross-country regression on OECD countries and finds a semi-elasticity with respect to the replacement rate of 1.3, which when evaluated at the Australian replacement rate gives an elasticity of 0.5. Fredriksson and Söderström (2008) use Swedish wage variation across regions to identify a semi-elasticity, which evaluated at the Australian replacement rate gives an elasticity of 1.9. Krueger and Meyer

Another notable aspect of the chart is that the extensive margin responses ('Work More' and 'Work Less') have similar shape, but the 'Work More' response is shifted to the right of the 'Work Less' response. This result is driven by the underlying shape of the income distribution, which has a peak that lies between the 'Work More' and 'Work Less' peaks. Intuitively, the size of the labour supply response depends heavily on the underlying income distribution.

4.2 Comparison with Hendren's results

Given that this work is based on the intellectual concepts developed in Hendren (2014), it is natural to compare the empirical results obtained here with those from this paper. In order to make this comparison, the estimates presented above are converted using the adjustment noted in footnote 8. The results, shown in Figure 7, are also presented based on income percentiles, rather than on income level.

Figure 7: Comparison of results with Hendren (2004)



Several differences between the estimates are evident. The large spike in the Australian estimates due to income support payments is non-existent in

(2002) provide a detailed survey focusing largely on American estimates, and suggest an elasticity of around 1.

the American Deflator. Further, the convex shape noted by Hendren, and interpreted as suggesting that 'it is more costly to redistribute from high-earners to median earners than from median earners to the low-earners' is also not evident in the Australian results. Finally, the American results show a much lower value for high-income earners.

The most important point to note in comparing these two sets of results is that the US results are based on percentiles of income amongst those who filed a tax return, whereas the Australian results are based on the percentile of income across the population. A significant proportion of those who don't file do so because they don't earn enough income to be required to file a tax return, and so care must be taken when making a comparison. In particular, the large 'spike' in the Australian data occurs at the base payment for Australian welfare payments, and many from this group would not file a tax return.

There are a number of other factors that could explain the differences between the two estimates. The Inequality Deflator is a product of the tax and transfer system that exists in each country, as well as the shape of the income distribution and the ability of workers to respond to changes in tax rates. All of these factors are likely to differ between Australia and the US. Australia has a more generous social safety net, a less skewed distribution of income, and less flexible workplace institutions than the US. Therefore, it would be expected that Australia and the US would have different estimates of the Deflator. However, there will also be variation that exists solely due to the difference in estimation methodology. While it is not possible to separate how much of the variation is due to a real difference between the Inequality Deflator in Australia and the US, and how much is due to different estimation approaches, it is important to consider the likely source of deviation by examining the main differences in turn.

The most striking deviation is the large value of the Inequality Deflator estimated for Australia for low-income earners, with no comparable feature on the American Deflator. It would be expected that this feature would be larger for Australia, given that Australia has a more generous social safety net. However, the apparent reason that this feature is completely missing from the American Deflator is that Hendren (2014) uses the IRS definition of 'Ordinary Income' as the main definition of income in the paper, which excludes most types of income support payments.

A second notable difference is the higher level of the Deflator estimated in Australia at high-income levels. While this is not as visible on the chart, it

will have a large impact on many applications of the Deflator as the top few percentiles of income earners earn a significant proportion of national income. One of the weaknesses of the approach used in this paper is that MITTS is based on a cross sectional income survey, which have known limitations when looking at the top end of the income distribution. Therefore, any results from the MITTS application for very high income earners should be interpreted with caution.

4.3 Subclass analysis

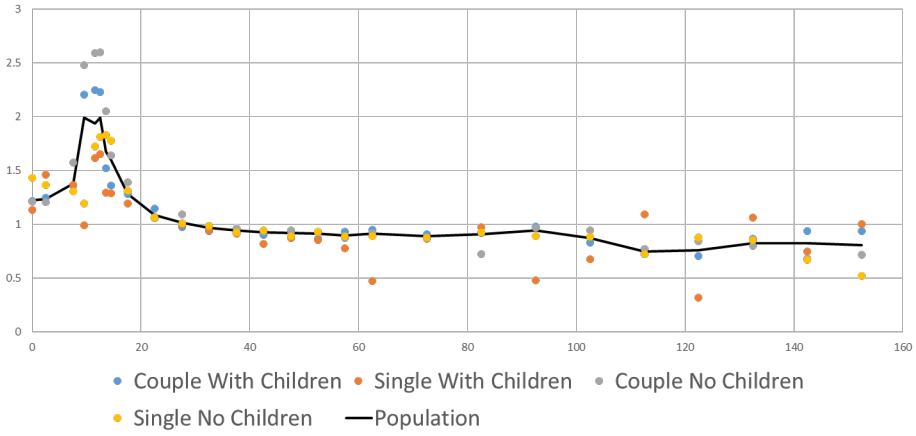
In the previous sections, the Inequality Deflator was defined solely on income. However, the concept can be naturally extended to take account of different characteristics, such as whether or not the person is single, and whether or not they have children. However, in order for the underlying properties of the Inequality Deflator to hold, it is important to classify groups based on the existing structure of the tax system. For instance, it is possible to make a small adjustment to the existing tax/transfer system that only affects single parents by changing the payment rate or income test for the Parenting Payment. However, it is less sensible to think about a payment based on gender, as the existing tax and transfer system does not base payments on gender.

It is possible to imagine a separate Inequality Deflator for each group that faces a different tax schedule. For instance, it is possible to have a Deflator defined for families with two adults and three children, with the youngest child less than six years old. However, as the Australian tax system varies based on partner status, partner income, number of children and age of children (among others), and each different combination of these characteristics implies a different effective tax rate, there are not enough people in the MITTS setup to estimate a Deflator for each possible group. Instead, it is important to identify groups based on the most important characteristics used in the tax and transfer system. For this paper, four subgroups were chosen. These are singles without children, singles with children, couples without children and couples with children. These groups were chosen on the basis that partner and parental status are the main factors in determining tax liability and transfer eligibility.[30]

[30]These groups are also roughly aligned with the modelling approach used by MITTS, where separate labour supply preference parameters are estimated for couples, single men,

Figure 8 shows the results of the Inequality Deflator looking just at each individual group. For instance, it considers a $10 payment made to single parents with taxable income in a $5000 income range. The rest of the modelling follows the same process as described above.[31]

Figure 8: Estimates of sub-group Deflators



There are several important features to this chart. First, it should be noted that given the lower sample sizes, each individual result will be more variable. This is particularly evident when looking at single parents in high income ranges, where there are very few people in the model.

The next feature is that the general shape of the Deflator is quite similar across the four subgroups, with a spike around $15,000 and a slow decline after that point to a value slightly less than one. The major difference between the groups is that couples have more extreme values than do individuals. This is driven by the ability of families to adjust their labour supply to achieve a tax benefit.

4.4 Which Deflator to use?

We have now defined an Inequality Deflator at the population level, as well as one at a subgroup level. It is important to think carefully about which

single women and sole parents.

[31] As there is no attempt to model general equilibrium effects from the payment, the results from a payment to everyone can simply be split up into the different subdivisions for this analysis.

Deflator should be used to analyse policy proposals. In a general sense, the correct Deflator is the one that is at the level of transfer payment being considered. For instance, if we are thinking about implementing a policy, and then compensating people through the income tax system, then the correct Deflator is the population level Deflator as the income tax is only defined on taxable income (and doesn't vary with other personal characteristics). However, if we were going to compensate people through the transfer system, then it would be more suitable to use the subgroup Inequality Deflators.

From a practical perspective, estimated Deflators are very similar through the middle of the income distribution. Moreover, variation at the top end of the income distribution appears to be more due to smaller sample sizes and estimation issues, than to an underlying difference in behaviour between these groups. Given the relatively close estimates of the subclass Deflators, it is unclear whether their use will give significantly different results in applied work compared to the population Deflator.

4.5 An Inequality Deflator based on household income

All of the previous sections have looked at the cost of redistributing income between 'individuals' with different levels of income. However, one of the advantages of the MITTS framework is that we can look at the cost of redistribution at the household level.[32] This is a sensible approach as household income is generally considered to be a better measure of welfare than individual income. Moreover, when performing policy evaluation, it is common to have the distributional impact of a policy measured at the household level, rather than at the individual level,[33] which implies that the Deflator should ideally also be measured at a household level.

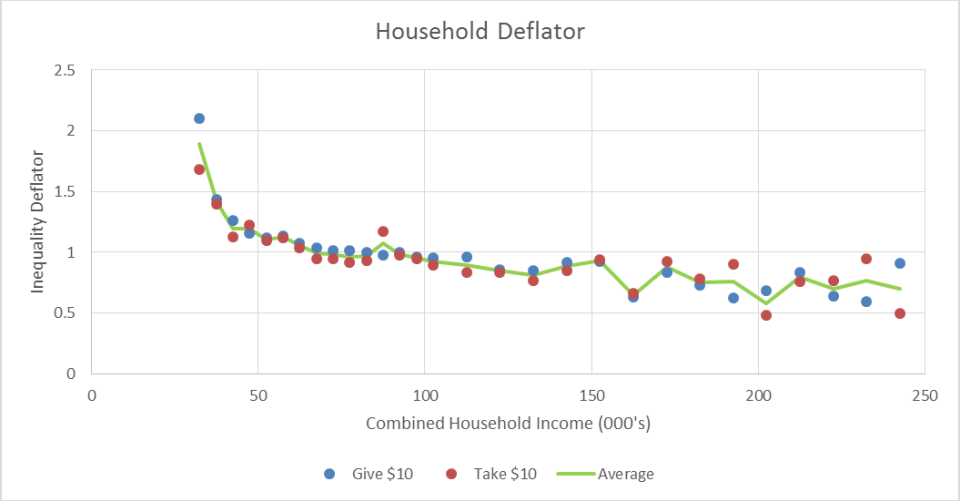
The estimation of the household Deflator follows the same framework as previous sections, altering the amount of tax paid by $10 per week if the sum of taxable income amongst adult household members falls within a $5000 range. The results (for couples with and without children) are shown

[32]Throughout this section, the term household is used to refer to members of the same income unit, rather than to denote people living together. This means that couples/defactos are part of the same 'household' but a house with three adult friends would not be part of the same 'household'.

[33]Most measures of consumption for instance, are measured at a household rather than an individual level, therefore if we wanted to use the Inequality Deflator to analyse the incidence of a consumption tax, it is more meaningful to use a household level Deflator.

in Figure 9.

Figure 9: Estimates of the Household Deflator for couples with and without children



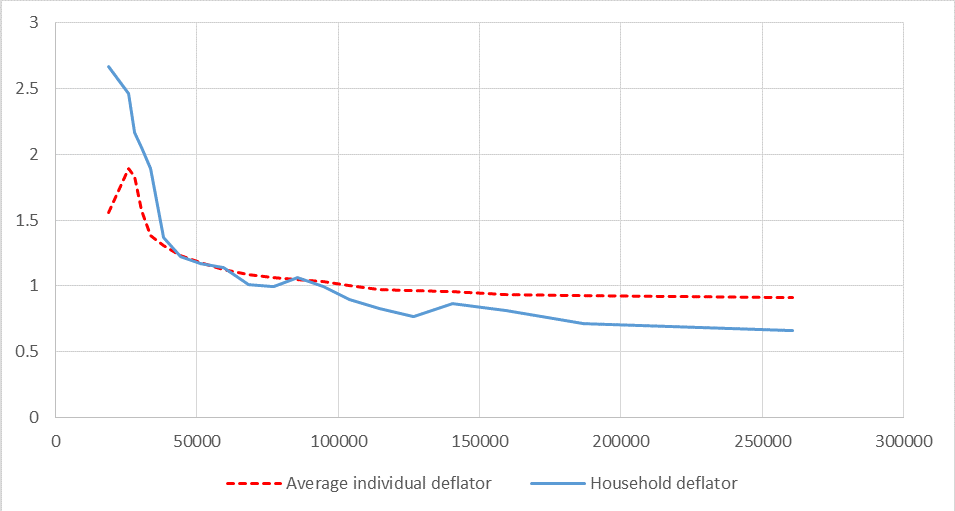
One noticeable difference between the household level results and those reported at an individual level is that there are no results reported for low-income levels. This occurs because there are very few households that have income below this level. Beyond this, the general shape of the Deflator is quite similar, with a high level at low incomes, a slow decline through most of the income distribution, and a drop off at high-income levels.

In order to see how the household Deflator compares to the earlier results, it is useful to compare the household level Deflator with the average value of the individual Deflator average for the couple. If these values are the same, then the household Deflator has no additional value. However, as can be seen in Figure 10, a significant divergence can be seen between the two values.[34]

The primary reason that these series diverge in Figure 10 is that the labour supply elasticity of an individual depends on their partner's income. For instance, a person with a low personal income will behave very differently if their partner is unemployed, compared to if their partner has a high income. As such, only looking at individual income misses a significant amount of information about the likely labour supply response of that individual.

[34]This figure is generated using the Binscatter function discussed earlier, which removes variation amongst the average Deflator measure, as well as smoothing out both functions.

Figure 10: Comparison of the Household Deflator and the Individual Deflator



The results presented here suggest that the household Deflator would generate qualitatively different results to the individual Deflator. This provides a further argument in favour of the structural labour supply approach used in this paper, as to implement a household Deflator using the reduced form approach used in Hendren (2014) would require the estimation of labour supply elasticities conditional on partner's income.

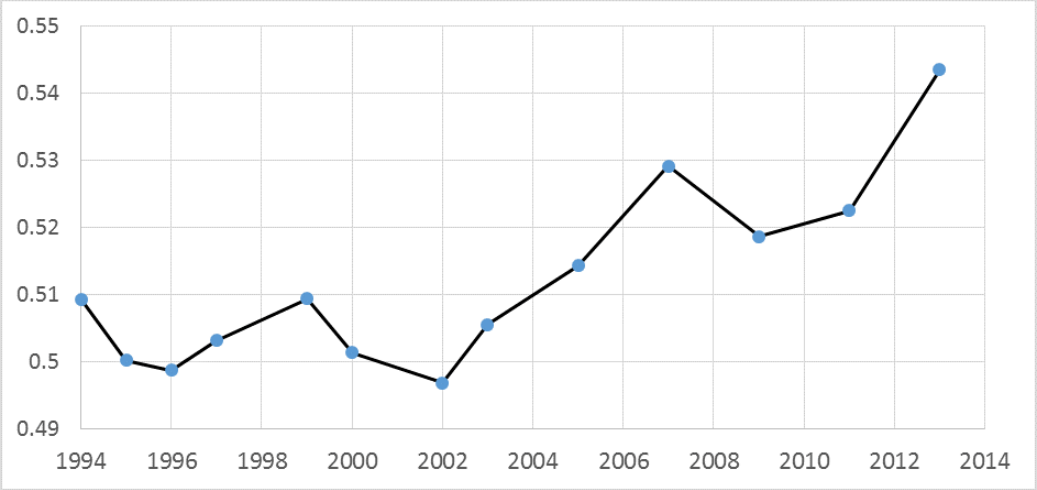
5 An application: Growth and growing inequality in Australia

In recent years, Australia has experienced a strong period of growth that has coincided with an increase in income inequality (Figures 11 and 12).[35] While this trend of rising inequality has not been as pronounced as in other countries (OECD 2015), it nonetheless poses a dilemma for making statements about improving living standards. Has the growth been a true expansion of the economic opportunities available in Australia, or simply a result of pursuing policies that favour efficiency over equity?

The Inequality Deflator provides one mechanism to answer this question.

[35]See also, Atkinson and Leigh (2006), Fletcher and Guttmann (2013) and Greenville et al. (2013).

Figure 11: Trends in the gini index in Australia

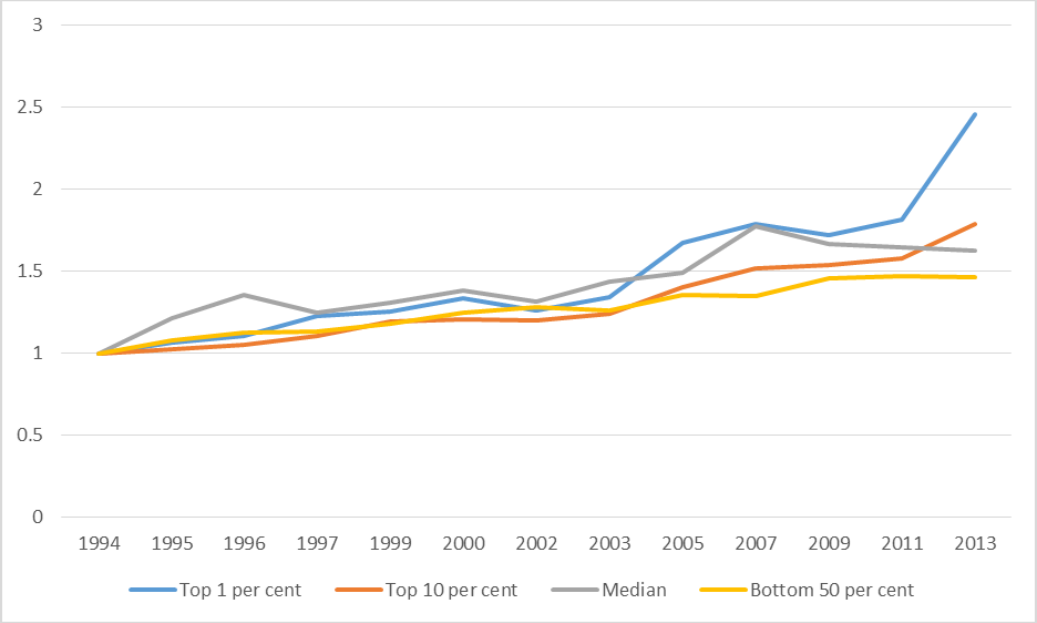


Source: Survey of Income and Housing (various years).

Using the Inequality Deflator, it is possible to create a policy experiment in which the modern income distribution is adjusted to reflect the income distribution in previous years. This generates the rate of growth that would be achieved if the tax system is used to ensure that this growth rate is equal across the income distribution. This methodology allows for the rate of growth to be examined while effectively holding the income distribution constant.

This technique is proposed in Hendren (2014) and implemented using US income tax data from 1979-2009. The paper found that roughly 15-20 percent of the growth in this period is lost if the US income distribution is held constant. Hendren (2014) also contains a discussion of the theoretical underpinnings of the approach. The key insight is that when comparing the income distributions of two different time periods, there are many ways to define the surplus gained or lost for any individual in that distribution. For instance, it is possible for people who are in the middle of the income distribution at one point in time to be at the top of the distribution at another point in time. However, for the purpose of this exercise, it is assumed that the relative income rankings are stable. In comparing changes in the income distribution, the top percentile from one distribution will be compared to the top percentile of another distribution, the second percentile compared to the

Figure 12: Indexed income growth, by group



Source: Survey of Income and Housing (various years).

second percentile and so on.

Two other technical properties of this approach are worth noting. First, the Inequality Deflator is both conceptually defined and empirically estimated as a marginal concept, while this application is non-marginal. Therefore, the results are best thought of as first-order approximation of the costs of increased inequality. Second, as we are comparing income distributions, the difference in surplus must be equal for people with the same income level (by construction). This removes the conceptual issues discussed in Section 2 that occur when surplus varies amongst people with the same income level.

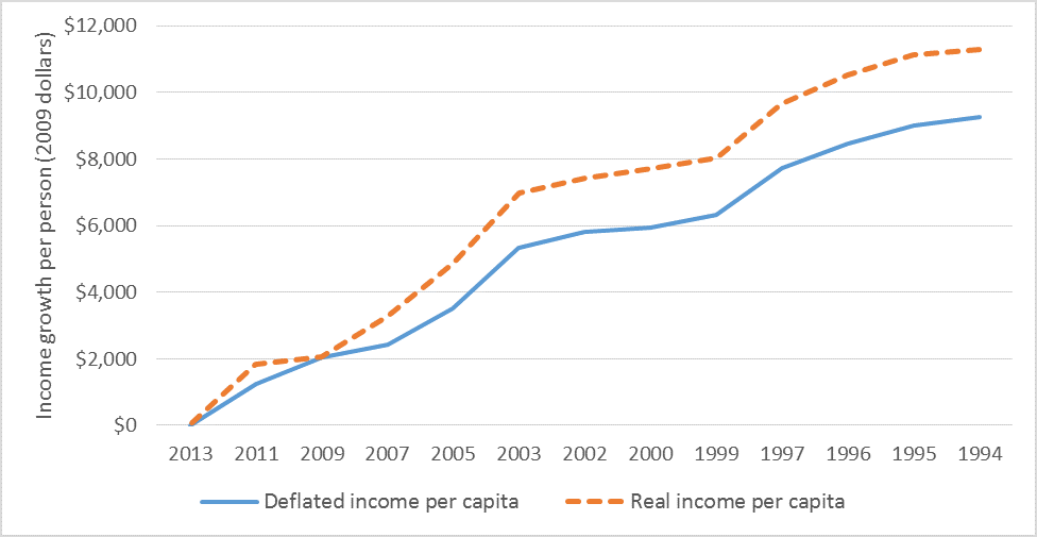
5.1 Estimation and results for Australia

Data on the income distribution in Australia are taken from the Household Income Distribution Surveys[36] conducted by the Australian Bureau of

[36]As discussed in Wilkins (2015), there are a variety of data sources that are suitable to the study of income inequality in Australia, including the surveys used in this exercise,

Statistics from 1994 to 2013, and use the total income from all sources in the previous financial year as the measure of income. Individual level data is used along with the individual level Deflator estimated in Section 4. The main result is presented in in Figure 13.

Figure 13: Growth in Australia adjusted with the Inequality Deflator



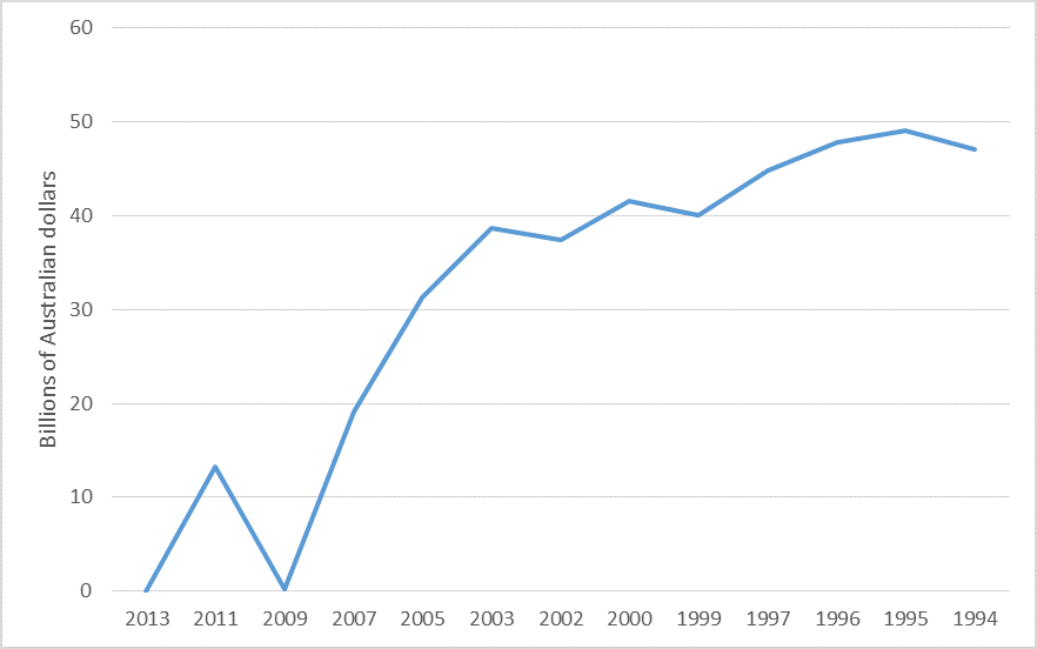
This figure is interpreted as the total level of growth since a given year, with the solid line showing the standard measure of income growth per capita, while the dashed line represents the amount of growth that would have occurred if the tax system had been used to spread the growth evenly throughout the income distribution. For instance, since the first survey in 1994, Australian incomes have grown around $11,300 per capita on average. However, if the tax system was used to spread this growth evenly across the income distribution (by adjusting the 2013 income distribution to be equal to the 1994 income distribution), then growth per person would be around

ABS expenditure surveys, the Census, the HILDA survey and tax record data, with each data source possessing a number of strengths and weaknesses. This main issue raised in relation to the income survey used in this study is that, over time, the ABS have improved several features of the survey, as well as made changes to make the survey more internationally comparable (Siminski et al. (2003) and Wilkins (2014)). While these methodological changes do effect the comparability of the results across time, the issues will not qualitatively effect the results in this section.

$9,300. This implies that around 18 per cent of growth since 1994 is lost once we account for this increase in inequality.

Another way to interpret these results is to look at the total cost of increased inequality in Australia (Figure 14). This is calculated as the difference between the two lines in Figure 13, and scaled up based on the Australian population. The results, displayed in Figure 14, suggest that the cost of increased inequality in Australia between 1994 and 2013 is around $50 billion.[37]

Figure 14: Total cost of increased inequality



6 Conclusion

The Inequality Deflator provides a promising practical process for making policy decisions where equity and efficiency considerations are in conflict. It also provides a way to evaluate the economic progress of a country that has experienced both growth and increased income inequality. This paper

[37] 2009 dollars.

develops a new method for estimating the Deflator for the Australian economy. This approach is used to estimate sub-group Deflators for four household types, as well as a household level Deflator for the Australian economy. The structural microsimulation model also allows for an examination of how well the marginal approximation of the Inequality Deflator performs for non-marginal projects. Finally, the new approach provided in this paper can act as a complement to the sufficient statistics approach used in Hendren (2014) that provides useful insights into a new field.

In addition to the applications discussed through the paper, the Inequality Deflator provides a number of promising areas for future research. The Inequality Deflator represents the redistributive trade-off that is currently made through the Australian tax system. An obvious application is to compare this with estimates of society's preference for redistribution, in order to estimate whether Australia currently has too much or too little redistributive taxation. Another potential avenue for future research is to use the Inequality Deflator to calculate an inequality adjusted marginal excess burden. Typically, the efficiency cost of a tax is generated using a calculation that returns tax revenue in a lump sum manner. If instead, this revenue was returned through the income tax (ie using the Inequality Deflator), then the value of the measured excess burden would be distribution neutral. This would be particularly useful for comparing the excess burden of two taxes, as it holds equity consideration constant while allowing efficiency to be directly compared.

Appendix: Discussion of the modelling approach

This paper utilises the MITTS modelling framework to estimate the Inequality Deflator for the Australian economy in 2009. For the most part, this modelling was done using parameters and assumptions that were common to previous MITTS projects. This includes the utility function, the choice of which households' behaviour was modelled and adjustment of weights to align with national aggregates. However, the nature of the exercise necessarily required judgment calls to be made regarding the specification of the shock used in the model. Further, given the time required to run the MITTS model, it is not possible to perform sensitivity analysis across all possible variables of interest.

This appendix aims to provide the rationale behind four key decisions; the size of the financial incentive provided through the tax system, the width of income for which people are eligible for the financial incentive, the range of income for which the modelling exercise is performed, and the use of the average of 'give' and 'take' runs.

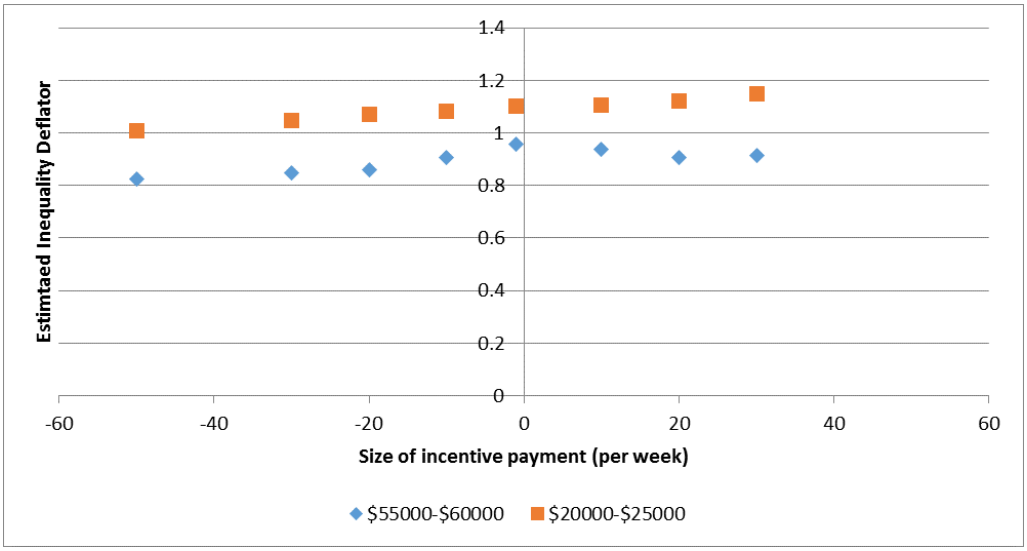
The size of the financial incentive

The Inequality Deflator is estimated by providing a small financial incentive to adjust labour supply. In the main calculations, this small amount was chosen to be $10 per week. However, in order to determine the appropriate size of the shock, a number of alternative sized shocks were estimated for two points in the income distribution. The results of these runs can be seen in Figure 15.

This exercise provides several important pieces of information. First, for the modelled income ranges ($20,000-$25,000 and $55,000-$60,000), there is a relatively constant ratio between the Deflators. This suggests that the size of transfer would not affect the application of the Inequality Deflator to welfare trade-offs between these groups.

Next, there is an increasing trend for both series, suggesting that the cost of transferring money through the tax system faces increasing costs. However, for values around $0, these differences are relatively small. This can be seen as the estimation error that occurs as we move away from a marginal change and towards a larger policy impact. However, it also provides some guidance as to how large a transfer can be considered using this framework

Figure 15: Effect of the size of the modelled shock on the estimated Deflator



before the assumption of a marginal policy change breaks down.

There is also a modelling concern around having transfers that are too small. Effectively, there is a concern that if a financial transfer is too small, there will be very little behavioural response in the model, and the results will be driven by one or two individuals, who may have atypical labour supply characteristics.[38]

The final decision of $10 per week was a compromise between the concern that for large values, the Inequality Deflator values will diverge, and for small values, the results may be unreliable.

The width of the transfers

In this exercise the tax incentive was provided to people in $5000 ranges (for instance, a $10 per week incentive is given to people with income between $20,000 and $25,000).

The main concern regarding this decision is that MITTS is a discrete

[38]The probabilistic nature of the model can alleviate this concern to some extent, however, even with one hundred observations of each individual, a small policy change may result in a one percent probability of one or two people responding in the model. The difference between the implied elasticity in this case is 100 per cent.

model, meaning that individuals choose from eleven discrete labour supply points (six for married men). If the income range is too small, it is more likely that individuals in the model will not have a labour supply point within the set. This would result in a downward bias in the level of behavioural response.

On the other hand, wider ranges provides less specific information about particular ranges of the income distribution. For instance, it is possible that there is more variation in the Inequality Deflator for low incomes that is averaged out by applying wide income ranges.

The ranges for which the estimates are accurate

This paper estimates the Inequality Deflator for levels of annual taxable income between $0 and $150,000. It is natural to ask whether the Deflator can be extended further up the income distribution, as well as whether the existing high-income estimates are sound.

The main issue that occurs at high incomes is that the policy will influence fewer people as the income range increases. This will increase the variance of the estimates of the Inequality Deflator as the budgetary impact and welfare impact of a policy is determined by a small number of individuals. Having a small number of individuals is problematic, both because those individuals might have unusual labour supply characteristics, but also because with a small number of records, the observed income distribution becomes less smooth. As discussed in Section 2, an important driver of the size of the Deflator is the number of people in the income distribution above and below the targeted payment, as this represents the number of people who can increase/decrease their labour supply in response to a compensation payment. If the sample size becomes too small to accurately represent the shape of the income distribution, then the Deflator estimates will become unreliable.

There is a further issue that occurs as incomes rise due to the top-coding of labour supply in the MITTS framework. At the high end of the income distribution, a reasonable proportion of individuals work 50 hours a week. By the assumptions of the model they are unable to work more than this amount. As a result, any tax increase that occurs at their existing hours of work can only be avoided by decreasing work (while for other individuals on the income distribution, this tax can potentially be avoided by increasing or

decreasing labour supply.

It is unclear whether this is a reasonable assumption. It is possible that these top coded individuals are actually working as hard they can, and it is not possible for them to increase their income. However, to the extent that this is just a result of the structure of the model, this will increase the measured efficiency cost (decrease the Inequality Deflator).

Finally, it should also be noted that for high-income individuals, it is not clear that labour supply responses are the main mechanism that people use to respond to higher/lower taxes. Very high-income individuals may be more likely to respond to tax changes by rearranging their tax affairs, which is outside the scope of this model.

More generally, it is unclear that if society wished to increase taxes on the very wealthy, the best way to do it would be through the income tax. In this case, it may be more reasonable to measure the distributional trade-offs that exists in the corporate tax system or estate planning laws. As a result, very high income individuals are best seen as beyond the scope of this project.

The preferred estimate as the average of the 'give' and 'take' runs

The model was run to provide a small benefit through the tax system, and was also run to provide a small cost through the tax system. Under the Hendren approach, the Deflator estimated in these cases will be equal. However, under the MITTS approach used in this paper, the estimates differed in some situations. In these cases, the average of the 'give' and 'take' runs was used as the preferred values.

Referring to Figure 3, it is notable that the give and take estimates are very close through the middle of the income distribution, while they diverge at the extremes of the income distribution. The likely driver of this result is masses of people earning a particular amount of income and being unable to earn more/less because they are at the top/bottom of the allowable labour supply, while others around this income level are not subject to the same constraints. Effectively, the give and take scenarios are targeting different groups of people.

For instance, there are a large number of people earning around $10,000-$15,000 that have zero labour income, with the income provided through

income support payments. An adjustment to the tax system to get people to move away from this income level will impact on this mass of people, who are all unable to earn less than this amount. In contrast, an incentive payment to move to this income amount will influence both people above and below this initial income amount.

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