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Relative welfare weights for individuals, consumers and producers

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Peter Varela
Research School of Economics, Australian National University

Abstract

This paper applies the concept of an Inequality Deflator to evaluate the relative value of capital versus individual income. As the shareholders of businesses are typically higher income earners than the average person (and the typical consumer), money transferred to business owners or shareholders will, on average, increase the level of inequality in an economy. To the extent that society values both equity and efficiency goals, benefits accruing to businesses should be less valuable than benefits accruing to a typical individual (or a typical consumer). The Inequality Deflator, when applied to capital earnings, can be interpreted as the amount of money that would be received by everyone if the income tax and transfer system were used to redistribute a dollar earned by a business evenly across the population. This paper estimates the relative welfare weights based on the Inequality Deflator for the United States and for Australia and finds that once distributional differences are adjusted for, a benefit of \$1 to a business is equivalent to around 97 cents to a typical consumer (weighted by consumption) and around 88 cents to a typical individual. The paper can also be used to improve welfare calculations in the sufficient statistics welfare literature, which typically assumes that a dollar transferred between a consumer and a producer has no net welfare effects and can therefore be ignored. However, once distributional effects are considered, the incidence of the tax (whether it falls on producers or consumers) has welfare effects.

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

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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

Modern societies display a preference for both efficiency and equity. As a result, if two policy options differ in terms of both efficiency and equity, it is difficult to make a firm policy recommendation. An appealing solution to this problem is to imagine small changes made to the existing income tax and welfare system that can be implemented along with a policy, which gives the two policy options an equivalent distributional outcome. This allows the two options to be directly compared. As redistribution through the tax system is costly, this process effectively puts a value on the equity outcomes of a policy or project. This approach was proposed in a series of papers by Kaplow (2004 and 2008), was developed into a workable empirical framework in Hendren (2014), and has two appealing rationales. First, it can be seen as identifying the revealed preference between equity and efficiency present in the existing income tax and welfare system, with this trade-off applied to new policy proposals. Second, the changes to the existing tax and transfer system can be seen as realisable compensation payments in a Kaldor-Hicks framework.[1]

In this paper, this intellectual framework is applied to the question of how to treat a welfare gain to a typical individual, in comparison with a typical producer and a typical consumer.[2] As the distribution of capital earnings and the distribution of consumption are not equal across the population, any policy that impacts either producers or consumers will change the effective distribution of income. The Inequality Deflator can be used to remove this distributional impact and allow a distribution-free comparison of policies.

The motivation for this research is twofold. First, practitioners of economic policy and program evaluation must continually make decisions that trade-off benefits and costs to individuals, consumers and businesses. At present, there are widely varied approaches to this problem. In some settings, a total surplus rule is used, which equates the value of producer and consumer surplus. However, this is often seen as a necessary simplification, and is described as a limitation of the cost benefit process in the Australian Government Handbook of Cost Benefit Analysis (Department of Finance and Administration 2006).[3] In other cases, a Consumer Surplus test is used.

[1] As opposed to lump sum transfers that are used in the standard Kaldor-Hicks framework.

[2] A typical consumer is taken to be a weighted average of individuals using observed consumption levels as weights. Similarly, a typical producer uses ownership of equity as weights. Finally, a typical individual uses equal weights for everyone.

[3] This policy dilemma is also discussed in Productivity Commission (2013), and

For instance, in questions of competition law, a Consumer Surplus test is used in Australia (Fallon 2005) and is increasingly used in a global setting (International Competition Network 2011).[4] This provides zero weighting to producers and will typically provide very different policy advice to a total surplus test. A final approach is to say that distributional concerns are beyond the scope of cost benefit analysis, and to report which parties gain and lose, but leave a normative judgement to an external party, such as an elected official.[5] The methodology proposed in this paper provides a simple means to account for the distributional impact of a policy and allows the economic analyst to compare proposals in a pragmatic and consistent manner.

The second motivation is that the relative welfare weights estimated in this paper can be used to extend the sufficient statistics literature, which typically relies on the assumption that benefits to producers and consumers are equivalent (see for instance Harberger (1964) and Chetty (2009)). This assumption allows transfers between parties to be ignored, and in some cases dramatically simplifies the welfare calculation. While it has long been noted that these weights need not be equalised (Harberger 1978), the assumption has been used by default given the absence of a reasonable alternative weighting system. This paper can be seen as a validation test of this assumption. If the relative welfare weights for consumers and producers estimated using the method in this paper are close to one, then the assumption that producer and consumer benefits are equivalent is reasonable, while if the estimated weights differ considerably from one, then a transfer between producers and consumers will have welfare effects that need to be incorporated into the calculations.

Calculation of the relative welfare weights for individuals, producers and consumers requires an estimate of the Inequality Deflator, and the joint distribution of income, equity ownership of businesses, and consumption. This paper performs this calculation for the US and Australian economies. For the US calculation, the estimates of the Inequality Deflator are taken from Hendren (2014), while the joint distribution of income, consumption and wealth are taken from the 2013 wave of the Panel Study of Income Dynamics. For the Australian calculation, the estimates of the Inequality

Sims (2012).

[4]It should also be noted that, as described in Orbach (2010), the Consumer Welfare standard is not well defined in a legal setting, and has been used in different ways in different legal rulings in the United States.

[5]This was proposed by Boadway (1976), and is currently the official policy of the Australian Government (OBPR 2014).

Deflator are taken from Varela (2017), with the joint distribution of income, consumption and wealth taken from the 2009 survey of Income and Housing Costs. A range of alternative specifications are considered, including varying the assumptions used to estimate the Inequality Deflator, and varying the definition of capital and consumption. The results are reasonably robust to such variation, with $1 of benefits to a capital owner being roughly equivalent to a 94-99 cent benefit to a typical consumer, and around 80-96 cents to a typical individual.[6]

2 The Inequality Deflator

The Inequality Deflator takes its name from a working paper by Hendren (2014). The conceptual basis of the Deflator is to imagine a small change to the existing tax and transfer system that returns a small amount of money to people earning a given income (Figure 3.1).[7] If there was no behavioural response to this tax change, the cost in terms of government revenue would be equal to the benefit received by individuals. However, the change to the tax system will change the incentives for people to earn income. If people respond to the tax change by earning more income (and therefore paying more tax), the impact on government revenue will be less than the welfare cost. If people respond by earning less income (and therefore paying less tax), the impact on government revenue will be more than the welfare cost.[8]

The Inequality Deflator is defined as the ratio of the budgetary cost and the benefit to individuals (measured as the sum of equivalent variations) resulting from such an adjustment to the tax system. It can be thought of as the cost, in terms of government revenue, of transferring money to people at different points in the income distribution. It can also be interpreted as a measure of the marginal cost of funds for people at a particular point in the income distribution. Importantly, as shown in Hendren (2014), it can be used directly as weights in cost benefit analysis to account for the distributional impact of a policy or project.

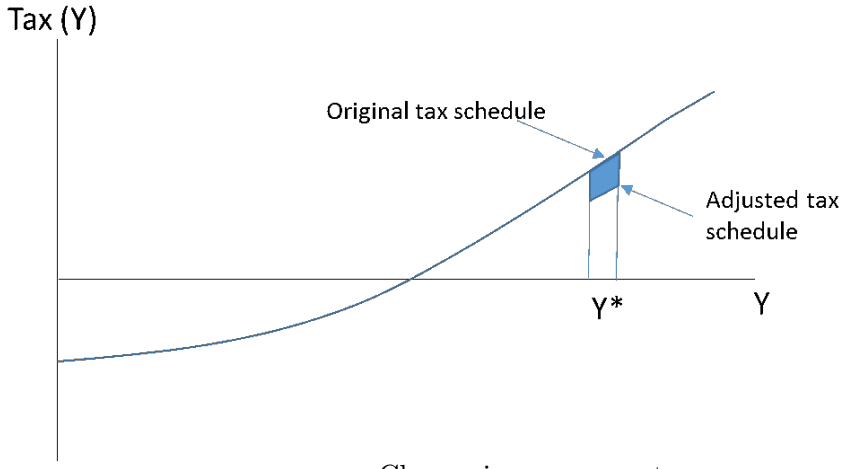
Using the Deflator in cost-benefit analysis has two intuitive interpretations. The first is that through the income tax and transfer system, the

[6]There is a larger distributional difference between a typical individual and a typical owner of capital than there is between a typical consumer and a typical owner of capital. This is because the distribution of consumption is also highly correlated with income.

[7]This section contains a brief overview of the Inequality Deflator. However, a much more thorough treatment is provided in Hendren (2014) and Varela (2017).

[8]The benefit to those who move to receive the payment is second order, and for a small payment will be equal to zero by the envelope theorem.

Figure 1: A stylised depiction of an adjustment to the existing tax and transfer system



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

government reveals a preference regarding the relative welfare of different income groups in society.[9] Using the Inequality Deflator to evaluate future policy decisions is equivalent to following the revealed preference of the government. This can also be expressed in terms of social welfare functions, where the Inequality Deflator is defined as the social welfare function that rationalises observed government policy. Policy options are then evaluated based on this social welfare function.

The second interpretation is that a policy proposal could be implemented alongside a small adjustment to the existing tax and transfer system in order to make the proposal distribution neutral. This is equivalent to implementing the traditional Kaldor-Hicks welfare criteria so that transfer payments have to be made through the tax and transfer system (rather than through

[9]To see why this is the case, the government could actually implement the shock described in Figure 3.1, and take away or give a small amount of money to someone earning a particular income. The amount of government revenue this costs is equal to the Inequality Deflator. The fact the government has chosen not to do this suggests that social valuation of income in this group must be equal to the social valuation of the government revenue that could be transferred. If the social value to the income group was greater than the Deflator, then transferring money to this group would be welfare improving. Similarly, If the social value to the income group was less than the Deflator, then transferring money away from this group would be welfare improving.

lump sum transfers). This interpretation has the desirable property that if a policy influences people equally conditional on income, then using the Deflator is equivalent to searching for potential pareto improvements, and so doesn't depend on the assumption that existing government policy is rational. However, the example covered in this paper has a large amount of variation conditional on income, and so the interpretation of the Deflator must be modified.[10] Instead, it is possible to implement compensating payments through the tax and transfer system so that, on average, people at a given income level are fully compensated (meaning that some will be better off and some worse off after the compensation payment).[11]

As discussed in Section 2.2 of Varela(2017), a key concern when evaluating a project or policy using the Deflator is whether there are additional fiscal effects from implementing the project or policy. For instance, a policy may be highly valued by low income individuals, but if this increases the attractiveness of earning a low income relative to a high income, it is equivalent to an increase in the marginal tax rate.[12] As such, the methods used in this paper are best applied to situations in which there is no change in behaviour, such as transfers of economic rent between business and individuals.

The empirical estimates of the Inequality Deflator used in this paper come from Hendren (2014) for the US economy, and Varela (2017) for the Australian economy. The main estimates of the Deflator are presented in Figure 3.2, while a number of alternate specifications are included in the results. The vertical axis represents the total amount of surplus that would be received by everyone if money was taken from a particular individual and spread throughout the economy. For instance, a dollar of surplus to someone in the 10th income percentile could be turned into \$1.20/n for every person (where n is the number of people in the economy).

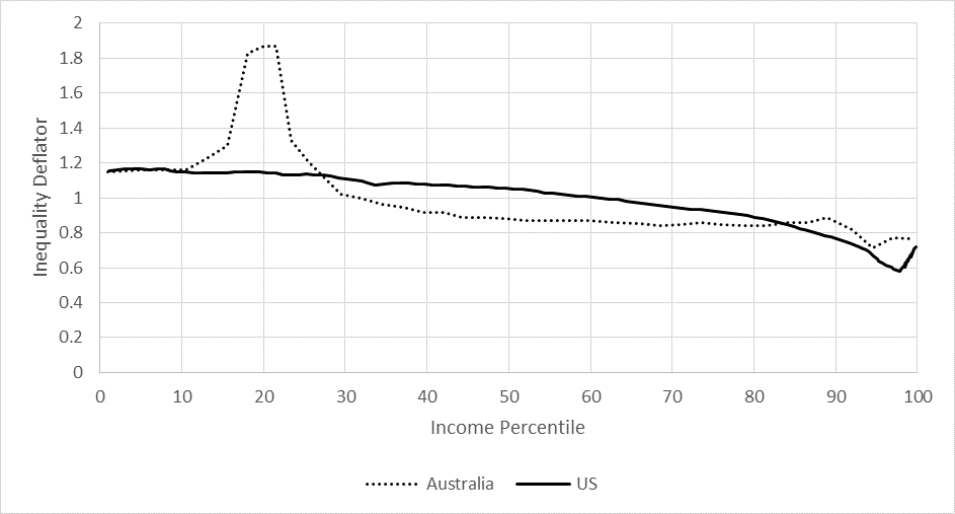
As discussed in Section 4.2 of Varela (2017), care should be taken in making direct comparisons between the sets of results in Figure 3.2 as the definition of income percentile varies between the two studies. For the US results, income percentile refers to percentile of those who file a tax return,

[10]Both Hendren (2014) and Section 2.2 of Varela (2017) include discussions of the interpretation of the Inequality Deflator when the benefits to individuals vary conditional on income.

[11]This type of Quasi-Pareto Improvement was proposed by Ng (1974).

[12]In the case in which a distributional payment acts exactly like part of the tax system (such as a means tested subsidy for health or education), then a redistributive payment through the tax system will have the exact opposite effect as the subsidy, and so it is appropriate to use equal weights to evaluate policy in this case (Kaplow 2004).

Figure 2: Inequality Deflator estimates for Australia and the US



while the Australian results refer to percentiles of the Australian population. In particular, the 'spike' that is observed in the Australian results occurs at the base payment rate for Australian government income support payments. Many people at this point of the income distribution do not file a tax return and therefore would not be identified using the US methodology.

Beyond this issue, there are two sources of difference between the US and Australian results. First, the Inequality Deflator is a product of the tax and welfare system utilized by each country, and will also be affected by other country specific factors such as the elasticity of taxable income and the design of the tax and transfer system in each country. For instance, Australia's relatively larger social safety net is a primary driver of the large 'spike' around the 20th income percentile.[13] The second source of divergence is that Hendren (2014) and this thesis use different estimation techniques, which will inevitably introduce variation in results. It is noteworthy that while there are a range of factors that create divergence between the Australian and US estimates of the Inequality Deflator, these differences do not result in large differences in the relative welfare weights of individuals, consumers and producers estimated in this paper.

[13]The 'spike' in the Australian Deflator represents the income of individuals on unemployment benefits and other welfare programs, with little or no other income. Those with lower levels of income are ineligible for these benefits, generally as a result of a spouse's income.

3 Applying the Inequality Deflator to individuals, producers and consumers

The starting point for the discussion is the well-established finding that capital tends to be more unequally distributed than income, which is less equally distributed than consumption, which in turn is less than perfectly distributed. This has been shown in the American context by Saez and Zucman (2015), in the Australian context by Finlay (2010) and Headey et al. (2008), and found to be a common feature of OECD countries in Förster et al (2014). It was also established to be a consistent feature of economies in different countries and at different points in time in Thomas Piketty's Capital in the Twenty First Century (Piketty 2014).[14] Piketty also established that capital earnings increased the level of total inequality in an economy. This implies that if $1 is taken from every individual, and then returned in proportion to a person's capital ownership or consumption level, it would result in an increased level of inequality in a society.

This paper uses the framework of the Inequality Deflator to provide relative welfare weights for a typical owner of capital, a typical consumer (weighted by the level of consumption), and a typical individual. In practice, this means calculating the average value of the Inequality Deflator for people in each of these groups. As discussed in Hendren (2014), taking the average Deflator amongst a group of individuals in this manner can be interpreted as implementing the same preferences as exists in the current tax and transfer system, provided the government is acting to maximize a social welfare function based on individual income. However, as discussed in Section 2.2 of Varela (2017), this can be problematic if the relevant social welfare function also includes other factors, such as age, and gender, that are not able to be influenced through the income tax system.[15]

An alternative interpretation of the Inequality Deflator applied to these aggregate groups, is to imagine a dollar gained by a typical owner of capital, and then distributed through the population using the tax and transfer system. The amount of surplus that can be gained when spread equally is

[14] Piketty (2014) is based on a broad range of research conducted with the World Wealth and Income Database.

[15] While this paper is primarily concerned with issues of vertical equity, and the trade-offs made between people of different income levels, the actual preferences of a society are likely to be more nuanced, and may include issues such as gender, age, race and geographic location, which aren't directly captured by the tax and transfer system. This suggests that where such an issue is a primary driver of policy, the Inequality Deflator is not the correct tool to perform analysis.

the Inequality Deflator for capital owners.[16]

An important clarification to be made with regard to this framework is that it is designed to examine transfers where the incidence of the transfer is known, and the transfer does not change the incentives of anyone to earn income. For instance, it is designed to look at small one-off transfers between groups. However, if that transfer was expected, it would change the incentives to earn and save (and the question then becomes one of optimal capital taxation). The Inequality Deflator is also limited in the sense that a decision to transfer money between two groups may be 'unfair' in a manner removed from the concept of vertical equity examined in this paper. For instance, a regulatory decision that makes a business' property freely available may improve equity, but may still be considered unfair if it is violating an existing property right.

Some examples of policy debates in which benefits between different groups could be compared using this framework include:

- Transfers to businesses as a result of monopoly pricing.
- A reduction in the corporate tax rate that creates a 'windfall gain' for existing owners of capital.
- The decision to use government purchasing power to lower the price of pharmaceuticals.
- Increasing the prices allowed to be charged by regulated monopolies, such as electricity networks.
- Efficient regulation of banking fees and consumer credit.

In many of these cases, the transfer between groups is only part of the impact of the policy, and policy analysis must include all the relevant components. Moreover, some of these cases may include offsetting incentives that must be considered in any policy analysis.

[16]However, given that people with the same income level have different amounts of consumption and capital income, it is not possible to characterize this as a potential pareto improvement. In fact, in the empirical exercise conducted in this paper using a rule in which all people must be compensated (such as is described in Section 3.5 of Hendren (2014)) is prohibitively difficult to implement.

4 Results

4.1 Results for the US economy

This section reports the average value of the Inequality Deflator amongst different groups, relative to the average Deflator of a typical individual. These groups include typical capital owners (weighted by the level of capital ownership), and typical consumer (weighted by the level of consumption), as well as a number of subcategories of capital and consumption. In order to test the robustness of the results, a variety of different definitions are used for the Inequality Deflator. This section reports the results for the US economy, while the following section reports the results for the Australian economy.

The measure of capital ownership is intended to represent the beneficiary of a dollar gained by a business. The main measure of capital ownership is the value of shares plus the value of businesses and farms owned by the household reported in the Panel Study of Income Dynamics (PSID). Alternate measures of capital ownership include the total value of all assets (both with and without housing equity), and total cash in annuities and chequing accounts.

The main measure of consumption used in the exercise is the sum of all expenditure reported in the PSID. A small literature exists that compares this measure of consumption with results from the Consumer Expenditure Survey (CES),[17] which is typically considered to be the best source of consumption data, but is not suitable for use in this paper as it has no information on individual wealth levels. This research finds that the PSID matches the levels of aggregate expenditure from the CES quite well, and is therefore suitable for use in this exercise.

The empirical estimates of the Inequality Deflator are taken from Hendren (2014). However, a number of different specifications of the Deflator are presented in this work. Therefore, in this section four different values of the Deflator are used. The first is the baseline estimate of the Deflator, which is calculated using a compensated elasticity of taxable income of 0.3.[18] The second and third Deflator values are based on the high elasticity (ETI = 0.5) and low elasticity (ETI=0.1) estimates from Hendren (2014). The final Deflator is the household estimate calculated in Section 4.5 of the Hendren

[17] For instance, Andreski et al. (2014) and Charles et al. (2006).

[18] A different ETI is used for people in the phase-in region (0.31) and phase-out region (0.14) of the Earned Income Tax Credit. There is also an extensive margin elasticity of 0.09 applied to those eligible for the Earned Income Tax Credit.

paper. For the first three cases, the Deflator is estimated at an individual level. In order to align this with consumption and wealth information, which is recorded at the household level, the average value of the Deflator amongst adult members is used.

The main results are presented in Table 1. These results should be interpreted as the relative weight between a type of capital owner and a consumer. For instance, the value of 0.88 in the first cell of the table means that a typical capital owner has a weighting that is 0.88 times the weight of a typical individual in the baseline scenario.

Table 1: Relative welfare weights in the US

	Baseline	High Elasticity	Low Elasticity	Household
Capital Owners	0.88	0.80	0.96	0.84
Consumers	0.97	0.94	0.99	0.95

Table 2 reports results of the average relative weights calculated using different definitions of consumption and wealth.[19] In each case, the result is reported as the relative welfare weight compared to a typical individual (as in Table 1).

Table 2: Welfare weights for different US asset classes

	Baseline	High Elasticity	Low Elasticity	Household
Total wealth including property	0.92	0.87	0.97	0.88
Total wealth excluding property	0.91	0.84	0.96	0.87
Stocks	0.90	0.83	0.96	0.86
Net value of Businesses and Farms	0.86	0.75	0.94	0.82
Annuities and IRA accounts	0.97	0.94	0.99	0.95
Own home	0.96	0.93	0.99	0.93
Other real estate	0.89	0.82	0.96	0.86
Chequing and Saving	0.94	0.89	0.98	0.91

Finally, Table 3 shows the results disaggregated by different consumption types. Vacations and Other Recreation are associated with highest income earners and therefore having the lowest welfare weighting, while food was associated with lower incomes and has a higher relative welfare weight.

[19] With the definition of these categories the same as those used in the PSID.

Table 3: Welfare weights for different US consumption items

	Baseline	High Elasticity	Low Elasticity	Household
Total Utilities	0.98	0.95	0.98	0.97
Total Food	1.01	1.03	1.00	0.98
Transport costs (ex. cars)	0.99	0.97	0.99	0.98
Clothing	0.93	0.88	0.97	0.91
School fees and related costs	0.95	0.90	0.98	0.93
Home repairs	0.93	0.88	0.97	0.91
Home furnishings	0.94	0.90	0.98	0.92
Vacations	0.92	0.86	0.97	0.90
Other recreation	0.93	0.87	0.97	0.91
Health	0.99	0.97	0.99	0.96

4.2 Results for the Australian economy

The results for the Australian economy follow a similar structure to the US results presented above. The relative welfare weights of typical capital owners, typical consumers and typical individuals are presented. Then, the definitions of capital owner and consumption are varied to show that the results are relatively robust to different specifications of these variables.

The main measure of capital ownership is the total measure of capital holdings included in the 2009 Survey of Income and Housing Costs, and includes government and non-government superannuation, shares, partnerships, trusts, incorporated and unincorporated businesses, loans, bonds and financial accounts. Alternative measures of capital include total ownership of businesses (incorporated and unincorporated), total value of superannuation (government and non-government), and total holding of shares. A breakdown of the Deflator by all capital classes included in the Survey of Income and Housing Costs is included in the appendix to this paper.

The measure of consumption is total consumption at the household level reported in the Household Expenditure Survey.[20] Consumption measures by category of expenditure are included in the appendix to this paper, although there is little variation across expenditure classes.

The empirical estimates of the Inequality Deflator are taken from Varela (2017), which defines Inequality Deflators in a number of different ways. Therefore, in this section, results will be presented using five different De-

[20]The Survey of Income and Housing and the Household Expenditure Survey are collected together, and are linked at the unit record level.

flators.

- **Deflator 1**: This is the baseline estimate provided in Varela (2017). It is based on a change to the personal income tax and transfer system, and the average Deflator is evaluated across all records in the Survey of Income and Housing Costs. For households with multiple adults, the average value of the Deflator is used.

- **Deflator 2**: The same as Deflator 1, but the estimate is only evaluated on records included in the sample used to estimate the Deflator. This means that those under eighteen years old, over sixty-five years old, those who are self-employed, eligible for the Disability Support Pension or who are full time students are excluded from the exercise.

- **Deflator 3**: The same as Deflator 1, but using a lower estimate for high income earners. As discussed in Section 2.2 of Varela (2017), the approach used to estimate the Deflator in Australia is less suitable at high incomes than that used in Hendren (2014).[21] While Hendren also stressed caution regarding the exact estimation of the Deflator at high incomes, and caution should be applied in using estimates from different countries, the Deflator for those earning above $150,000 is changed from 0.81 to 0.6 (the value for high income earners in Hendren (2014)) as a form of sensitivity test.

- **Deflator 4**: The Subclass Level Deflator. This uses the values estimated in Section 4.3 of Varela (2017), and it allows the Deflator to vary, both by income level, and by household type (couples with children, couples without children, singles with children and singles without children).

- **Deflator 5**: The Household Level Deflator. This is estimated by providing an incentive to earn a particular level of household income, rather than individual income. For single adult households, this is set equal to Deflator 1.

[21] The Australian methodology was based on underlying survey data, which has well known limitations for examining the top of the income distribution, compared to an approach that uses all tax records. Moreover, the approach in Varela (2017) only looks at the labor supply response, rather than looking at all responses to an income tax (such as tax planning). This approximation is likely to be more problematic for high income earners.

The primary results are shown in Table 3. As with the preceding section, the results in this table are presented as the average welfare weight relative to a typical individual.

Table 4: Relative welfare weights in Australia

	Def. 1	Def. 2	Def. 3	Def. 4	Def. 5
Total equity	0.89	0.92	0.86	0.82	0.89
Expenditure	0.94	0.97	0.93	0.89	0.95

The results show that regardless of the definition of Deflator used, a typical capital owner should be given a welfare weight of between 82-92 percent of a typical individual. Where a policy affects a typical consumer (such as an indirect tax), a typical capital owner should be given a weight of between 89-97 per cent of a typical consumer.

In Table 4 the results are shown by type of equity ownership. It shows that the Deflator is higher (and hence the implied welfare weight is higher) for superannuation and businesses, while the Deflator is lower (and the implied welfare weight is lower) for private trusts. However, the qualitative result that a dollar falling to a capital owner is less valuable than a dollar falling to a typical individual is consistent regardless of the definition of capital used.

The appendix to this paper contains estimates of the average Deflator by all classes of capital, as well as by type of expenditure. There is a significant amount of variation amongst the type of capital holding. This reflects the fact that different capital classes are utilized differently by people with different levels of income. The values in table 5 are preferred to those in the appendix, because the table is more indicative of a typical business owner. However, regardless of the definition used, the same qualitative result holds, that income to businesses should be treated less favorably than

Table 5: Welfare weights for different Australian asset classes

	Def. 1	Def. 2	Def. 3	Def. 4	Def. 5
Businesses	0.88	0.89	0.82	0.86	0.88
Trusts (private)	0.83	0.85	0.77	0.69	0.84
Shares	0.90	0.92	0.87	0.79	0.89
Superannuation	0.91	0.94	0.89	0.82	0.91

income to individuals, and a 'transfer' between these groups will have welfare consequences.

4.3 Summary of results and discussion

The method described above is performed using different estimates of the Inequality Deflator, as well as using different assumptions about what constitutes capital and consumption. Given these variations, the weights for equity holding varied between 0.8 to 0.96 in the US, and from 0.82 to 0.92 in Australia, while the weights for typical consumers varied between 0.94 to 0.99 in the US and from 0.89 to 0.97 in Australia. Breaking down the results further into type of capital ownership and expenditure showed additional variation, with business ownership, shares and private trusts being associated with a lower welfare weight (as they are associated with higher income earners), while annuities, IRAs and standard bank accounts were all associated with weights close to one.

While some caution must be exercised when comparing the results across the two countries, as the methodology of estimating the Inequality Deflator varies for the two countries, there is enough stability in the results to suggest that the relative welfare weights for capital owners is, both economically and statistically,[22] different from one.

There are two further factors that suggest that the relative welfare weights should be further removed from one. The first of these issues is foreign ownership of capital. Throughout the calculations, foreign ownership (and indeed foreign consumption) is ignored. However, in the United States around 15 per cent of business equity is owned by foreign investors (US Federal Reserve 2016) while in Australia, the figure is around 7 per cent (Australian Government Treasury 2016). The extent to which this changes the results depends on what value a policymaker puts on non-residents. For instance, if a weighting of zero is given to outside parties, then the relative welfare weights for US equity presented above need to be scaled down to 0.88*0.85 = 0.75. However, if non residents are considered in a similar manner to residents, then the original results remain.

The second issue is that this methodology uses a single cross section of data, and in doing so pools together people at different ages, and at different stages of the employment cycle. For instance, it will show recently

[22]For the Australian estimates, the MITTS model is not well suited to calculating standard errors. However, the US high and low estimates can be viewed as bounds on a confidence interval, and justify the claim that the relative weights are statistically different from parity.

unemployed people, university students and recently retired people as low income, whereas over their lifecycle these individuals might actually be high income.

This raises an interesting restriction of the current Inequality Deflator approach. As specified, the Inequality Deflator assumes that governments have a revealed preference over the income distribution in any year. Alternatively, following the other interpretation of the Deflator, it assumes that governments can target payments or taxes to individuals earning a particular income level, but that it cannot tax target payments based on existing asset levels (which may better target lifetime income). In reality, governments do exhibit some preference for redistribution across lifetime income, such as taxes on capital income and asset tests associated with the Australian Age Pension. Nevertheless, the majority of redistributive taxation is defined based on annual income, and so the existing Inequality Deflator framework is likely to be a good approximation.

Extending the empirical framework of the Inequality Deflator to include government preferences for redistribution over the lifetime is a daunting empirical exercise (and one beyond the scope of this research). Nevertheless, we can get an idea as to how such an adjustment would change the final result. Lifecycle patterns are observed in both wealth levels and yearly income. Variation in wealth occurs as people accumulate savings to retire, and then (partially) run down these savings after retirement. This variation will increase the observed correlation between income and wealth, and mean that the relative welfare weights reported above are too low. On the other hand, yearly income levels fluctuate due to periods of study, short term unemployment and retirement, which will all show an individual to be very low income even though they might have a high lifetime income. This effect will push the observed results in the opposite direction, meaning that the relative welfare weights reported above will be too high. The combined effect of these two factors will depend on which factor has a larger influence. In a general sense, it will depend on whether annual income or current wealth is more highly correlated with lifetime income. However, without a long-term panel of wealth and income, or an agreed upon measure of lifetime income that the government would use for distributional purposes, it is difficult to say in which direction this effect would ultimately bias the results.

5 The importance of this approach for sufficient statistics papers

Evaluating welfare effects through the sufficient statistics technique is increasingly common in modern public finance. This process, well summarised by Chetty (2009), involves specifying a utility maximization problem in abstract terms, and using first order conditions to write the welfare effect of interest in terms of empirically estimated variables. In doing so, it allows normative results to be found without the need to fully specify the relevant utility and production functions.[23]

One common assumption used in this literature is that a small change in prices will have no welfare effect. Effectively, a price change will just transfer welfare from producers to consumers with no net effect. However, the relative value of producer and consumer benefit is a subjective choice. In this section we will explore how relaxing this assumption can increase the complexity of the welfare calculations using the example of Harberger triangles. As discussed in Chetty (2009), Harberger triangles can be understood as the intellectual forerunner to much of the modern sufficient statistics literature, which suggests that an equivalent effect will occur if this principle is applied to a range of modern papers.[24]

In the standard Harberger problem, a single indirect tax is placed on a good (x_1), while a representative consumer is assumed to maximize a utility function:[25]

$$U = \max_{x,y} u\big(x_1, ..., x_j\big) + y \quad s.t.\ p.x + tx_1 + y = z \tag{1}$$

While a representative firm takes prices as given and maximizes:

$$\pi = \max_{x} p.x - c(x) \tag{2}$$

[23] A full description of the sufficient statistics framework, as well as a number of examples of the framework being applied are found in Chetty (2009).

[24] A similar argument can be made regarding pecuniary externalities. In a standard welfare framework, pecuniary externalities have no welfare effect as a change in price will harm consumers and benefit producers in equal measure. However, if these groups were not given equal standing, then pecuniary externalities would have net welfare implications.

[25] As is common in the literature, an iso-elastic utility function is used here to simplify the algebra by removing income effects.

This also provides the two first order conditions for individual and firm maximisation:

$$U'(x) = p \tag{3}$$
$$C'(x) = p \tag{4}$$

In the standard Harberger welfare problem, social welfare is written as the sum of consumer welfare, producer welfare and tax revenue (with equal relative weightings):

$$W = \max_x \left[u(x) + Z - tx_1 - p(t)x\right] + \max_x \left[p(t)x - c(x)\right] + tx_1 \tag{5}$$

This allows the p(t)x terms to cancel out from the producer and consumer side:

$$W = \max_x \left[u(x) + Z - tx_1\right] + tx_1 \tag{6}$$

Taking derivatives:

$$\frac{dW}{dt} = u'(x)\frac{dx}{dt} - x_1 - c'(x)\frac{dx}{dt} + x_1 + t\frac{dx_1}{dt} \tag{7}$$

Using the first order conditions in (3) and (4), this can be simplified to the familiar result:

$$\frac{dW}{dt} = t\frac{dx_1}{dt} \tag{8}$$

This result suggest that the welfare effect of a tax can be determined with a relatively small amount of information, and the simplicity of this result has resulted in a large empirical literature (Hines (1998), and Dahlby (2012)). In order to show the potential importance of distributional outcomes, we now return to the Harberger example, and assume that producers and consumers have a different welfare weight. We continue to assume that tax revenue is returned lump sum to households and give this the same weight as consumers (although this is not necessary). Finally, we normalize the weight of consumers to one, with a welfare weight of δ given to producers. In this case, equation 5 becomes:

$$W = \max_x \left[u(x) + Z - tx_1 - p(t)x\right] + \delta\left[\max_x (p(t)x - c(x))\right] + tx_1 \quad (9)$$

$$= \max_x \left[u(x) + Z - tx_1 - \delta c(x)\right] + (\delta - 1)p(t)x + tx_1 \quad (10)$$

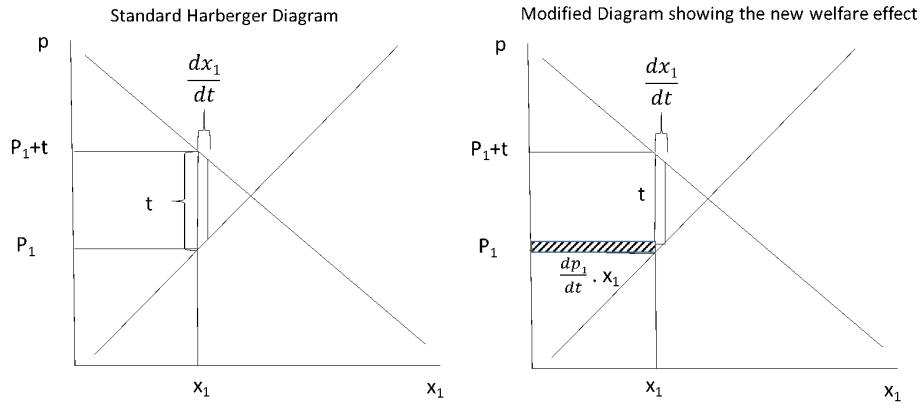
$$\frac{dW}{dt} = u'(x)\frac{dx}{dt} - x_1 - \delta c'(x)\frac{dx}{dt} + (\delta - 1)\left[p(t)\frac{dx}{dt} + x_1\frac{dp}{dt}\right] + x_1 + t\frac{dx_1}{dt} \quad (11)$$

$$= p\frac{dx}{dt} - \delta.p.\frac{dx}{dt} + (\delta - 1)\left[p(t)\frac{dx}{dt} + x_1\frac{dp}{dt}\right] + t\frac{dx_1}{dt} \quad (12)$$

$$= (\delta - 1)\left(x\frac{dp}{dt}\right) + t\frac{dx_1}{dt} \quad (13)$$

There is now an additional term in the welfare expression that represents any transfer between producers and consumers as a result of the price change. This transfer could occur in the market in which the tax is placed (x_1), but could also occur in any other market where prices change as a result of the tax. The result is apparent in the standard Harberger welfare diagrams in Figure 3.3:

Figure 3: Harberger diagram with distributional effects



The first thing to note about this result is that in order to evaluate this expression, two additional pieces of information are now required. Namely, it is now necessary to know both the relative welfare weights and the incidence of taxation on consumer prices across multiple markets. This means that even if the relative welfare weights are known (or assumed), the welfare calculations are still more difficult than if the welfare weights are assumed to be equal.

It should also be noted that the Harberger framework is a partial equilibrium framework, and so excludes the possibility of offsetting welfare effects in other markets. For instance, if the indirect tax being considered lowers the return to investment, which reduces the level of investment and savings, then this would have an offsetting welfare effect that would push the relative weight back towards unity. However, such effects are generally very difficult to predict, and are typically ignored in this type of analysis.

Finally, it should be noted that the equation reverts back to the original form (as in equation (8)) if $\frac{dp}{dt} = 0$. In other words, if the tax is fully borne by consumers, and there are no price changes in secondary markets,[26] the original formula is still valid regardless of the assumptions around relative welfare weights.

6 Conclusion

This paper highlights a practical problem from the project evaluation field. Namely, how to apply relative weights to individuals, consumers and owners of businesses when performing welfare analysis. It proposes a simple and practical solution to this problem that builds on the modern public finance literature. Importantly, as with the Inequality Deflator more generally, the results can be implemented as a simple weighting scheme, with the same weights being used regardless of the project or policy being examined.

The procedure here is subject to three potential critiques. The first is whether the Inequality Deflator can be estimated reliably enough to be used in applied policy discussions. A significant amount of variation still exists in empirical estimates of the Elasticity of Taxable Income, which is a significant determinant of the Inequality Deflator. Both Hendren (2014) and Varela (2017) acknowledge the difficulties in estimating the Inequality Deflator, and care should be taken to not overstate the accuracy of the final results. Still, varying the definition of capital and consumption as well as varying the specification of the Inequality Deflator provides some sense of the robustness of the results in this paper.

The second critique is that policies that trade-off benefits between individuals and businesses may affect the incentives for individuals to save and invest. If this is the case, it is incorrect to evaluate such policies in a partial equilibrium framework that holds savings and investment fixed as there will be offsetting welfare effects that occur in these markets. However, this approach would still be valid when looking at the transfer of economic rent.

[26] For instance, if there is perfect competition in all markets.

The final critique is whether averaging the value of the Inequality Deflator amongst a group is a sensible measure for policy evaluation. As discussed above, this results in a policy with the same distributional trade-off as that observed in the income tax system. However, as there is variance in the ownership of capital and consumption conditional on income, the Inequality Deflator is no longer equivalent to searching for pareto improvements. To some extent the value of this approach is a subjective decision. However, the merits of the approach must be judged against the alternatives in this area, which ignore distributional concerns (giving everyone equal weighting), or approach them in a relatively arbitrary way (an assumed social welfare function). Viewed in this way, the technique developed in this paper represents a pragmatic approach to an important policy dilemma.

Appendix

In this appendix, additional calculations are reported for the Australian economy, with further disaggregation by type of capital and consumption. For instance, a typical business owner is wealthier than the typical owner of a bank account, and so implementing this technique will imply a lower welfare weight for a business owner than for the holder of a bank account. However, care should be taken with these results as they are based off survey results, and some categories within this survey have a relatively small number of large positive responses.

The tables show that the average Deflator varies significantly across different types of capital. The top row of Table 6 shows the average across all asset classes, so all other rows should be read relative to that row. For instance, incorporated and unincorporated businesses, private trusts and silent partnerships all had a lower Deflator than the one calculated using the total capital measure. This means that a policy evaluation on one of these asset classes would use a lower welfare weight. On the other hand, accounts held with financial institutions, bonds and loans made to others were all associated with a higher Deflator level, implying that a higher welfare weight should be used.

Table 6: Average Australian welfare weights, by type of capital holding

	Defl. 1	Defl. 2	Defl. 3	Defl. 4	Defl. 5
Total wealth	0.93	0.94	0.91	0.88	0.94
Balance of accounts with government superannuation funds	0.90	0.94	0.89	0.80	0.90
Balance of accounts with non-government superannuation funds	0.91	0.94	0.89	0.83	0.92
Value of accounts held with financial institutions	0.96	0.95	0.95	0.93	0.96
Value of debentures and bonds	0.95	0.91	0.95	1.17	0.92
Value of own incorporated business (net of liabilities)	0.83	0.86	0.76	0.70	0.84
Value of own unincorporated business (net of liabilities)	1.02	1.10	1.02	1.26	1.00
Value of public unit trusts	0.95	0.96	0.94	0.85	0.98
Value of silent partnerships	0.84	0.86	0.80	0.75	0.79

A similar exercise is performed for different types of consumption in Table 4. There is less variation amongst expenditure types than amongst

capital types, although tobacco products, food and beverages, medical care and fuel and power all have a higher Deflator than the overall consumption Deflator.

Table 7: Average Australian welfare weights, by expenditure class

	Defl. 1	Defl.2	Defl. 3	Defl. 4	Defl. 5
Total Consumption	0.94	0.97	0.93	0.89	0.95
Housing	0.95	0.98	0.95	0.91	0.94
Fuel and Power	0.97	0.99	0.97	0.95	0.98
Food and Non-Alcoholic Beverages	0.96	0.97	0.95	0.92	0.97
Alcoholic Beverages	0.93	0.96	0.92	0.88	0.94
Tobacco Products	0.99	1.01	0.99	0.98	1.01
Clothing and Footwear	0.93	0.95	0.91	0.86	0.94
Household Furnishings	0.93	0.95	0.92	0.89	0.93
Household Services and Operations	0.95	0.97	0.95	0.91	0.96
Medical Care	0.95	0.96	0.95	0.91	0.96
Transport	0.93	0.96	0.92	0.87	0.94
Recreation	0.93	0.96	0.93	0.89	0.94
Personal Care	0.94	0.96	0.93	0.89	0.95
Miscellaneous	0.92	0.94	0.91	0.84	0.93

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