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Fiscal incidence in New Zealand: The effects of taxes and benefits on household incomes in tax year 2018/19

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Supplementary material supporting this report can be accessed at the following GitHub address: https://github.com/Treasury-Analytics-and-Insights/analytical-note-24-01-effects-of-taxes-and-benefits

Executive summary

Analyses of the distributional impact of taxation and government spending typically focus on individuals' and households' *disposable income* – the income they receive "in the hand" after accounting for the transfers they receive from the government, minus the income taxes they pay. A broader perspective is given by fiscal incidence studies, which also consider the taxes households pay on their consumption and the government expenditure on the in-kind benefits they receive, to estimate their so-called *final income*.

In this analytical note we report results for fiscal incidence in the 2018/19 tax year. We augment results for household disposable income produced by the Treasury's TAWA model with estimates of the consumption taxes that households pay and the cost to the government of the education and health services that they receive. Our analysis broadly follows the approach of previous Treasury publications (Crawford and Johnston, 2004; Aziz *et al.*, 2012).

We present results for the distributions of household market, disposable, and final income – and the components of income support, income and consumption taxes, and in-kind benefit spending by which they are related – over deciles of household equivalised disposable income. We also estimate the corresponding distribution of the *net fiscal impact*, which is the net effect of these four classes of taxation and spending. We estimate Gini coefficients and Lorenz curves corresponding to various definitions of household income. Finally, identifying *retired* households based on the retirement status of their members and the primary sources of their income, we contrast the distribution of net fiscal impact for these households to that for the complementary set of non-retired households.

Key Results

In this analytical note we report results of a calculation of household final incomes in tax year 2018/19. A household's final income is obtained from its disposable income – income from market sources plus income-support payments, minus direct taxes (ie, personal income tax and the ACC earners' levy) – by subtracting the indirect or consumption taxes (ie, GST and excises) the household pays and adding estimates of the government spending on health and education services that it receives in kind. We report distributional results for household incomes, the taxation and spending components that contribute to them, and the net fiscal impact of government spending and taxation on households.
We find the following results:

- Cash income support payments and direct taxes result in disposable incomes that are lower than market incomes on average over the population of New Zealand households, and more equally distributed. The further inclusion of indirect taxes and in-kind benefit payments produces final incomes that are significantly more equally distributed than disposable incomes, and close to market incomes when averaged over all households.
- The Gini coefficient for household equivalised incomes decreases from 45.6 ± 1.5 to 35.8 ± 1.6 as income support payments are added to market incomes and again to 33.1 ± 1.5 as direct taxes are deducted. Consumption taxes – including GST and excises on alcohol, petrol, and tobacco – however, lead to an increase in income inequality according to this measure, which yields a value of 34.9 ± 1.6. The inclusion of in-kind spending on education and health results in a substantial drop in Gini coefficient to 28.1 ± 1.4 for final incomes.
- Our analysis allocates 66% of core Crown tax revenue and 68% of core Crown expenditure to New Zealand households. Although the taxes and spending allocated balance to yield an approximately neutral net fiscal impact on average over all New Zealand households, this impact is unevenly distributed. Households in the bottom five household equivalised disposable income deciles receive on average more in government services than they pay in taxes, whereas the opposite is true for households in the top four deciles.
- Income support and in-kind benefit spending broadly decline with increasing household disposable income. However, this trend is modulated by a large concentration of New Zealand Superannuation recipients in the second (ie, second lowest) decile of household equivalised disposable income, which is accompanied by higher health spending and lower spending on education and income support payments relevant to younger families in this decile.
- We find that the net fiscal impact for retired households is positive on average and in all income deciles except for the ninth and tenth, where a retired household is one for which 50% or more of household gross (market plus income support) income is derived by retired individuals.

Introduction

Household income surveys and microsimulation modelling of household incomes typically focus on disposable income – a household's market income (that derived from wages, salaries, self-employment, and investments), plus any income received from government transfers (public superannuation, working-age income support benefits, and other transfers), minus the income tax deducted from these income sources. This corresponds to the income available to a household for consumption and saving. Fiscal incidence studies extend this to consider a household's final income, which differs from its disposable income by the subtraction of the "indirect" taxes it pays on its consumption expenditure, and the addition of estimates of the cash values of in-kind benefits (sometimes also referred to as in-kind social services, social transfers in kind, or non-cash benefits) received by the household. This is argued to give a more complete picture of household incomes, as taxes paid on consumption reduce the income a household has available for saving and further consumption, while the household's receipt of government services implies that it need not pay for these services out of its disposable income. Cash values of in-kind benefits are often estimated on a cost-of-provision basis, in which households are attributed a share of the cost to the government of the service provided, according to some estimate of their use. Such studies typically include only the social services that can be most readily attributed to individual households – education and healthcare – corresponding to around 60–70% of total government taxation and expenditure (see Aziz *et al.*, 2012 and references therein).

Fiscal incidence studies are conducted regularly by government statistics departments in the United Kingdom (see, eg, Office for National Statistics, 2019a[1]) and in Australia (see, eg, Australian Bureau of Statistics, 2018). Similar studies have also been undertaken in developing countries (de Wulf, 1975). We note that while international comparisons of household income typically consider only market and disposable incomes, a recent work by Blanchet, Chancel, and Gethin (2022) compared inequality between the United States and Europe on a final income basis. In the New Zealand context, fiscal incidence was first studied by Snively (1986), who based her analysis on the 1981/82 Household Survey. Crawford and Johnston (2004) provided estimates of household final incomes in the 1987/88 and 1997/98 tax years[2], using the Treasury's TAXMOD tax-and-transfer microsimulation model with the corresponding Household Economic Survey (HES) years as inputs. Their results showed that in both these years – which bracket a period of significant economic reform in New Zealand[3] – final incomes were more equally distributed across the population of New Zealand households than disposable incomes, which were themselves more equally distributed than market incomes. Moreover, these authors showed that although there was a considerable increase in the inequality of market incomes between the 1987/88 and 1997/98 tax years, the increase in final income inequality over this period was much smaller. Aziz *et al.* (2012) used Taxwell, the successor model to TAXMOD, to model final incomes in the 2006/07 and 2009/10 tax years. Their results showed that while market incomes had increased since the 1997/98 year for the top half – when ranked by disposable income – of households, with broadly

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1 See also Welsh Government (2020) for a related analysis of the distribution of devolved public spending over household income levels in Wales.

2 That is, the years ended March 31, 1988 and 1998, respectively.

3 See, eg, Silverstone, Bollard, and Lattimore (1996) for a review of the economic reforms that were implemented in New Zealand over this period.

neutral changes for the lower half, final incomes had increased significantly for all households except those in the first (lowest) disposable income decile. A subsequent paper by Aziz *et al.* (2016) used income sharing assumptions to investigate the net fiscal impact on individuals, and thereby characterise its dependence on age and gender. More recently Stats NZ (2018) produced estimates for the distributions of household disposable income, savings, and consumption expenditure over household income quintiles and household composition types from a National Accounts (NA) perspective, by matching variables between the Household Income and Outlay Accounts and HES.

In this analytical note we investigate final incomes in the 2018/19 tax year, using the Treasury's Tax and Welfare Analysis (TAWA) model. TAWA is the successor model to Taxwell, and in its current operation heavily leverages the use of administrative microdata from Inland Revenue and the Ministry of Social Development within Stats NZ's Integrated Data Infrastructure (IDI) environment to model household disposable incomes. We estimate consumption taxes paid by households using the 2018/19 HES expenditure survey, and attribute education and healthcare spending to households following the approach of Aziz *et al.* (2012). We present results for the distributions across levels of household income of market, disposable, and final incomes, together with those of direct and indirect taxes and (cash and in-kind) benefits, and the net fiscal impact – the total increase or decrease in household incomes between the market and final income definitions. We also investigate the overall inequality of household incomes, as quantified by Gini coefficients, and show how these coefficients change as taxes and benefits are included in the corresponding income definitions. Finally, we separately consider retired households – those for which 50% or more of gross household income is due to retired household members – and provide results for the net fiscal impact on, and income inequality among, these households and the complementary set of non-retired households. In the Annex we provide details of our methodology, estimates of the progressivity of the broad tax and benefit categories we consider, and comparisons of our income inequality results to those found in previous Treasury studies.

Estimating fiscal incidence

Our analysis in this analytical note is based on modelling using TAWA – the Treasury's tax and transfer microsimulation model. TAWA models components of household[4] disposable incomes under existing policy settings and hypothetical reforms. The fundamental input data to TAWA is HES, though this survey microdata has been increasingly augmented over time with linked administrative data on taxes and benefits within the IDI. TAWA calculates transfer entitlements (which we generically refer to as benefit payments, although some of these entitlements take the form of tax credits) and direct tax liabilities for unit records in HES, facilitating distributional analysis for the population of New Zealand households. As TAWA calculates disposable incomes for HES unit records, household incomes calculated by TAWA can be connected to HES data on household expenditure, wealth, and material hardship[5].

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4 A household in HES (and TAWA) is a collection of people sharing a private residence and may in general include multiple families or other groups of unrelated individuals.

5 HES survey modules that collect, eg, household expenditure data are run every three years.

In addition to the estimates of market incomes, transfer entitlements, and direct tax liabilities provided by TAWA, our analysis includes estimates of the indirect taxes paid by households, based on reporting in the HES expenditure survey. Moreover, we also include estimates of the cash values of in-kind benefits received by households, in the form of education and healthcare spending. We estimate education spending received by children and students based on their reported enrolment in educational institutions in HES. Health spending amounts are distributed over all individuals in HES in proportions determined by the Ministry of Health's (MoH) Person-Based Funding Formula (PBFF) model (Ministry of Health, 2016), which assigns expected healthcare costs to a person based on their demographic characteristics. Moreover, we scale the tax and benefit amounts assigned to each household so that national totals estimated from the TAWA/HES sample match corresponding fiscal totals for revenue and expenditure taken from, eg, Treasury Budget publications (eg, The Treasury, 2022a) and NA data, as we discuss in the Annex.

Table 1 lists the income, benefit, and tax amounts that are taken from TAWA, and the categories in which we group them for our analysis[6]. These amounts are calculated by TAWA at an individual or family level and aggregated up to household level. Also shown in Table 1 are the additional components not provided by TAWA that we include in our study, ie, indirect taxes, income-related rent subsidies, and in-kind education and health benefits. We note that whereas we allocate education and health spending amounts to individuals and aggregate these to household level as we do for the amounts produced by TAWA, indirect tax and income-related rent subsidy estimates are only available at the household level. We refer collectively to the categories of Income replacement – working age, New Zealand Super and Veteran's Pension, Working for Families, Other income support, and Housing support as Income support in this note[7]. Further details of the definitions and estimation of taxes and benefit payments included in our analysis are given in the Annex.

[6] The relationships of the income, tax, and benefit components in Table 1 – and the definitions of household income to which they contribute – to levels of material inequality and wellbeing are discussed, for example, in papers by The Treasury (2022b) and Hughes (2022).

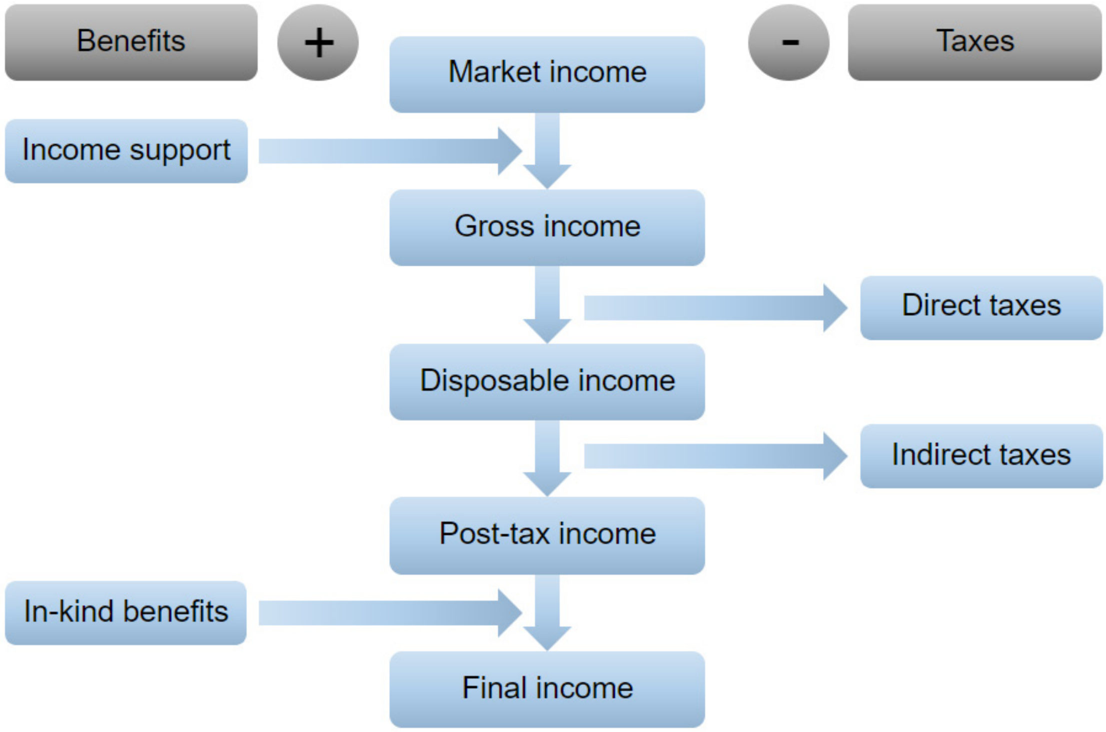
[7] We are therefore using a broad definition of income support as, eg, New Zealand Super and Veteran's Pension have a status in legislation distinct from that of the core income-replacement benefits.

Table 1: Components of household final income

Source	Income, benefit, or tax	Category
TAWA	Private taxable income	Market income
	Private non-taxable income	
	Personal income tax	Direct taxes
	ACC earners' levy	
	Jobseeker Support	Income replacement – working age
	Supported Living Payment	
	Sole Parent Support	
	NZ Super and Veteran's Pension	NZ Super and Veteran's Pension
	Family tax credit	Working for Families
	In-work tax credit	
	Minimum family tax credit	
	Best Start tax credit	
	Student allowance	Other income support
	Independent earner tax credit	
	Winter Energy Payment	
	Youth/Young Parent Payment	
	Other non-taxable benefits	
	Paid parental leave	
	Accommodation Supplement	Housing support
Additional	Income-Related Rent Subsidy	
	GST	Indirect taxes
	Alcohol excise	
	Petrol excise	
	Tobacco excise	
	Health spending	Health
	Early childhood education spending	Education
	Primary education spending	
	Secondary education spending	
	Tertiary education spending	
	Student loan spending	

We follow Crawford and Johnston (2004) and Aziz *et al.* (2012) in focussing on three primary definitions of household income: market income, disposable income, and final income. Market (or "original") income refers to the income that individuals or households obtain through market activity or from other private sources – ie, from wages or salaries, self-employment, investments, gifts, or inheritances[8]. Disposable income is the income available for a household to spend, after any cash benefits or transfers are allocated to the household and direct tax on its market income and transfers (where applicable) is deducted. Final income is the household's income after deducting indirect (consumption) taxes and attributing the cash value of in-kind benefits. Although these are the main definitions of household income that we consider in this note, we also consider two others, described by, eg, Office for National Statistics (2019a). The first is gross income, a household's total income from market sources plus all income support payments and transfers received, prior to the deduction of direct taxes[9]. The second is post-tax income, which is a household's disposable income minus indirect taxes. In Figure 1 we present a flowchart illustrating how these income definitions are related.

Figure 1: Illustration of different household income concepts



[8] Broader definitions of household income that include, eg, capital gains on assets or imputed rents on residences (Ching 2023; Ching, Reid, and Symes 2023; Inland Revenue 2023) are not considered in our analysis.

[9] In the New Zealand system some income support transfers are subject to personal income tax, whereas others are not.

Results

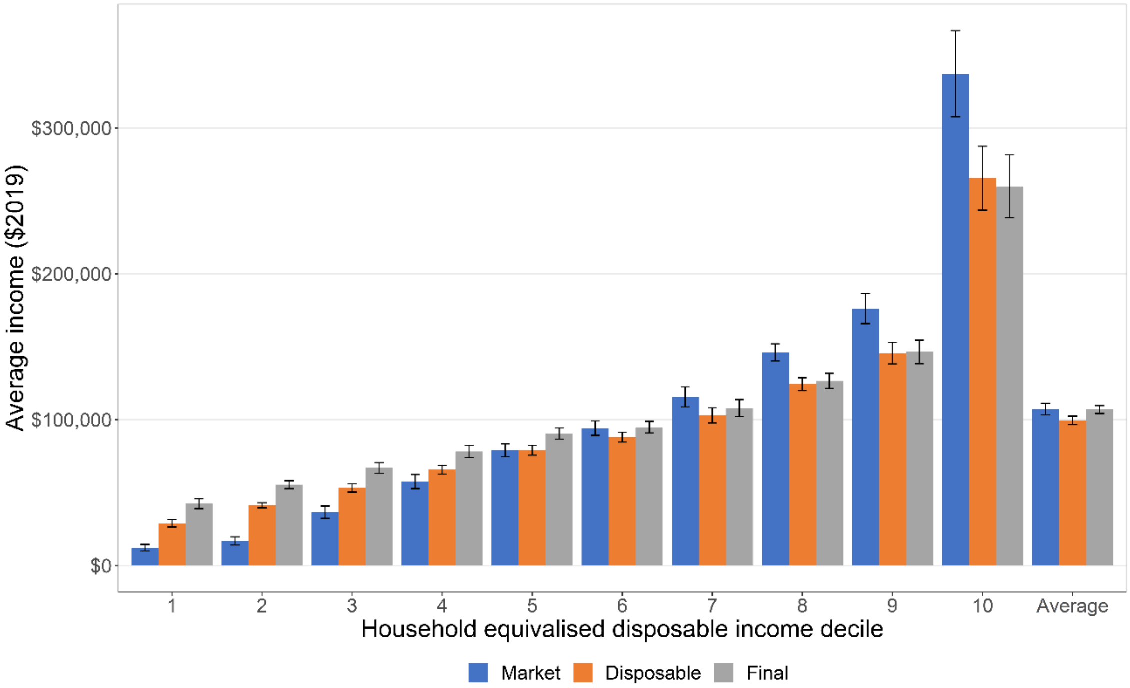
Market, disposable, and final income

In Figure 2 we show the average values of each of the three main definitions of household income – market, disposable, and final income (cf. Figure 1) – in each of the ten deciles of household equivalised disposable income (HEDI). Details of the modified OECD (mOECD) equivalisation scale (Hagenaars *et al.*, 1994) we use and the income levels defining the deciles are given in the Annex. We also show on this figure the average of each of these income definitions over the whole population of households. In this and subsequent figures we also indicate the sampling error – ie, 1.96 times the standard error of the point estimate – for each estimate. Note that although we use equivalised household disposable incomes to define the deciles on the *x* axis of Figure 2 the amounts shown on the *y* axis here (and in subsequent figures unless otherwise noted) are unequivalised[10] (ie, have not been adjusted for household size and composition). We see from Figure 2 that the inclusion of cash income support payments and direct taxes results in average disposable incomes that are lower than average market incomes when averaged over all households, and more equally distributed.

Adding in the effects of indirect taxes and in-kind benefit payments results, when averaging over all households, in final incomes that are larger than average disposable incomes, and indeed close to average market incomes. In fact, average final household incomes are at least as large as average disposable household incomes in all deciles except for the tenth, where the contributions of in-kind benefits are evidently outweighed by the effects of indirect taxes. Including indirect taxes and in-kind benefit payments results in further redistribution in addition to that due to income support payments and direct taxes, yielding a distribution of final incomes that is visibly more equal than that of disposable (and market) incomes.

[10] Note also that averages here are over groups of households, not individuals, and that individuals in smaller households will therefore tend to be more highly represented in these averages than those in larger households.

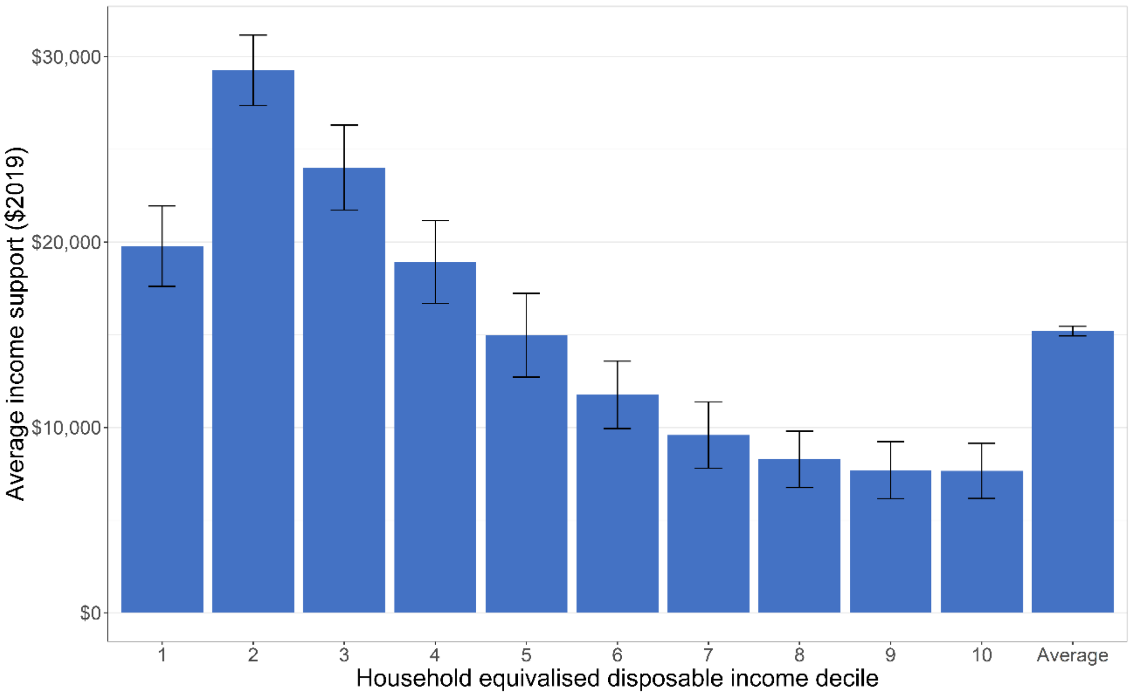
Figure 2: Market, disposable, and final income distributions over household income deciles



Income support

We now consider the individual components of taxation and expenditure that we model, beginning with income support payments. We illustrate the distribution of these payments across income deciles in Figure 3. We note that average income support peaks in decile two and thereafter declines with increasing HEDI decile, and that its value in decile one is significantly smaller than that in decile two.

Figure 3: Income support distribution over household income deciles

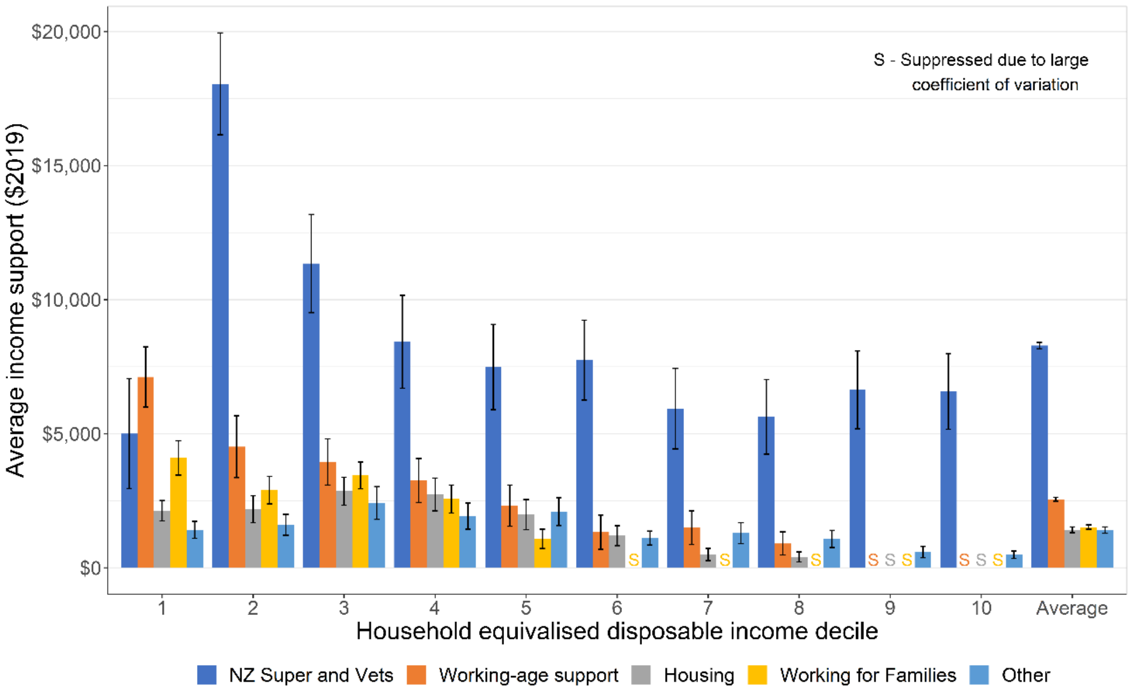


In Figure 4 we show the distribution of components of the income support system over household income deciles. In accordance with IDI confidentiality rules (Stats NZ, 2020), we suppress values when their sampling errors exceed 50% of the point estimate. This results in suppression of the mean values for Working for Families (WfF) tax credits in deciles six and above, and for working-age support and housing support in deciles nine and ten.

Average NZ Super and Veteran's Pension (NZS) amounts significantly exceed the average amounts of all other income support payments in all deciles except for the first and constitute more than half of average income support payments across all households. We note that average NZS payments are highest in the second decile and are associated there with a large group of NZS recipients with little other income[11]. Average NZS payments then decline over the next few deciles but remain significant even in the top decile.

The higher concentration of NZS recipients in the second decile is also reflected in the somewhat lower value of average WfF payments in this decile, as compared to deciles one and three, as there is a correspondingly lower proportion of families with children here. Average WfF payments otherwise decline steadily with increasing HEDI decile, as do average working-age support payments, whereas average housing support payments take their largest values in deciles three and four, before decreasing steadily with increasing HEDI from the fifth decile onwards. The final component of income support shown here, other income support payments, includes a range of different transfers (see Table 1) and exhibits non-suppressed average values even in the top decile.

Figure 4: Distribution of income support components over household income deciles

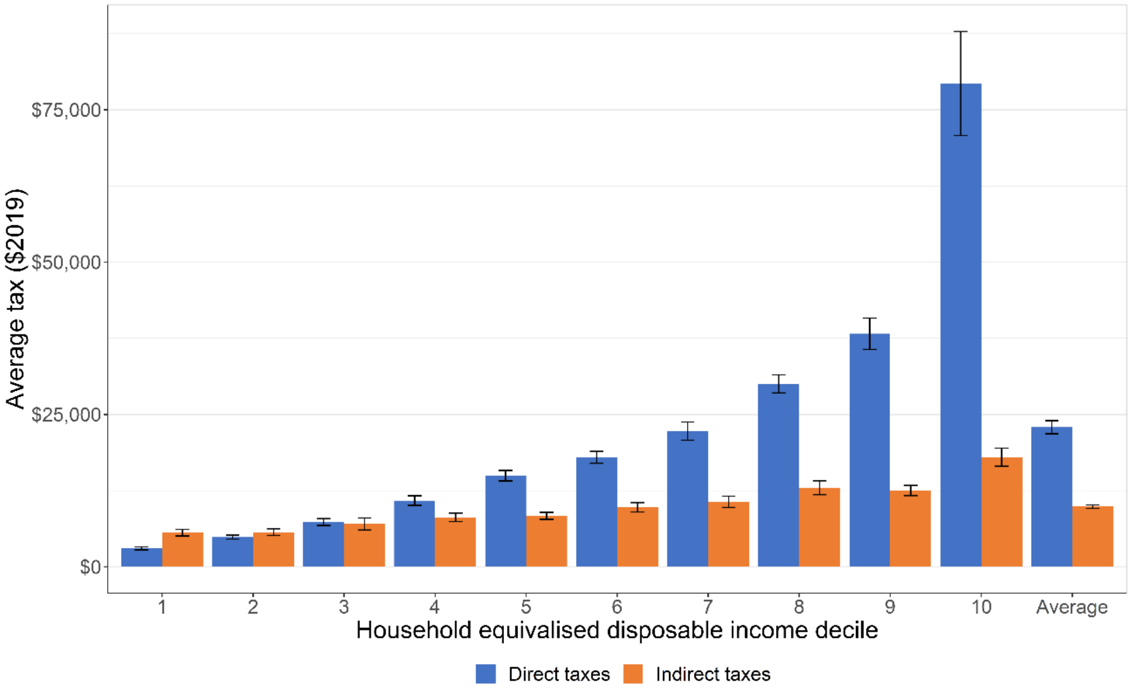


[11] The HEDIs of NZS recipient couples or singles with no other household members and no other sources of income would in fact fall in the first decile, given our choice of equivalisation scale and the income distribution observed in tax year 2018/19. However, the presence of other income sources and the adjustments made to taxes and benefits to match fiscal totals raise the HEDI of such households into the second decile in most cases.

Taxes

Next, we examine the distribution of direct and indirect taxes across HEDI deciles, which we show in Figure 5. We observe that the total amount of direct taxes collected in New Zealand is significantly higher than that of indirect taxes, with averages over all households of $22,910 ± 1,080 and $9,880 ± 290, respectively. The distribution of direct taxes is heavily skewed towards higher-income households, which is expected owing to the progressive structure of the personal income tax schedule. By contrast, indirect taxes are more evenly distributed across the population. We note that the increase of average indirect taxes with increasing HEDI decile is significantly slower than that of average disposable income (Figure 2), suggesting that indirect taxes have a regressive character[12]. We discuss the effects of indirect taxes on measures of income inequality in a later section of this note.

Figure 5: Distribution of direct and indirect taxes over household income deciles

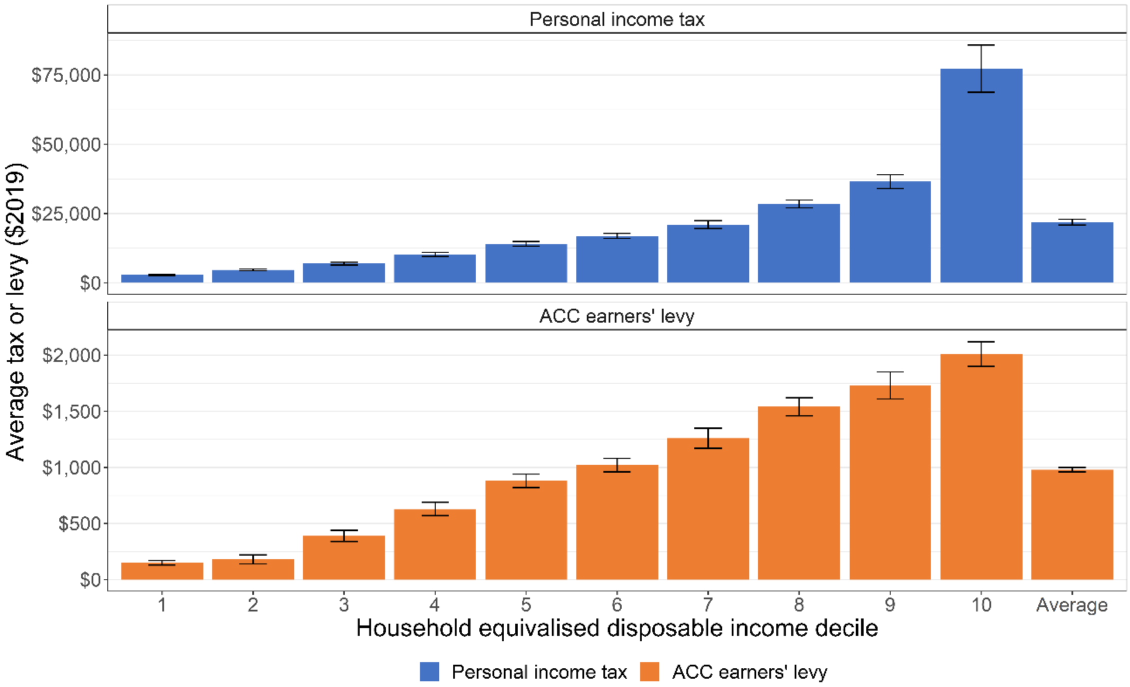


We take a more detailed look at the distribution of the components of direct and indirect taxes across household income deciles in Figures 6 and 7, respectively. From Figure 6 we see that personal income tax is the largest contributor to direct taxes across all deciles and for the total population of households. We note that the distribution of the ACC earners' levy is more uniform than that of personal income tax. This is easily understood as, in contrast to the progressive scale of personal income tax, the ACC earners' levy is applied at a flat rate of 1.39% on incomes up to $126,286 in tax year 2018/19[13]. The step increase in average ACC earners' levy charges between the second and third deciles reflects the fact that the levy is only charged on earned income, and not on the income support payments that constitute a far larger component of average household incomes in the first two deciles.

[12] Note, however, that in our analysis we consider consumption taxes in a single year, and that the distributional impacts of these taxes can be significantly different when analysed on longer timeframes, as discussed by, eg, Ching (2023), Ching, Reid, and Symes (2023), and references therein.

[13] https://www.ird.govt.nz/income-tax/income-tax-for-individuals/acc-clients-and-carers/acc-earners-levy-rates

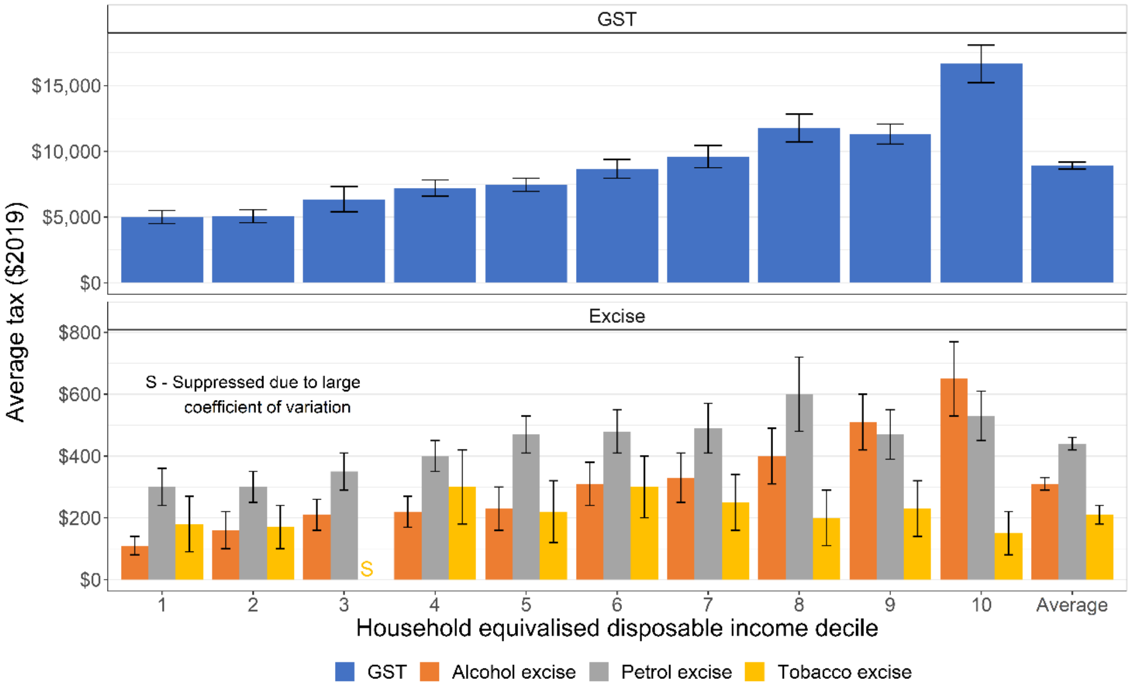
Figure 6: Distribution of components of direct taxes over household income deciles



In Figure 7 we show the distributions of indirect taxes over HEDI deciles. We see that goods and services tax (GST) is the primary contributor to indirect taxes, with average amounts broadly increasing with increasing decile. In the bottom panel we show the average amounts for the three excises we consider – alcohol, petrol[14], and tobacco. We observe that average alcohol excise amounts increase reasonably steadily with increasing HEDI decile, whereas the other two excises included in our analysis do not exhibit such a clear trend.

[14] Diesel and other fuel types are not included in our analysis as the corresponding excises are obtained via road user charges rather than being charged at the point of sale as in the case of petrol.

Figure 7: Distribution of components of indirect taxes over household income deciles

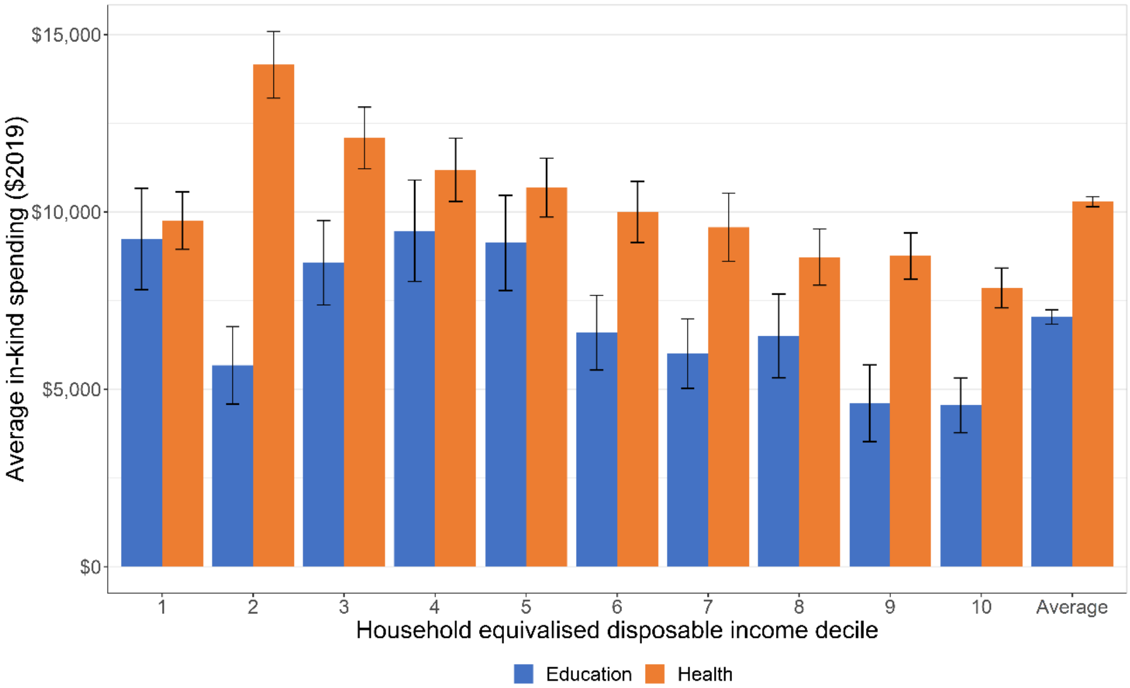


In-kind benefits

In Figure 8, we show the distributions of average spending on the two categories of in-kind benefits included in our analysis – education and health – across HEDI deciles. Our methodology for allocating this spending to households is described in the Annex. We see that average health spending is largest in the second decile, which is a consequence of the large proportion of senior citizens – who in the PBFF model are assigned higher cost weights due to their ages – in this decile, and thereafter declines reasonably steadily with increasing HEDI decile. The lower average health spending in the first decile appears to be due to a smaller population of NZS recipients, and smaller average household sizes, in this decile as compared, eg, to the third decile.

Average education spending exhibits a broad decline with increasing HEDI decile, with the exception of a significant dip in the second decile. We attribute this dip to the large proportion of NZS recipients here, which implies a smaller population of families with school-aged children and students (cf. the results for WfF shown in Figure 4).

Figure 8: Distribution of components of in-kind spending over household income deciles



Net fiscal impact

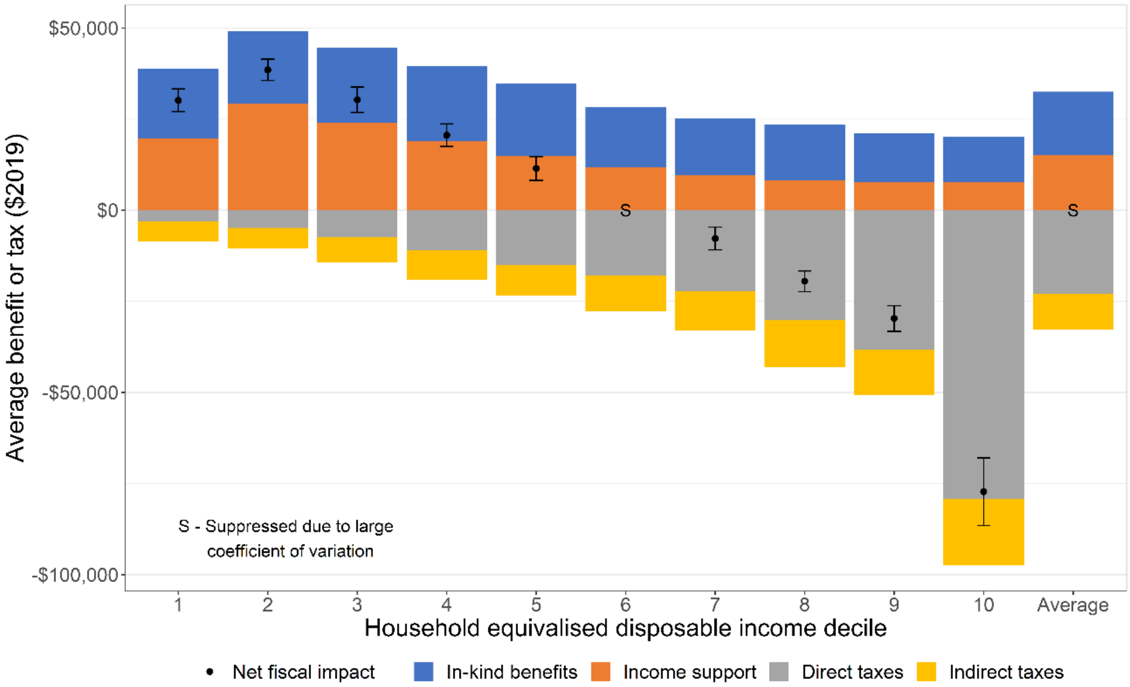
We now consider the net fiscal impact on household incomes resulting from income support payments, in-kind benefits, and taxes – ie, the difference between household market and final incomes. In Figure 9 we present the average net fiscal impact in each decile, with error bars representing the associated sampling errors, together with the distribution of the four classes of taxes and benefit spending (cf. Figure 1) across income deciles as bars above and below the *x* axis[15]. We see that the positive contributions of average income support and average in-kind benefit payments are relatively evenly distributed across income deciles as compared to the average taxes deducted from household incomes, which are significantly skewed to the higher deciles. Although the estimate of the average net fiscal impact over all households is suppressed due to its sampling error being more than half of the point estimate, it is clear from Figure 9 that the taxes and benefits included in our analysis almost exactly balance out across the population. As we discuss in the Annex, the taxation and spending categories we include in our analysis correspond to 66% of core Crown tax revenue and 68% of core Crown expenditure[16].

[15] In general the deciles in Figure 9 include households with members of varying ages. An analysis of net fiscal impact across the life cycle, based on the cross-sectional data provided by HES, is presented in Aziz *et al.* (2016).

[16] We also briefly discuss the revenue and expenditure categories not included in our analysis in the Annex.

Deciles one to five show positive values of average net fiscal impact whereas the highest four deciles show negative values. The average net fiscal impact takes its largest positive value in decile two and decreases smoothly with increasing HEDI decile, reaching its largest negative value in decile ten. The average net fiscal impact in the sixth decile is suppressed due to its large sampling error. We see from Figure 9 that the smaller value of the average net fiscal impact in decile one as compared to that in decile two is primarily due to the larger average income support in the second decile, which is associated with the large NZS recipient population in this decile (see Figure 4)[17].

Figure 9: Distribution of net fiscal impact over household income deciles



Income inequality

A widely used summary measure of income inequality is provided by the Gini coefficient. In this note we report Gini coefficients scaled by a factor of one hundred. In Figure 10, we show the Gini coefficients, along with their associated sampling errors, for each of the five household income definitions (see Figure 1). For each income definition we equivalise the income of each household[18], assign the equivalised value to each individual in the household, and calculate the Gini coefficient of the resulting distribution of incomes over individuals in the HES sample.

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[17] Note that although the average in-kind spending in decile 2 is comparable to that in decile 1, its composition in terms of education and health components is quite different.

[18] Household income equivalisation scales such as the mOECD scale that we use are intended to account for sharing of disposable incomes, and their applicability to, eg, final incomes is a delicate question (see, eg, Crawford and Johnston, 2004 and references therein). Here we follow Hérault and Jenkins (2022) in applying the same equivalisation scale to all income definitions for the purposes of comparing inequality measures between these definitions.

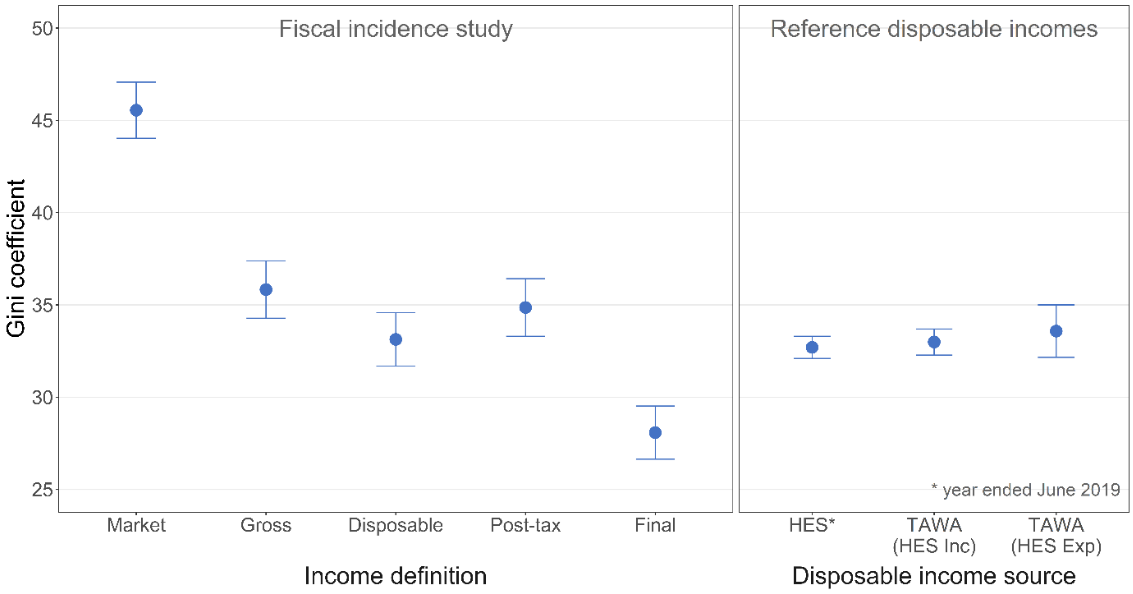
We see from Figure 10 that including income support benefits in the calculation results in the lowering of the Gini coefficient from its value of 45.6 ± 1.5 for market incomes to 35.8 ± 1.6 for gross incomes. The inclusion of direct taxes to form disposable incomes further reduces the Gini coefficient to 33.1 ± 1.5. The equalising effects of these contributions are partially offset by the inclusion of indirect taxes, which lead to a post-tax income Gini coefficient of 34.9 ± 1.6 – ie, whereas direct taxes reduce income inequality as quantified by the Gini coefficient, indirect taxes increase it. However, the inclusion of in-kind benefits in the final household income calculation has a significant redistributive impact, resulting in a drop in the Gini coefficient to 28.1 ± 1.4. We refer the reader to the Annex for further discussion of the redistributive effect – ie, the reduction (or increase) in Gini coefficient – associated with each of the four classes of taxes and benefit spending, and the decomposition (Jenkins, 1988) of each of these redistributive effects into measures of the magnitudes and progressivity of the corresponding tax and benefit classes. We note that Crawford and Johnston (2004) and Aziz *et al.* (2012) reported Gini coefficients calculated from unequivalised incomes. In the Annex we compare Gini coefficients calculated from the household incomes we find in our analysis with those obtained from these previous studies, on a common unequivalised basis.

On the right-hand side of Figure 10 we present three Gini coefficients, each corresponding to a different HES-based disposable income distribution, for comparison to the values that we estimate in our analysis. Specifically, we show the disposable income Gini coefficient estimated by Stats NZ using the 2018/19 HES income survey and the Gini coefficients of the disposable incomes calculated using the TAWA model with the 2018/19 HES income and expenditure samples as inputs. Each of these Gini coefficients is calculated from mOECD equivalised household incomes assigned to individuals in the same manner as our estimates shown on the left-hand side of Figure 10. In contrast to our results, however, no scaling of tax and benefit amounts to match fiscal totals is performed in the calculation of these reference Gini coefficients.

We observe that the disposable income Gini coefficient for TAWA operating on the HES income sample is marginally higher than that obtained by Stats NZ, with a somewhat larger sampling error[19]. The sampling error on the corresponding Gini coefficient for disposable income calculated by TAWA from the HES expenditure sample is larger still, reflecting the smaller sample size in this case. We note that the value of 33.6 ± 1.4 we find for this Gini coefficient is somewhat larger than that of the Gini coefficient for disposable income in our analysis, indicating that our scaling of components to match fiscal totals results in a slightly less unequal disposable income distribution.

[19] This increase in sampling error may be in part due to variance inflation resulting from the survey sample reweighting performed in the TAWA data preparation process.

Figure 10: Gini coefficients



A visual representation of inequality across the entire income distribution is provided by the Lorenz curve, from which the Gini coefficient can be obtained as twice the area enclosed between the curve and the diagonal line of perfect equality. Comparing Lorenz curves for different income definitions may in general reveal, eg, decreases in inequality in one part of the income distribution that are offset by increases in inequality in another part when inequality levels are summarised in terms of Gini coefficients. In Figure 11 we show the Lorenz curves estimated for each of the five income definitions. As in the case of the Gini coefficients shown in Figure 10, these curves all correspond to equivalised household incomes attributed to individual household members.

The behaviour of the Lorenz curves in Figure 11 is consistent with that of the Gini coefficients in Figure 10. The Lorenz curve for market income sits furthest from the diagonal line of income equality[20] and each successive addition of tax and benefit components moves the Lorenz curve closer to this line, with the exception of indirect taxes, which push it further away, illustrating the disequalising effect of this component[21,22]. We note that, aside from the significant change in the Lorenz curve that occurs in going from market to gross income, all the shifts that the Lorenz curve undergoes upon the inclusion of additional tax and benefit components are broadly uniform, except perhaps in the edges of the distribution where the curves are harder to distinguish.

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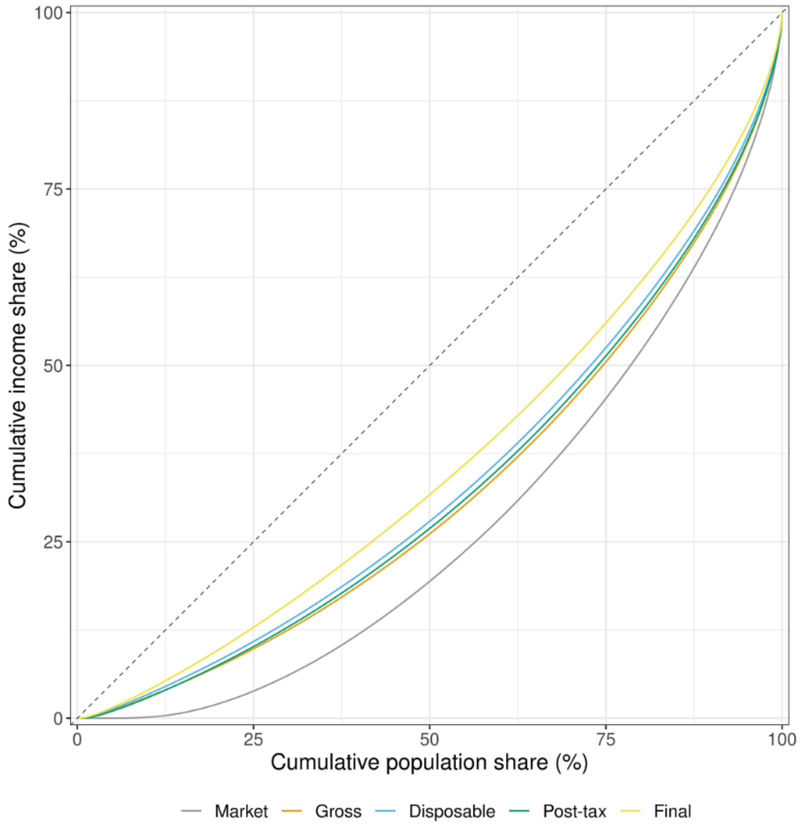
[20] In constructing all Lorenz curves and other inequality measures, we set any negative incomes – due to self-employment losses – to zero.

[21] Note that as our analysis is based on HES, it does not cover very high income (or wealth) households (cf. Inland Revenue, 2023) and cannot provide any information on the contribution of these households to the overall equalising or disequalising effect of indirect taxes.

[22] We refer the reader to the Annex for a brief discussion of the impacts of details of the HES expenditure survey methodology on the Lorenz curves for post-tax and final incomes shown here.

Figure 11: Lorenz curves

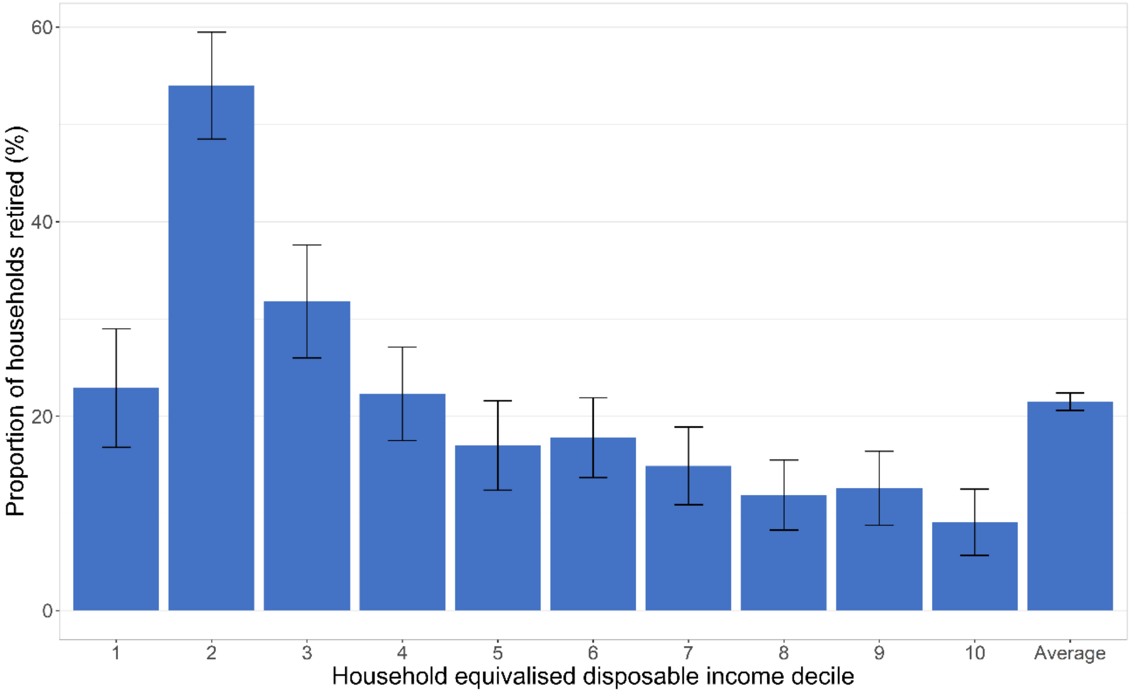


Retired and non-retired households

We have seen in the previous sections of this note that NZS is a substantial component of net fiscal impact that is spread across all ten income deciles. We note that the projected future costs of NZS and the associated fiscal impacts are key elements of the Treasury's long-term fiscal modelling (The Treasury, 2021; Bell, 2021), while differences in material standards of living between age groups have also been discussed in recent work by the Treasury (The Treasury, 2022b). In this section we consider a separation of households into retired and non-retired groups, and separately estimate the net fiscal impact on each of these groups. We take an approach that broadly follows that of the Office for National Statistics (2019b) and identify a household as retired if 50% or more of the gross income of the household is accounted for by household members that reported being retired in HES. We classify the remaining households that do not meet this criterion as non-retired, although we stress that many of these households contain retired individuals.

Figure 12 illustrates the way in which retired households are distributed across the deciles of HEDI. Consistent with our results in the income support section, we see that the households that we classify as retired are concentrated in the second HEDI decile, though there are significant retired-household fractions in all deciles, including the tenth decile.

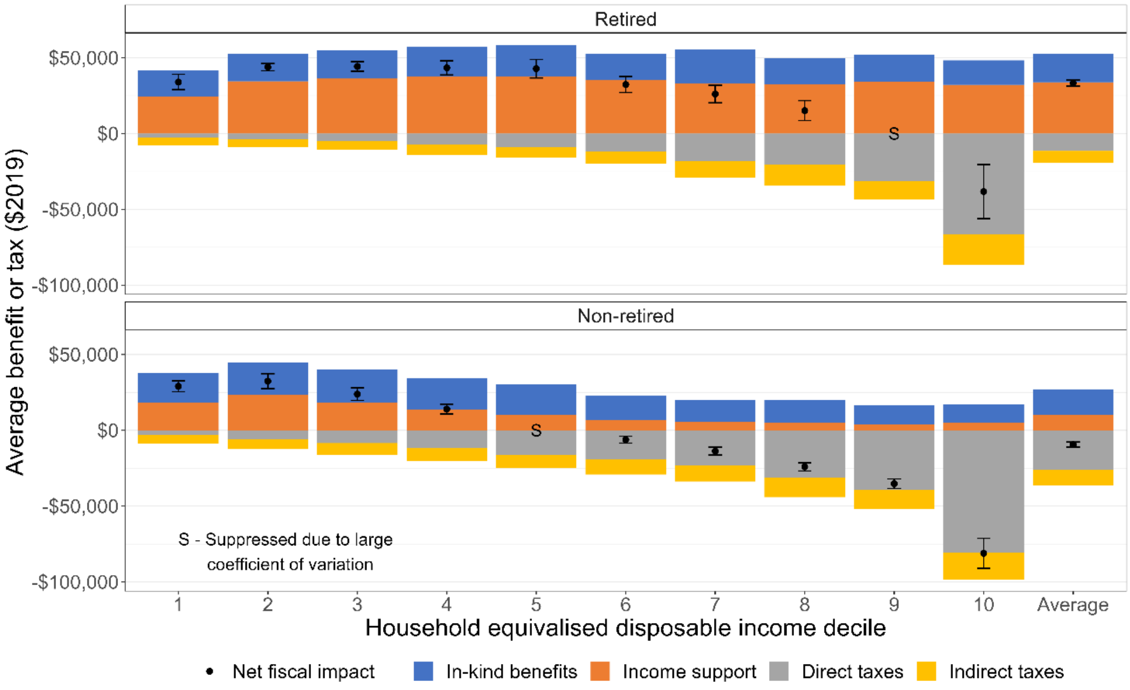
Figure 12: Distribution of retired households over household income deciles



In Figure 13 we show the average net fiscal impact and the four classes of taxes and benefits that contribute to it for the retired and non-retired household groups in each of the HEDI deciles. Interestingly, whereas the results for the full population of households (Figure 9) yielded a negative average net fiscal impact in the top four deciles, the analysis of retired households reveals a positive net fiscal impact for all deciles except the ninth (for which the estimate is suppressed due to its large relative sampling error) and tenth, and indeed for the retired-household population on average. This positive fiscal impact is largely due to the significant income support (NZS) received by retired households, which (outside the top two deciles) outweighs their typically lower tax contributions, as compared to other households.

The distribution of average net fiscal impact for non-retired households shown in Figure 13 is comparable to that shown for all households in Figure 9. We note, however, that whereas the estimates of the fiscal impact on average over all households and in the sixth decile were suppressed in Figure 9 due to their proximity to zero relative to the scale of their sampling errors, the corresponding estimates for non-retired households can be seen to be negative, while the estimate in the fifth decile is suppressed.

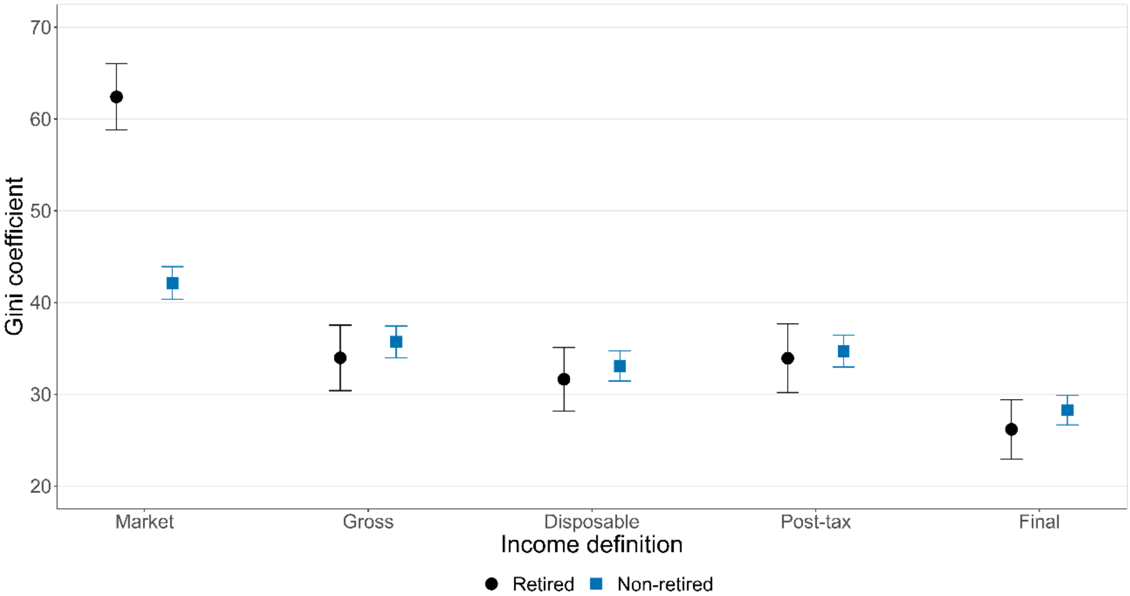
Figure 13: Distribution of net fiscal impact over household income deciles for retired and non-retired households



In Figure 14 we show the Gini coefficients for the five measures of household income for both retired and non-retired households[23]. The Gini coefficients found for non-retired households are close to those obtained for all households (Figure 10). We note that the Gini coefficient for retired-household market incomes is much larger than the corresponding coefficient for non-retired households and that for the full population of households. This high inequality of market incomes for retired households is easily understood when we consider that many retired households will rely on NZS as their primary source of income and receive comparatively little income from market sources. Market income amounts in the retired population will therefore be highly concentrated on those households that continue to derive significant market incomes after retirement. The other retired-household Gini coefficients follow the same pattern as those for non-retired households (and indeed for all households), although the point estimates are marginally smaller in each case.

[23] These coefficients quantify the inequality within each group of households and are not sensitive to any inequality between the two groups.

Figure 14: Gini coefficients for retired and non-retired households



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Annex

HES and TAWA

To estimate consumption taxes and their incidence on households, we run TAWA on the 2018/19 HES expenditure survey. HES expenditure survey data is collected for a subset of the respondents to the full HES (income) survey, with interviews taking place over the period July 2018 to June 2019. In the 2018/19 year, the HES expenditure survey covers 9,987 individuals residing in 3,933 households, a subset of the HES income sample of 55,380 individuals in 21,156 households. Both samples are weighted to match the population totals of 4,834,000 individuals in 1,748,000 households. HES expenditure respondents are surveyed throughout the year and supply a diary of their expenditure over a seven-day period prior to the survey interview. Annual expenditures on recurring expenses (eg, utilities) are estimated based on the respondent's most recent payments. Annualised expenditure amounts are then used by Stats NZ to estimate, eg, the consumers price index.

All estimates in this note are produced by TAWA using the 2018/19 HES expenditure survey as an input, except where otherwise noted. TAWA combines income amounts reported by HES respondents together with those identified from linked administrative data, including income support payments[24], and produces results for tax (March-end) year 2018/19. To facilitate the calculation of disposable incomes, amounts that are not subject to personal income tax are isolated from those that are. We note that the category of private non-taxable income (see Table 1) includes sources of income such as maintenance and alimony payments, gifts from other households, and inheritances. The category of other non-taxable benefits contains Ministry of Social Development supplementary benefits other than those already included in other categories (such as Accommodation Supplement). Supplementary benefits include Disability Allowance, Child Disability Allowance, Temporary Additional Support, and Education and training assistance payments. Non-recoverable *ad hoc*/hardship assistance payments are also included in this category. We note that TAWA uses survey weights that are adjusted somewhat from the original HES weights. We calculate sampling errors using replicate weights that are constructed to match the same benchmarks as the TAWA weights.

Taxes and benefits not modelled by TAWA

We now provide details of the components of final income we include in our analysis, beyond those calculated by TAWA. In general, we assign tax and benefit amounts to individuals and households that exhibit certain characteristics in the HES data. These amounts are typically based on fiscal totals taken from, eg, Treasury Budget publications. We then scale the assigned amounts by uniform factors chosen so that in each case the survey-weighted estimate of the corresponding total fiscal revenue or expenditure matches some known (or estimated) total fiscal value. In most cases the fiscal totals used in either the initial assignment or the scaling step are only available for fiscal (June-end) years 2017/18 and 2018/19. We average these values with weights ¼ and ¾, respectively, to estimate values for the tax year 2018/19.

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24 We note that Stats NZ also augments HES responses in recent survey years (including 2018/19) with linked administrative data. However, TAWA's use of administrative data is independent of this process, with some methodological differences.

Income-related rent subsidy

The income-related rent subsidy (IRRS) provides subsidised housing rent to low-income families. Households receiving the IRRS are identified in HES by their responses to housing tenure questions. However, the TAWA model does not explicitly model IRRS, and so we assign values for this subsidy to the appropriate HES households in our analysis. Following Crawford and Johnston (2004) and Aziz *et al.* (2012), we include this subsidy as a component of income support, treating the value of the IRRS – the difference between the market rent for the household's domicile and the actual rent the household pays – as a cash transfer. To determine IRRS amounts, we estimate subsidy values for the households receiving IRRS from Kāinga Ora – Homes and Communities microdata within the IDI. From the March 2019 snapshot of IRRS-receiving households we calculate the average subsidy amounts for households with a given combination of household composition, geographic location (we use the four Accommodation Supplement regions for this purpose), and annual assessable income (in $1000 bands). We then perform some simple smoothing over the latter variable and assign the resulting amounts to the corresponding households in HES. From the HES expenditure survey, we identify 34,000 ± 7,000 (N=81), 28,000 ± 8,000 (N=81), and 8,000 ± 4,000 (N=27) IRRS households in Accommodation Supplement regions 1, 2, and 3 respectively, whereas the number of IRRS households in region 4 is suppressed due to its large coefficient of variation. We scale IRRS amounts allocated to households to match the total IRRS expenditure of $953 million in tax year 2018/19.

Indirect taxes

Indirect taxes are taxes on consumption and include both GST and excises charged on alcohol, petrol, and tobacco. We estimate these amounts from the HES expenditure survey data. Essentially all households in HES report some GST-chargeable expenses, and we assign a GST amount to each based on their reported expenditure. Expenses that are not subject to GST, such as rent, financial intermediation, and life insurance, are excluded from the expenditure totals used to calculate GST for each household. The portion of the remaining household expenditure that corresponds to the 15% GST rate is then identified as the total GST charge for the household. The GST amounts assigned to households are then scaled uniformly so that the population total matches 15% of the GST-chargeable New Zealand resident consumption, which is obtained from the NA. This national final consumption expenditure figure – which excludes rent, imputed rent, expenditure abroad, and other categories of expenditure on which GST is not charged – implies a total household GST revenue of $15,602 million in tax year 2018/19.

As there is not, in general, a single percentage excise rate that applies for any of the three excise categories we consider, we cannot calculate the excise component of expenditure on any of these categories as a percentage of that expenditure, as we do for GST. We follow Aziz *et al.* (2012) in distributing the total excise revenue for each of the excise categories over households in the survey that report such expenditure, in proportion to the expenditure that they report in that category. In total, the HES expenditure survey identifies 683,000 ± 30,000 (N=1,467), 949,000 ± 29,000 (N=2,037) and 199,000 ± 20,000 (N=408) households reporting expenditure on alcohol, petrol, and tobacco, respectively. Total fiscal revenues for these excises are taken from the NA, and the shares of national spending on these categories that are due to households (as opposed to industry) are estimated from the NA input-output tables for the 2019/20 tax year. The values of these estimated shares are 75% for alcohol and tobacco and 67% for petrol, and result in fiscal totals of $545 million, $765 million, and $370 million for alcohol, petrol, and tobacco excises, respectively.

It is important to note that the methodology by which the HES expenditure survey collects information on the expenditure of individual households introduces an additional form of sample variability. For example, a household that purchases petrol every second week may appear in the survey as one with either zero annual petrol expenditure or twice its actual annual petrol expenditure, depending on when the household's survey interview occurs. Our estimates of Lorenz and concentration curves involving indirect taxes will therefore exhibit spurious variations on a scale corresponding to some small number of households. We have not investigated this variability in detail but note that on general principles it should be represented in the sampling errors we estimate for Gini coefficients and related quantities.

Health spending

We follow Aziz *et al.* (2012) in allocating health spending across individuals in the HES expenditure survey in proportions determined by the PBFF model (Ministry of Health, 2016). The PBFF model assigns a cost weight to all individuals in the New Zealand population, based on their age (in five-year bands), gender, ethnicity (Māori, Pacific, or other[25]), and the deprivation (NZDep) quintile of the area where the individual's household is located. This model was used by MoH to estimate the allocation of health spending to each of the District Health Boards (DHBs)[26]. We interpret the cost weight attached to an individual as representing the share of health spending that the individual receives, in expectation[27]. We therefore assign the appropriate PBFF cost weight to each individual in HES, which corresponds to distributing the total PBFF model service budget of $10,591 million across the population. For our analysis, these individual cost weights are then scaled so that the total health expenditure across the population that we model matches the total health spend of $17,991 million in tax year 2018/19.

Education spending

We consider four components of education spending: the subsidisation of early childhood education (ECE), funding of school-aged child placements, tertiary student funding, and student loans. We note that whereas Aziz *et al.* (2012) included the student allowance in in-kind education spending, we classify it as an income-support benefit, due to its nature as a payment from which personal income tax is deducted at source (cf. Figure 1).

From the HES expenditure survey, we identify a population of 173,000 ± 13,000 (N=387) children aged below five and attending ECE based on their survey responses. We assign $8,513 per year, the average subsidy per full-time equivalent ECE place (1000 funded hours per year), to each of these children, and then scale these values to match the total ECE expenditure of $1,883 million during the 2018/19 tax year.

We allocate school-aged education funding for all children aged 5–14, and those children aged 15–17 with a survey response indicating (main institution) enrolment in secondary education. In total, there are 809,000 ± 30,000 (N=1,794) such students represented in the HES expenditure survey. To each of these students we assign the average school

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25 The ethnicity variable in HES allows respondents to select multiple ethnicities. We regard any individual reporting Māori ethnicity as Māori for the purposes of allocating PBFF costs. Of the remaining individuals, we regard any reporting Pacific ethnicity as Pacific while we classify the rest as other.

26 The DHBs were formally abolished on 1 July 2022 and replaced with the national health agency Te Whatu Ora – Health New Zealand.

27 The health costs we assign to individuals therefore effectively correspond to a group risk-related insurance premium, as noted by Crawford and Johnston (2004).

operational and salary funding for children of their age, which were sourced from Ministry of Education (MoE) data. For simplicity we treat children aged 5–12 as attending primary school, and children aged 13+ as secondary school students. We then scale education spending values for primary and secondary school students to match the total primary and secondary school Crown expenditure in tax year 2018/19, respectively. In addition to operational and salaries funding, we also allocate shares of other costs, such as school transport, special needs support, and professional development, to primary and secondary schools in proportion to the primary and secondary school placement numbers, which were obtained from Treasury Budget reporting (The Treasury, 2022a). This results in totals of $3,884 million and $2,817 million for primary and secondary school funding, respectively.

We allocate tertiary education funding to individuals aged over 15 who reported attendance at a tertiary education institution in HES. This results in a total of 279,000 ± 26,000 (N=516) such students. To each of these students we allocate the average tuition and other tertiary funding per equivalent full-time student, which takes a value of $14,370 in the 2018/19 tax year. These individual values are then scaled so that the population totals match the total tertiary tuition and other tertiary funding of $3,161 million for tax year 2018/19.

Our estimates of student loan expenditure are based on the fair-value write-down on student loans. This write-down is estimated by MoE and represents the expected loss to the government associated with new student loan borrowing, due both to the discounting of future repayments made on the debt, and the risk of (partial) non-repayment. On this basis, the 2018/19 Student Loan Scheme Annual Report (Ministry of Education, 2019) estimates the annual cost of student loans as $571 million. When assigning this amount to students in the HES expenditure sample population, we follow Aziz *et al.* (2012) in distinguishing two components of student loan borrowing: course costs (which includes both course fees and borrowing for course-related costs) and living costs. We treat students receiving a student allowance as not receiving any living costs component of student loans, and therefore distribute this component (34% of the total student loan spend) evenly over those students who did not receive a student allowance.
The remaining 66% of the student loan total corresponding to course funding is distributed evenly over all students.

Scaling to fiscal totals

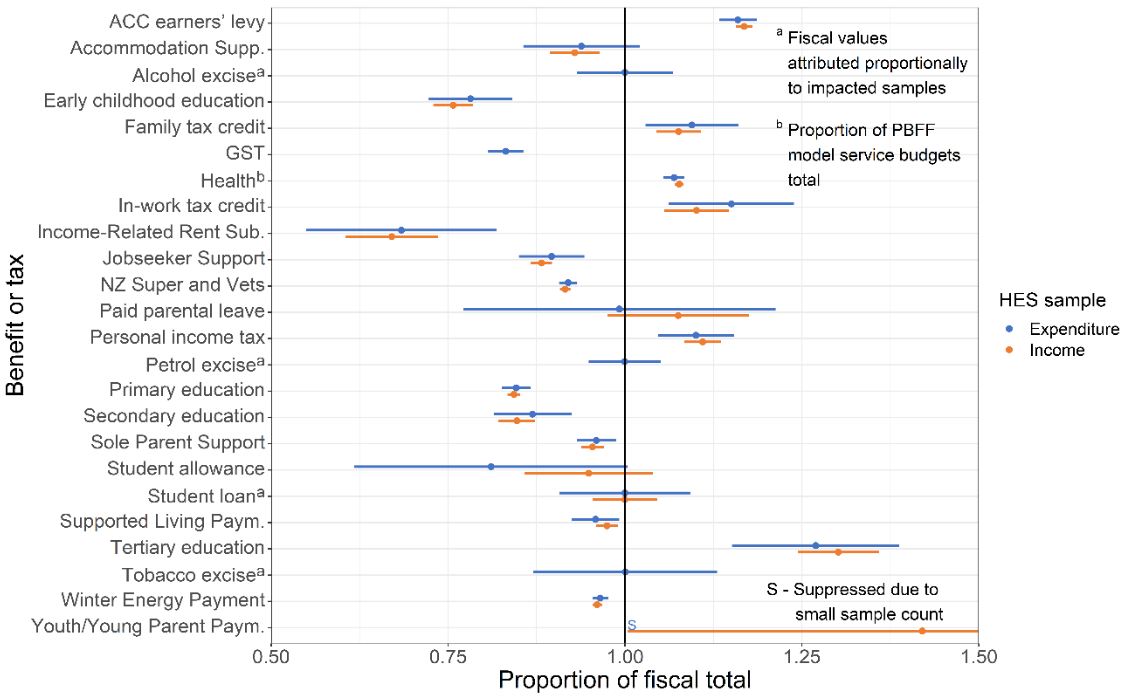
In general, we scale each tax and benefit amount assigned to individuals and households in the HES expenditure survey so that the aggregate value for the New Zealand population estimated from this survey sample matches an appropriate fiscal total. We apply such a scaling both to the taxes and benefits calculated by TAWA and the components listed in the previous section. In most cases these fiscal totals are sourced from Treasury Budget publications but some are taken from more detailed Crown financial data sources. The extent of this scaling for each component is indicated by Figure 15, in which the aggregate value of each component prior to scaling is shown as a proportion of the fiscal total to which it is scaled. Confidence intervals around each estimate indicate the absolute sampling error of the estimate and are also expressed as a proportion of the fiscal total. All estimates presented in the main sections of this note are based on the HES expenditure survey, but in Figure 15 we also show, where applicable, the corresponding estimates obtained when using the HES income survey as an input to TAWA. We note that the estimates based on the income survey are typically close to those from the expenditure survey, with smaller sampling errors, reflecting the larger size of this survey sample.

As excises are estimated by distributing total excise revenues across households in proportion to their expenditure on excise-attracting items, the aggregate totals of the excise amounts assigned to HES households are 100% of the fiscal totals in our modelling by construction. Similarly, as we distribute the total cost of student loans over all tertiary students in the HES sample, the aggregate student loan expenditure based on this sample trivially agrees with the fiscal total. The cost weights of the PBFF model that we use to determine the proportions in which health expenditure is distributed across the HES sample themselves represent a share of the PBFF model total DHB expenditure, rather than the total expenditure on the health system. In Figure 15 we therefore show the aggregate total of the PBFF cost weights over the HES sample as a fraction of the total DHB expenditure estimated by the PBFF model. We then scale the cost weights so that their survey-weighted total matches total Crown health expenditure before using them in our analysis.

There are two components of income support modelled by TAWA for which the unscaled total value differs significantly from the fiscal total: the minimum family tax credit (MFTC) and the Best Start tax credit (BSTC). The accuracy of modelling of MFTC is limited by the small number of people that receive it in the population, and indeed this small sample size leads to its estimate in the expenditure sample being suppressed due to the large sampling error associated with it. We stress, however, that the contributions of this tax credit to WfF payments, income support, and all subsequently derived quantities are included in our analysis. The unscaled values of MFTC as calculated from the HES income survey by TAWA come to a total of $22 ± 6 million, which should be compared to the fiscal total of $13.4 million for this tax credit in the 2018/19 tax year.

As BSTC was introduced to replace the parental tax credit (PTC) part way through tax year 2018/19, we include expenditure on PTC in the fiscal total to which we scale BSTC, resulting in a total of $48.6 million. Unscaled estimates of BSTC totals are $154 ± 25 million and $156 ± 12 million from TAWA operating on the HES expenditure and HES income surveys, respectively, more than three times larger than the fiscal total. This discrepancy presumably arises from the sensitivity of BSTC to the precise ages of children in the transitional 2018/19 tax year, whereas in its current operation TAWA references only the child's age at the time of the HES interview, which may have occurred at any time in the year from July 2018 to June 2019. The estimate for the total Youth Payment and Young Parent Payment amount from TAWA run on the HES expenditure survey is suppressed due to its small sample size. Although the total for these payments that TAWA derives from the HES income survey is not suppressed, the upper limit of the confidence interval around this estimate is 1.84 times the fiscal total and falls outside the scale of Figure 15.

Figure 15: Benefit and tax totals from the TAWA/HES sample – proportions of fiscal totals



The functional classifications of Social security and welfare, Health, and Education constitute 32.9%, 21.1%, and 16.5% of core Crown expenses in tax year 2018/19, respectively (The Treasury, 2022a). In our analysis we assign 89.0% of Social security and welfare expenditure, 91.2% of Education expenditure, and 100% of Health expenditure to households. We do not allocate expenditure amounts for other functional classifications. The largest of these excluded classifications are Core government services (5.9%), Law and order (5.3%), Finance costs (4.3%), Economic and industrial services (3.4%), Transport and communications (3.3%), and Defence (2.8%). In general the remaining $29.6 billion of expenditure cannot be directly associated with households in the same manner as we allocate, eg, health spending, though we note that assigning this spending equally to all households would increase the average net fiscal impact in each decile by $16,900. We do not attempt to attribute any of the remaining $29.3 billion of core Crown tax revenue (eg, corporate taxes or taxes paid by trusts) to HES households and note that to the extent that a portion of this tax revenue could be associated with households its incidence on them would be highly uneven.

Household income equivalisation and income deciles

In this note we focus on the distributions of taxes, income support payments, and in-kind benefits over levels of household income. To do so we show distributions of these quantities over deciles of HEDI. Income equivalisation aims to account for income sharing and economies of scale in households. We use the mOECD equivalisation scale (Hagenaars *et al.*, 1994), in which the first adult (aged 14 or over) member of the household is given weight 1, each subsequent adult is given weight 0.5, and children (aged under 14) are given weight 0.3. The total of these weights for a household is its equivalisation factor and dividing the household's total disposable income by this factor yields its equivalised disposable income.

The HEDI deciles are defined so that they contain (approximately) equal numbers of households. Estimates of the decile boundaries – ie, the maximum HEDI included in each decile except the tenth – are shown in Table 2 together with the sampling errors on these estimates. We note that in general the deciles are not evenly spaced. The spacing between neighbouring decile boundary estimates increases as we go from lower to higher deciles (as do the associated sampling errors), reflecting the right-skewed nature of the income distribution.

Table 2: Household equivalised disposable income decile boundaries

HEDI decile	Maximum HEDI ($)	Sampling error ($)
1	24,300	400
2	27,500	500
3	32,600	900
4	38,300	1,000
5	44,700	1,100
6	52,200	1,300
7	61,200	1,300
8	72,300	2,000
9	93,800	4,100

Redistribution and progressivity

We now discuss the progressivity of direct and indirect taxes, income support payments, and in-kind benefits. Consider a "pre-fisc" income Y_{pre} from which a tax is deducted, yielding a "post-fisc" income Y_{post}, and the Gini coefficients G_{pre} and G_{post} that quantify the inequality of the distributions of Y_{pre} and Y_{post}, respectively. The redistributive effect RE resulting from the application of the tax can be expressed as (Jenkins, 1988)[28]

$$RE = G_{pre} - G_{post} = \frac{t}{1-t} K + D,$$

where t is the average rate of the tax, K is the Kakwani progressivity index (Kakwani, 1977), and the reranking index D is a measure of the magnitude of re-ordering of incomes that results from applying the tax. The average tax rate t is simply the ratio of the population total of the tax $T = Y_{pre} - Y_{post}$ over the population total of Y_{pre}, whereas the quantities K and D depend on the way in which the tax T is distributed over individuals[29]. A similar expression for the redistributive effect arising from the payment of a benefit $E = Y_{post} - Y_{pre}$ is given by replacing $t/(1-t)$ with $e/(1+e)$, where e is the analogously defined average benefit expenditure rate.

[28] See Hérault and Jenkins (2022) for a recent application of this decomposition to household income data from the United Kingdom collected over the period 1977-2018.

[29] In this section, as in our discussion of Gini coefficients in the main text, we assign equivalised household incomes to all household members, and analyse the resulting distributions of incomes over individuals.

The quantities K and D can be expressed in terms of cumulative shares of incomes and taxes (or benefits) that are similar to the expression of the Gini coefficient of an income distribution in terms of the corresponding Lorenz curve. Ordering individuals by increasing values of Y_{pre}, the concentration curve of Y_{post} with respect to Y_{pre} is the graph of the cumulative share of Y_{post} as a function of the cumulative share of individuals with respect to this ordering. The concentration curve of a tax T or benefit expenditure E with respect to Y_{pre} is also defined in the same way, whereas, eg, the concentration curve of Y_{pre} with respect to itself is simply the Lorenz curve for Y_{pre}. For each of the four classes of taxation and expenditure we consider, we show in Figure 16 the concentration curves of Y_{post} and T (or E) with respect to Y_{pre}, together with the Lorenz curve of Y_{pre}. In each case the progressivity index K is given by twice the area (shaded) between the Lorenz curve of Y_{pre} (grey) and the concentration curve of T (or E) with respect to Y_{pre} (blue)[30]. We also indicate in each panel of Figure 16 the concentration curve of Y_{post} with respect to Y_{pre} (yellow). On general principles this curve must everywhere sit on or above the Lorenz curve of Y_{post} (not shown), and the reranking index D is twice the area enclosed between these two curves.

We consider first the cases of income support payments (Figure 16(a)) and in-kind benefits (Figure 16(d)). In both instances the concentration curve of the respective benefit expenditure with respect to the pre-fisc income (market income in the case of income support payments and post-tax income in the case of in-kind benefits) exhibits a broad concavity opposite to that of the pre-fisc income Lorenz curve. This behaviour is easily understood in the case of income support payments as households with smaller market incomes tend to receive larger income support payments than those with larger market incomes. The fact that this same concavity is observed for in-kind benefits shows that households with lower (post-tax) incomes tend to receive more in-kind benefit expenditure than those with higher incomes (cf. Figure 8). However, the benefit concentration curve in Figure 16(d) is much closer to the diagonal line of perfect equality than that in Figure 16(a), indicating that in-kind benefits are more equally distributed than income support payments. Consequently, the progressivity index[31] reported in Table 3 for in-kind benefits is smaller than (indeed approximately half of) that for income support payments, resulting in in-kind benefits causing a smaller redistributive effect than income support payments, even though the average rate[32] of the former benefits is around 50% larger than that of the latter.

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[30] We follow the convention that the area enclosed between the concentration curve for a benefit and the corresponding pre-fisc Lorenz curve is considered positive when the enclosed area sits above the pre-fisc Lorenz curve. This is opposite to the standard convention for a tax, in which case an area below the pre-fisc Lorenz curve is considered positive.

[31] We present our estimates of redistributive effect, progressivity index, and reranking index in the same units as those for Gini coefficients (ie, values are scaled by a factor of one hundred).

[32] We note that as we analyse equivalised household incomes assigned to all household members, the average tax and benefit rates we estimate here do not correspond directly to unequivalised tax or benefit amounts. In particular, the average tax rates we find are not comparable to those reported by Ching (2023) and Ching, Reid, and Symes (2023).

We now turn our attention to the cases of direct taxes (Figure 16(b)) and indirect taxes (Figure 16(c)). The concentration curve of direct taxes sits below the gross income Lorenz curve. This indicates that the cumulative share of direct taxes paid initially (ie, at the lowest gross incomes) grows more slowly than the cumulative share of gross income as households are successively included in the two cumulative totals, whereas at the highest incomes the cumulative share of direct taxes paid grows more rapidly than that of gross income. This is the behaviour expected for a progressive tax schedule such as that of personal income tax[33]. By contrast, the concentration curve of indirect taxes shows the opposite behaviour, sitting above the Lorenz curve for disposable income. On the annual basis on which we analyse them, indirect taxes therefore exhibit a regressive character, which manifests in the progressivity index (Table 3) taking a negative value for this tax component and results in the negative redistributive effect – ie, the increase in Gini coefficient associated with the inclusion of indirect taxes – observed in Figure 10.

In Table 3 we also report the reranking indices associated with the four classes of taxes and benefits. The reranking index for direct taxes is significantly smaller than all others. This result is perhaps to be expected as, eg, the application of the personal income tax scale would not induce any reranking of the incomes of individuals, were all components of gross income subject to this tax. Any reranking due to direct taxes in our analysis must therefore arise from the presence of non-taxable components of gross income, and the aggregation of the incomes of individuals into (equivalised) household incomes. By contrast, although the amounts of income support or in-kind benefits received by a household and the indirect taxes paid by it may be correlated with the appropriate pre-fisc income in each case, they are not almost directly determined by it in the same way that direct taxes are[34].

[33] For comparison, a flat income tax – one charged at a single rate irrespective of gross income – would have a concentration curve coincident with the pre-fisc Lorenz curve.

[34] We note that some component of the reranking index we find for indirect taxes (and that for in-kind benefits) is presumably due to the additional variability in estimates of these taxes associated with methodological details of the HES expenditure survey that we discuss elsewhere in this Annex.

Figure 16: Concentration curves and progressivity index construction

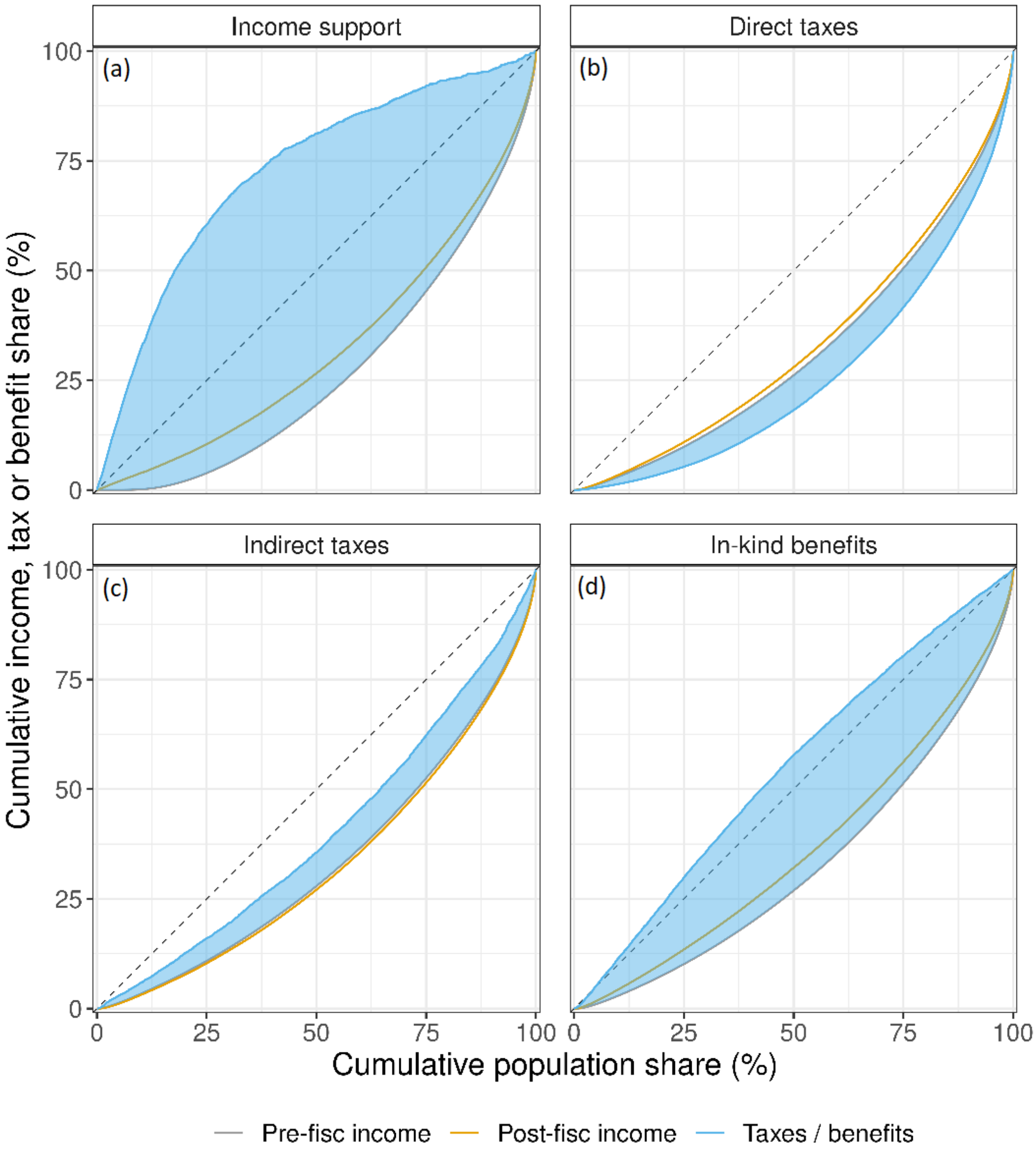


Table 3: Redistributive measures

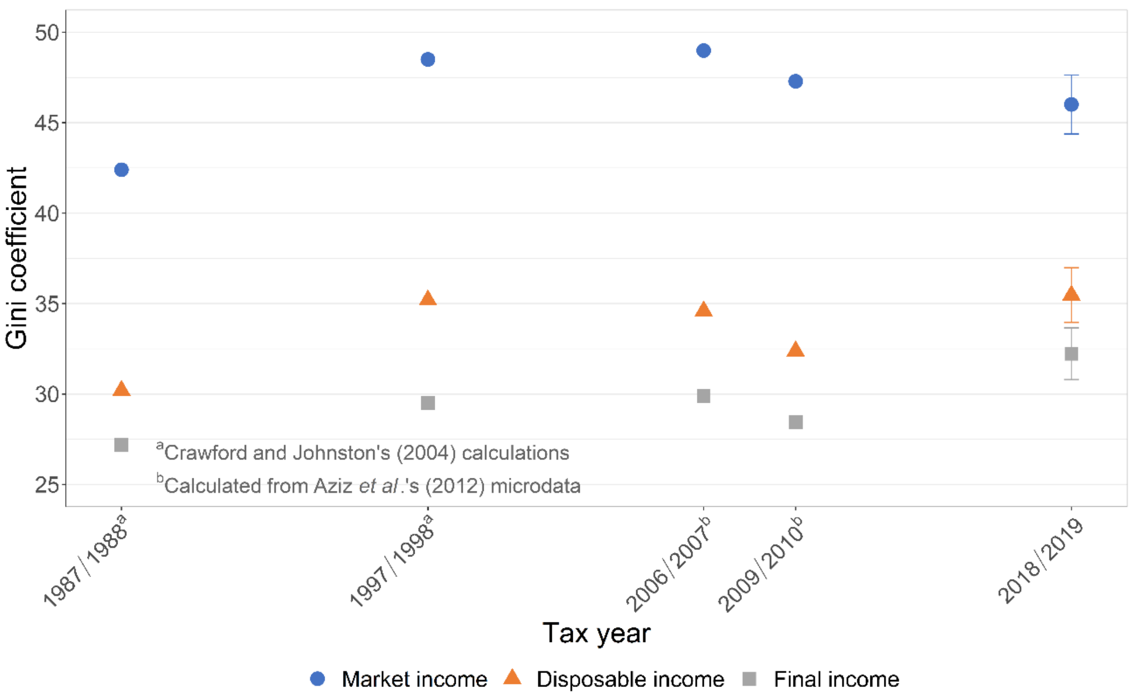
Tax or benefit	Redistributive effect	Kakwani progressivity index	Average rate (%)	Reranking index
Income support	9.73 ± 0.44	90.72 ± 2.44	13.14 ± 0.61	0.81 ± 0.064
Direct taxes	2.69 ± 0.24	11.99 ± 0.81	18.75 ± 0.38	0.08 ± 0.006
Indirect taxes	-1.73 ± 0.21	-13.30 ± 1.85	9.78 ± 0.28	0.29 ± 0.054
In-kind benefits	6.78 ± 0.29	43.95 ± 1.95	20.21 ± 0.79	0.61 ± 0.049

Gini coefficients – comparison to results of previous studies

In this section we compare the inequality of household market, disposable, and final incomes in our study to the results of the previous studies of Crawford and Johnston (2004) and Aziz *et al.* (2012). For each of the three primary definitions of household income, Crawford and Johnston (2004) assigned the unequivalised income of each household to each household member and reported the Gini coefficient of the resulting income distribution of individuals. However, Aziz *et al*. (2012) reported Gini coefficients calculated directly from unequivalised household incomes, without attributing these household incomes to individual household members. We recalculated Gini coefficients for the 2006/07 and 2009/10 tax years from the microdata produced by Aziz *et al.* (2012) on the same basis as those calculated by Crawford and Johnston (2004). These are shown together with the estimates of Crawford and Johnston (2004) and the estimates we obtain, on the same basis, for tax year 2018/19 in Figure 17.

We observe a drop in market income inequality from 2009/10 to 2018/19 but note that the point estimate for 2009/10 sits within the confidence interval for the 2018/19 Gini coefficient. We also note that the Gini coefficients for both disposable and final income in 2018/19 are larger than those in all previous years shown. We caution, however, that there have been significant methodological revisions to the microsimulation modelling underlying our analysis since the publication of Aziz *et al.* (2012) and that firm conclusions about trends in final income inequality cannot be drawn without reanalysing earlier years on a basis consistent with the present study.

Figure 17: Comparison of Gini coefficients for unequivalised incomes to results of previous studies



Future improvements

There are several potential avenues for improvement of the methodology for future fiscal incidence studies at the Treasury. Household incomes are estimated using the TAWA model, which heavily utilizes administrative data within Stats NZ's IDI environment to comprehensively represent market incomes and model components of the income support and direct tax system. The TAWA model is undergoing continuous improvement to increase the accuracy of its modelling of the existing tax and transfer system and its projections of future income distributions both in the *status quo* and under potential policy reforms. Some components of the system, such as BSTC, are known weaknesses of the model, particularly in the transitional 2018/19 tax year we consider here. Income-related rent subsidies are, in our analysis, added in post-processing of the TAWA output, but including their treatment within the core TAWA model is a noted direction for future work. In addition, although TAWA models the ACC earners' levy, ACC payments that are disbursed to households are, in the current operation of TAWA, ingested from Inland Revenue administrative data and allocated as part of market income. As ACC payments for injuries in the workplace might be expected to be disproportionately incident on lower income households, correctly accounting for these payments may lead to increases in our estimates of the redistributive character of the New Zealand system. The version of the historical HES back-series from 2006/07 onwards that has been enhanced by Stats NZ using administrative data and was used recently in another Treasury analytical note (Stephens, 2023) may also provide a suitable alternative data source on which to base future fiscal incidence studies.

Although most tax and benefit components included in our analysis are scaled to known fiscal totals, some are left unadjusted from their TAWA values. We do not adjust the independent earner tax credit, due to the uncertainty as to its total value in a given year that results from the generally very slow and partial uptake of the credit by eligible recipients. We note also that we follow the standard weighting approach of TAWA, in which the HES sample is weighted to represent the population of private households in New Zealand. We have not made any adjustments to account for individuals living in non-private residences (see Crawford and Johnston, 2004). Making such adjustments would improve the accuracy of some of our estimates. In our analysis we allocate student loans in a top-down manner, following the approach of Aziz *et al.* (2012). However, administrative data within the IDI could be used to assign the cost of student loans to individuals and therefore households, and to account more accurately for its interaction with the student allowance, which is sourced from administrative data by TAWA. Further improvements could also be made in the modelling of education spending for school-aged children. In our analysis school operational and salaries funding is – for each age – averaged over all schools in the country before being assigned to school students. Generalizing our approach to include the variation in school placement funding with, eg, the deprivation index of school catchments, would appear to be a straightforward way of improving the modelling of school funding and its progressivity. The modelling of health funding is similarly limited by the assumptions underlying our application of the PBFF model. Higher-income households are more likely to use private healthcare and insurance options, which are not accounted for in our analysis, suggesting that we are likely to overestimate the extent to which public healthcare funding is incident on these households. At the other end of the income distribution, lower income households may be less likely to make use of public healthcare services in practice, implying that our analysis may overestimate the government's contribution to final incomes there. Improving the modelling of the incidence of public health spending on households to correct for these biases remains an outstanding challenge for future fiscal incidence studies in New Zealand.

IDI disclaimer

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/. The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.