

# Distributional National Accounts for Australia, 1991-2018

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PRELIMINARY DRAFT (PLEASE DO NOT QUOTE)

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## Abstract

We produce estimates of the distribution of the National Accounts measure of national income in Australia for the period 1991 to 2018 by combining household survey data and tax records data, and adjusting individual incomes so as to sum to national accounts aggregates. We document the shifts in income shares over the period, contrasting changes in the distribution of pre-tax and post-tax national income. We then compare Australia to the US and France. Finally, we compare our new inequality estimates with traditional household survey based estimates.

## 1. Introduction

A recent literature led by researchers affiliated with the World Inequality Database (Atkinson and Morelli 2018; Bozio et al. 2018; Garbinti et al. 2018; Piketty et al. 2018, 2020; Piketty et al. 2019) has attempted to provide a more complete picture of the distribution of income through allocating all of the income as measured in national accounts to individual members of society. The guiding principles for these ‘distributional national accounts’ are to allocate the entirety of national income to individuals, and to do so according to who are the ‘beneficial recipients’ of the income.

By doing so, a more accurate picture of the distribution of income is possible compared with traditional inequality studies using household survey or tax records data, which typically only capture cash incomes, thereby missing important components such as in-kind benefits from government-provided goods and services, imputed rents on owner-occupied housing, and retained earnings of companies. By accounting for these income components, the distributional national accounts approach therefore generates estimates of individuals’ incomes that are on average larger than obtained from household surveys or income tax data but which should more accurately reflect the distribution of all (cash and in-kind) income.

In this paper we attempt to produce statistics on the distribution of income in Australia as measured by the national accounts.<sup>1</sup> Our approach is guided by Alvaredo et al. (2020), which details the income concepts and methods of implementation adopted by the World Inequality Database. The guidelines

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<sup>1</sup> This paper builds on earlier work by Fisher-Post (2020).

are, however, not completely prescriptive because of the substantial variation across countries in institutional features and data availability. Our approach is therefore considerably influenced by the particular institutional features of Australia and the nature of the available data, including the relative strengths and weaknesses of alternative data sources.

Four main national income concepts are identified in Alvaredo et al. (2020) as being of interest: pre-tax factor income; pre-tax post-replacement income; post-tax disposable income; and post-tax national income. Pre-tax factor income approximately corresponds to total income accruing to capital and labour, but where all of national income is attributed to capital and labour. Pre-tax post-replacement income is the same as pre-tax factor income, but with an adjustment made to account for the public pension system by allocating pension payments to recipients and deducting the contributions used to fund them (such that it still sums to national income). Post-tax disposable income deducts all taxes attributable to individuals and adds cash transfers. Consistent with the principle of distributed income aggregating to national accounts totals, the total value of taxes deducted equals the total value of taxes collected by government (not just income taxes). However, government expenditure is not allocated to individuals and thus the sum of post-tax disposable income is less than national income. Post-tax national income addresses this deficiency by distributing all of government expenditure, inclusive of items not readily attributable to individuals, such as national defence.

We construct measures of all four income concepts, but the results we present are primarily for pre-tax post-replacement income and post-tax national income on the basis that these are the main pre-tax and post-tax income concepts of interest, corresponding to measures of the distributions of market income and 'post-government' income (the latter corresponding to 'beneficial receipt' of income).

We are not the first to attempt to describe the distribution of income in Australia adopting a National Accounts income concept. The Australian Bureau of Statistics (ABS) has, on four occasions since 2014, released distributional information on national income by combining information from its biannual household income survey with the National Accounts data (most recently in 2021; see ABS 2021a). The methods have been refined over time. In the most recent release, for each of nine years between 2003-04 and 2019-20, statistics are presented on the distribution of various components of the national household income account across households.

While complementary to the analysis we undertake, the ABS approach is somewhat different to that advocated by Alvaredo et al. (2020). The income concept differs slightly because of the failure to deduct consumption of fixed capital (hence, it is a national accounts concept of *gross* income that is distributed to households).<sup>2</sup> More importantly, the distributional information produced by the ABS is limited, presenting only the total, mean and share of each income component of the household income account for broad groupings of households: by main source of income (five groups), by equivalised income quintile, by household type (seven groups), by age group of the household 'reference' person (six groups) and by wealth quintile.

Compared with the ABS outputs, we therefore present distributional information that is based on income concepts more in line with the WID guidelines, and which is more detailed and better suited to international comparisons.

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<sup>2</sup> In practice, this is not an especially significant issue. For example, in 2017-18, total gross income in the household income account was \$1.53 trillion and (net) national income was \$1.47 trillion (ABS, 2021b). (Dollar amounts refer to Australian dollars throughout this paper.)

## 2. Distributing national income to individuals

In building the Distributional National Accounts for Australia, we follow earlier DINA estimates for France and the US (Garbinti et al. 2018; Piketty et al. 2018) and the Distributional National Accounts Guidelines (Alvaredo et al. 2020).

The goal is to distribute to individuals all of the national accounts measure of income, defined as GDP plus net foreign income minus consumption of fixed capital. As noted, following the DINA Guidelines, we construct four measures of income that are distributed to individuals, although only three of these sum to the national accounts aggregate. In the following we describe the methods and data used to produce each income distribution.

### 2.1. Pre-tax factor income

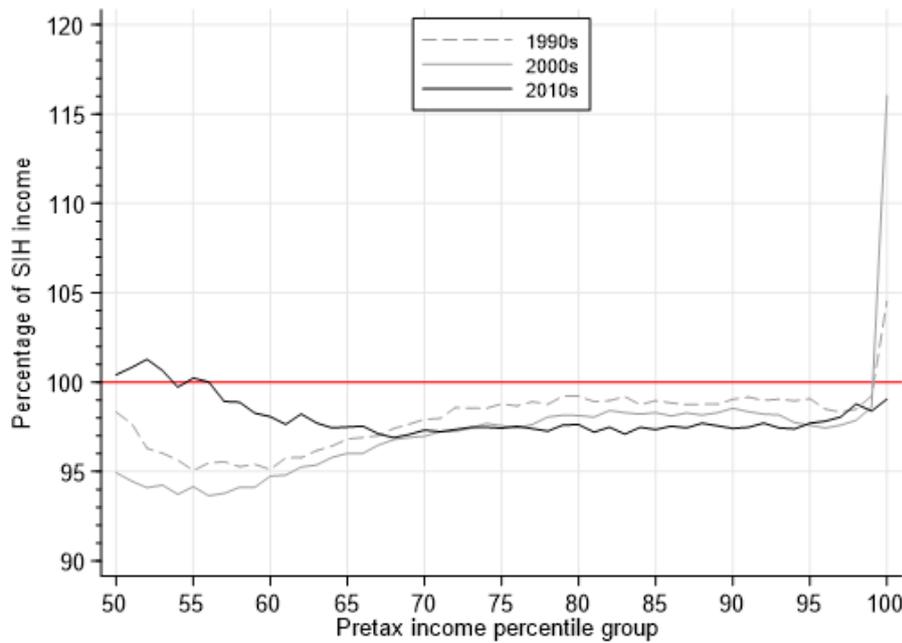
#### 2.1.1. Pre-tax cash incomes

For pre-tax cash incomes of individuals, based on exploratory work with both ALife (a 10% random sample of tax returns currently covering 1991-2017) and the Australian Bureau of Statistics' Survey of Income and Housing (SIH, covering 1994 to 2018 but with some gaps), we determined that the best approach was to primarily base cash income estimates on the SIH, but with ALife tax data used to adjust incomes for the top 1%. This is because the tax data appear inferior in income capture for most of the distribution (see Figure 2.1). Although non-labour income is higher in ALife than in the SIH for people with above-median incomes, it is not enough to compensate for the undercoverage of labour income.<sup>3</sup>

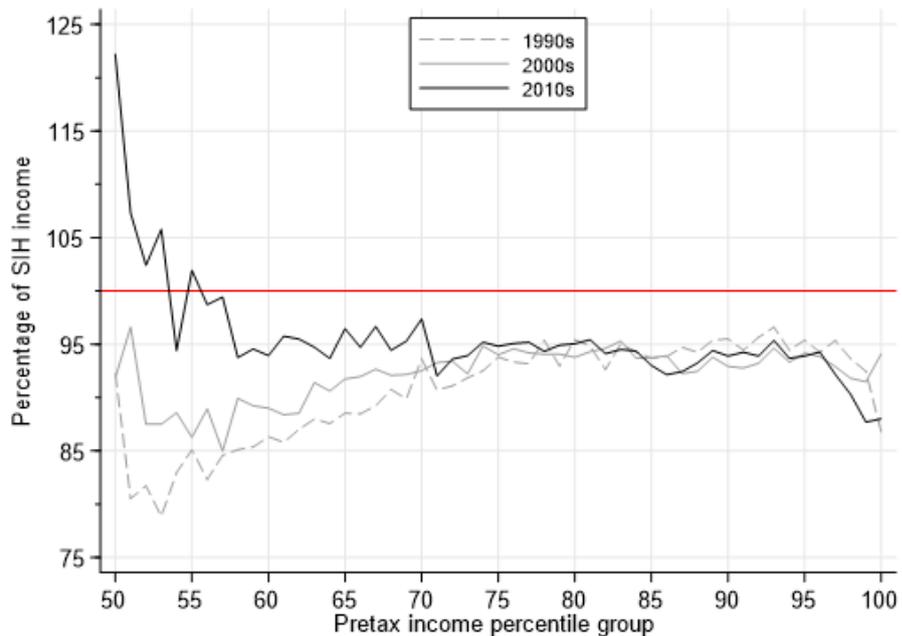
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<sup>3</sup> The SIH provides the longest time-span of coverage for income survey data in Australia, the main other survey source being the Household, Income and Labour Dynamics in Australia (HILDA) Survey, a panel study that commenced in 2001. The ABS has also conducted surveys that collected household income data (which is still available in unit record form) in 1975, 1982, 1986 and 1990. Unfortunately, unit-record tax data is not available prior to 1991. Further extension back to the mid 1970s may be possible using tabulations of tax data and the household survey data that is available. Prior to the mid 1970s, the only broad-based distributional information comes from income tax tables. At this stage, we leave DINA estimation prior to the 1990s as a task for future research.

**Figure 2.1: ALife tax data relative to SIH income survey data by percentile - Pretax income**



**Figure 2.2: ALife tax data relative to SIH income survey data by percentile - Labour income (but with individuals ranked based on pretax income)**



Up until 2015-16, the SIH unit record data contain measures of both annual income (for the preceding financial year, 1 July to 30 June) and 'current weekly' income. We use the annual income estimates for these surveys. However, in the 2017-18 SIH, only current weekly income is available. We therefore use an annualised measure of this income measure for this survey.

Our approach is something of a departure from existing studies, that have given greater weight to tax records data. However, DINA need to be flexible to national circumstances, and in Australia's case, survey data is preferable to tax records data for all but the top 1%.

Australia is by no means unique in the finding that income survey data is at least as good as tax data for incomes below the top 1%. Burkhauser et al. (2012) found the US CPS matched income tax data up to the 99<sup>th</sup> percentile, and Burkhauser et al. (2018) similarly found the UK HBAI matched income tax data up to the 99<sup>th</sup> percentile. Perhaps requiring some explanation is why the survey data actually captures more income below the 99<sup>th</sup> percentile than the tax data. Two main explanations exist: some forms of income are nontaxable and are even received by high income earners; and there are incentives to minimise income reported to tax authorities that do not apply to statistical agencies. Regardless of the explanation, the fact remains that macroeconomic aggregates are better captured when income survey data is used for the bottom 99% and tax data is only used for the top 1%.

Aside from better capture of the incomes of the bottom 99%, additional reasons to use the SIH include better flexibility to look at different income concepts (including equivalised disposable cash incomes) and income units (including the household unit). That said, we focus on the four income concepts described in the DINA Guidelines and distribute incomes of couples on an 'equal-split adults' basis, meaning each member of the couple is assigned 50% of the total income of the couple.

The SIH nonetheless has important limitations which need to be addressed. As noted, it is only available from 1994-95, and it has only been conducted every second year from 1997-98 to 2002-03 and from 2003-04 onwards. It also only has wealth data (and hence information on superannuation balances and home equity required to distribute capital income; see below) in 2003-04, 2005-06 and 2009-10 onwards.

In non-SIH years, we interpolate distributions and adjust according to changes in the components of the National Accounts in those years. We use the national income price index to either inflate the distribution from the closest earlier year or to deflate it from the closest later year. If both an earlier and a later year are available, we apply both methods separately and compute the final DINA estimates by taking the average of the two series thus obtained.

#### *Top 1%: combining survey and tax data*

As a growing literature has shown, survey data tend to undercover top incomes. Comparison of survey and tax data has revealed that this is the case in Australia too (Burkhauser et al. 2016) and that it mostly affects the top 1%. We follow the cell-mean imputation method we developed for the UK in Burkhauser et al. (2018), using tax data (Alife) to impute incomes of the top 1% in the survey data.<sup>4</sup>

First, we rank individuals in the Alife unit record data by their 'tax gross income', which is total income subject to taxation prior to any allowable deductions or rebates. This is the closest variable to 'pre-tax income' available in the tax records data. Second, we select individuals in the top 1%, using the ABS estimate of the total adult population shown for the relevant year. Next, we allocate top 1% individuals to income groups, with the size of each group equal to 1/100,000<sup>th</sup> of the total adult population, meaning we split the top 1% into 1,000 income groups. Third, we calculate the average income for each income group. Next, we repeat the first and second steps with the SIH data for the same year using our derived measure of individual gross income. We then duplicate each record according to its sample weight. Finally, for each of the 1,000 SIH income groups within the top 1%, we replace the individual-level SIH incomes with the mean income of the corresponding group in Alife.

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<sup>4</sup> A few preliminary adjustments to Alife data are required: see Appendix A.1.

Although gross income is thus imputed from tax data for the top 1%, we maintain the assumption that the income-source composition is as obtained from the survey data. In practice, all income components of the top 1% individuals are scaled up by a constant factor. An alternative assumption would be to use the income composition as determined by Alife, but this offers less detail and thus less flexibility in then adjusting incomes to match National Accounts totals (e.g., mixed-income is not directly observable in Alife).

Our procedure ensures that total ‘tax gross income’ for the top 1% – and for each of the 1,000 groups within the top 1% – is the same in the (adjusted) SIH and Alife data.

### *2.1.2. Labour income*

Grossing up of labour incomes is required because of potential under-reporting in SIH as well as the failure of the SIH to capture (all of) salary sacrificed employment income, fringe benefits and fringe benefits tax, and ‘employer social contributions’ (i.e., employers’ superannuation contributions and workers’ compensation premiums). Employee incomes are grossed up by a constant factor so that total employee income in the SIH equals total employment income in the National Accounts. Mixed income is grossed up separately, also by a constant factor. All grossing-up factors are provided in Appendix Table A.2. Total employee incomes have to be increased by between 6% and 26% to ensure consistency with National Accounts. The required increase is much larger and more volatile over years for mixed-income, ranging from 24% to 211% depending on the year.

### *2.1.3. Capital income*

Capital income is estimated based on reported business and investment income and imputed rent. A ‘grossing up’ adjustment is done separately for each of superannuation, imputed rent and other capital income. The principle is that superannuation income is imputed based on observed or estimated superannuation balances. Net operating surplus of households and non-profit institutions serving households (NOSH) is distributed based on imputed rent. The remaining (i.e., non-pension non-imputed-rent) capital incomes not captured by the SIH are distributed according to reported non-pension non-imputed-rent capital incomes (hereafter called ‘other capital income’).

From the total capital stock (“National net wealth”) as measured in the National Accounts, we compute the share of the capital stock in superannuation funds (“Pension funds & life insurance”) and then use that share to allocate the appropriate proportion of total capital income (other than NOSH) accruing to superannuation funds. The implicit assumption is that returns on superannuation are the same as the overall return on the national capital stock. Total capital income is obtained here from the National Accounts by adding “total net property income of households and NPISH” and “total net primary income of corporations”.

Superannuation income, NOSH and other capital incomes are thus allocated separately.

#### *Superannuation income*

We impute superannuation income proportionally to each individual’s superannuation balance. We use superannuation balances from the SIH for all years for which they are available (2003/04, 2005/06, 2009/10, 2011/12, 2013/14, 2015/16 and 2017/2018). For the years not covered by the SIH, we estimate superannuation balances separately for those aged 60 and over and those aged under 60.

For those aged under 60, we estimate a regression model of superannuation balances on age, labour income and sex (as well as interactions). For those aged 60 and over, the model is enriched by including superannuation income. The coefficient estimates (see Appendix A.3) are then used to

impute superannuation balances in the SIH data for years with no information, by using the set of estimated coefficients from the closest year available. This means that superannuation balances from 1991 to 2002 are all estimated based on the 2003 model. This approach is likely to generate some prediction errors. However, we note that superannuation wealth was limited in the 1990s since compulsory contributions only commenced in 1992, initially at only 3% of gross earnings and gradually increased up to 9% as of 1 July 2002.<sup>5</sup> Moreover, it is the relative distribution of superannuation balances that matters for imputation and not the absolute values, and these relativities are likely to have remained relatively stable between 1991 and 2003.

#### *NOSHN*

We impute the net operating surplus of households and Non-Profit Institutions Serving Households (NOSHN) proportionally to each household's net imputed rent. Where a household comprises more than one adult, the income is equally split. Gross and net imputed rents are directly provided in the SIH from 2005 onwards.<sup>6</sup> For earlier years, we predict gross and net imputed rents. Using 2005 values, we estimate a model to predict gross imputed rents based on reported tenure type, state of residence, area of residence, number of bedrooms, household gross income decile and landlord type. The approach draws heavily on the approach developed by the Australian Bureau of Statistics (ABS 2008a). For net imputed rent, all covariates listed above are interacted with (predicted) gross imputed rent and we add mortgage repayments and predicted gross imputed rent to the list of covariates. Coefficient estimates are reported in Appendix A.4. All models are estimated with and without tenure type as this variable was not available before 2002 in the SIH and thus cannot be used for imputation before that year. These models fit the data well with the adjusted R-square 0.97 for gross imputed rent and 0.69 for net imputed rent.

#### *Other capital income*

Other capital income has two components: that captured by SIH and that not captured by SIH, the latter of which is a residual equal to total capital income<sup>7</sup> from the National Account minus superannuation income from the National Account minus non-pension capital income as measured in SIH. This non-captured capital income will primarily comprise corporate retained earnings. We distribute it assuming it has the same distribution as observed other (non-superannuation non-imputed rent) capital income. Grossing-up factors reported in Appendix Table A.2 indicate that this captured capital income has to be multiplied by a factor of between 2 and 4.3 to match national accounts totals.

#### *2.1.4. Taxes on production*

As Alvaredo et al. (2020) show, a pre-tax income measure not only requires that income taxes are not deducted from capital and labour income, but that taxes on production (and taxes on wealth, if they exist) need to be *added* to incomes to ensure all of national income is allocated/distributed to individuals. As per the guidelines, taxes on production are assumed to have the same distribution as total factor income. This is somewhat arbitrary, but means pre-tax income distributions among those with factor incomes are unaffected by these taxes other than via a scaling up factor applied to

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<sup>5</sup> The minimum contribution rate is now 10% and is scheduled to gradually increase up to 12% by 1 July 2025.

<sup>6</sup> According to the ABS, 'Gross imputed rent is the market value of the rental equivalent, and has been estimated using hedonic regression. Net imputed rent for owner occupiers has been derived by subtracting the housing costs normally paid by landlords (i.e., council rates, mortgage interest, building insurance premiums, repairs and maintenance) from gross imputed rent.' (ABS 2008b, p.3).

<sup>7</sup> Defined here as 'total net property income of households and NPISH' plus 'total net primary income of corporations'.

all incomes. Inequality measures over the population increases, however, because people with zero factor incomes become relatively poorer.

## 2.2. Pre-tax national income

Following the approach adopted for the French DINA by Garbinti et al. (2018) and US DINA by Piketty et al. (2018), as well as the DINA Guidelines, we include the Age Pension as income to produce pre-tax national income. This presents no major difficulty as the Age Pension is reported in the SIH.<sup>8</sup> We distribute the total cost of Age Pension payments as a flat percentage of income tax liabilities. That is, we assume each individual's contribution to the funding of the Age Pension is in proportion of their income tax liabilities.

## 2.3. Post-tax disposable income

To move from pre-tax national income to post-tax disposable income requires deducting all taxes and adding all government cash transfers to individuals' pre-tax incomes. Deducting income taxes and adding cash transfers is straightforward since both are recorded in the SIH and ALife data. However, both income taxes and cash transfers need to be scaled up to match national accounts totals.

As noted in the DINA guidelines (p53), the aim is to “to describe post-tax, post transfer inequality for the population's actual perceived budget constraints, while excluding in-kind transfers such as health and education and other public spending (as these may impact purchasing power and disposable income only indirectly). For this reason, aggregate post-tax disposable income can be substantially less than aggregate national income.”

Government pensions and allowances as well as income taxes are distributed according to the survey (and tax) data. For taxes on production (indirect taxes), which were distributed proportionally to factor income in pretax series, the DINA Guidelines advocate they are removed in proportion to *consumption*, proxied by disposable income (before the deduction of taxes on production) minus saving (where savings rates are based on external sources). In the absence of data on savings rates by level of income, we simply remove production taxes proportionally to household disposable income (as defined in the SIH).<sup>9</sup> Corporate taxes are imputed proportionally to capital incomes after excluding imputed rent.

## 2.4. Post-tax national income

Moving from post-tax disposable income to post-tax national income requires distributing government expenditure to individuals. This comprises individual and collective consumption expenditure of the government and the surplus or deficit of the government, such that it adds up to national income (DINA guidelines, p64). The DINA Guidelines' definition of government surplus or deficit differs from the usual definition “due to the exclusion of other current transfers and capital transfers” (DINA guidelines, p51). Thus the government surplus or deficit is defined as net saving plus net other current transfers.

Three approaches are recommended by the DINA Guidelines: (1) assume health expenditures benefit all adults equally but that the benefits of other expenditures are proportional to disposable income; (2) assume everyone benefits equally from all government expenditure; and (3) assume the

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<sup>8</sup> Age Pension income is not directly reported in Alife, but we can combine information on receipt of government pensions and age to infer it. In addition, we use Alife only for the top 1%, a group almost certain not to receive the Age Pension given that it is subject to both an income test and an asset test.

<sup>9</sup> A potential refinement for future work is to estimate expenditure regression models using the ABS Household Expenditure Survey data (collected in 1993, 1998, 2003, 2009 and 2015) to impute household expenditure as a function of income (and perhaps other factors) and use this to distribute taxes on production.

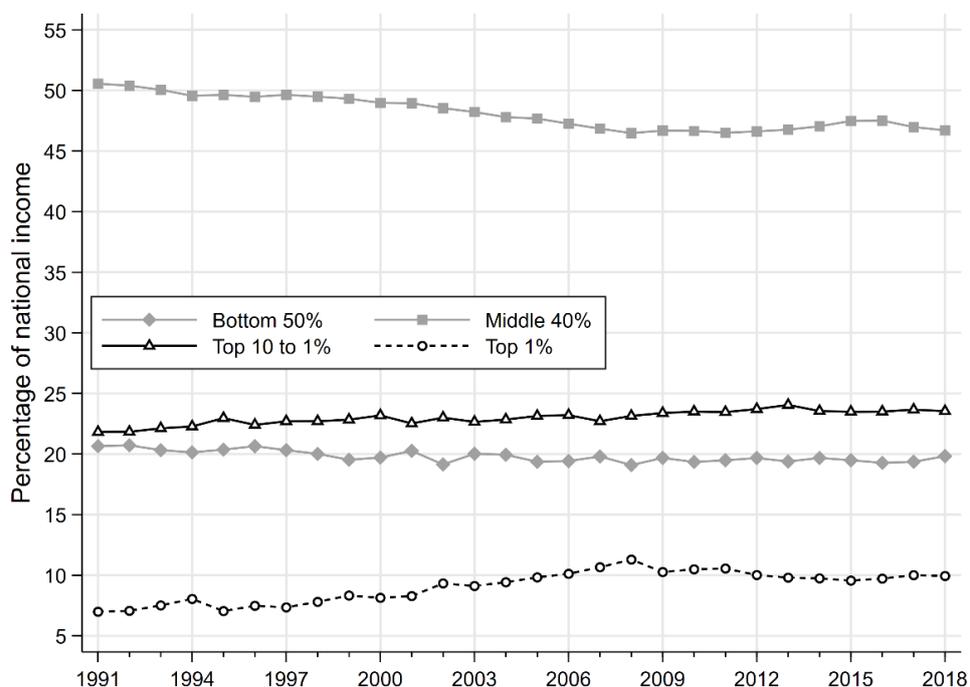
benefits of government spending are distributed in the same way as disposable income. The third approach means government spending can effectively be ignored since it doesn't affect the distribution other than to scale up everyone's income by the same fraction. Interestingly, the Guidelines do not allow for a scenario where government spending is redistributive. In Australia, the biggest expenditure items—health and education—are somewhat redistributive to lower-income individuals (ABS, 2018, Table 1.1). Consequently, of the approaches the guidelines recommend, the most appropriate approach for the Australian context is Approach (2). This means average government expenditure per adult is added to disposable income. This acts to lower measured inequality compared with post-tax disposable income, but nonetheless is likely to overstate benefits to high-income earners and understate benefits to low income earners and thus not reduce measured inequality as much as it should.

### 3. Inequality in Australia 1991-2018

#### 3.1. Pre-tax national income

Figure 3.1 presents estimated shares of pre-tax national income over the 1991 to 2018 period of the bottom 50%, top 50% excluding the top 10% (referred to as the 'middle 40%'), top 10% excluding the top 1%, and the top 1%. As noted, this provides information on how a 'market income' concept of income is distributed across individuals. The share of the bottom 50% remained relatively steady, at approximately 20%, but the middle 40% group experienced a decline from over 50% to approximately 47%, with the decline occurring between 1991 and 2008, since when there has been no net change. The income share of the top 10% to 1% rose from approximately 22% to 24%, while the top 1% income share rose from 7.5% to 10%, with all the increase occurring between 1995 and 2008 (and indeed there is a small decline evident after 2008).

**Figure 3.1 Pre-tax national income shares 1991-2018**

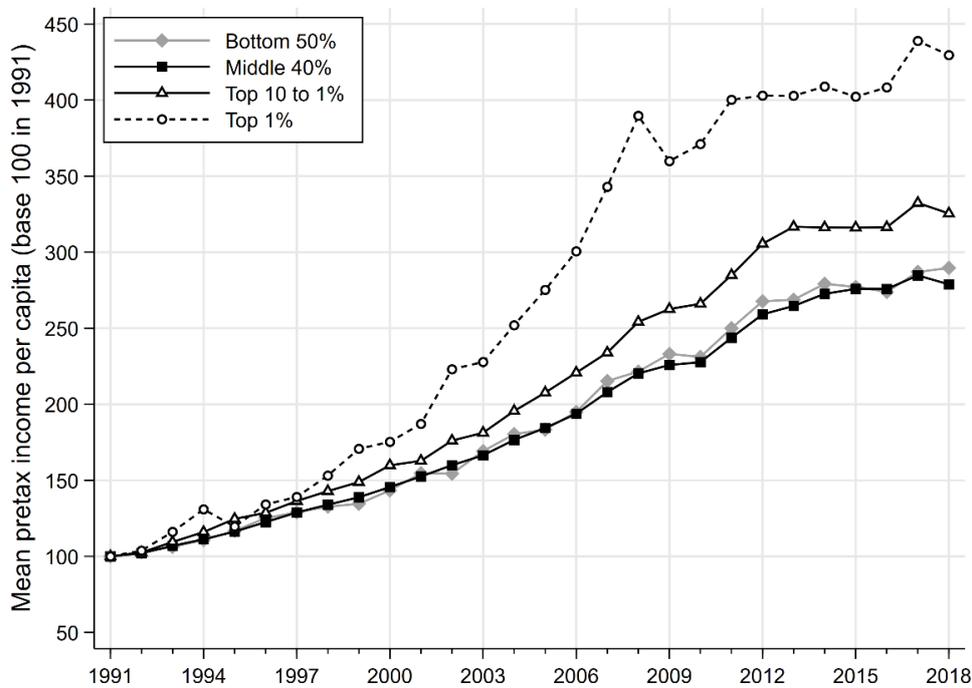


Notes: Distribution of pretax national income (before all taxes and transfers, except age pensions) among adults. Equal-split-adults series (income of married couples divided by two).

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Figure 3.2 compares the changes in mean income per adult of each of the four income groups examined in Figure 3.1. Since 1991, the mean income of the top 1% has increased by a factor of more than four. This compares with 3.5 for the top 10% to 1% and approximately 2.8 to 2.9 for the two groups comprising the bottom 90%.

**Figure 3.2 Mean adult pre-tax national income by income group 1991-2018**



Notes: Distribution of pretax national income (before all taxes and transfers, except age pensions) among adults. Equal-split-adults series (income of married couples divided by two).

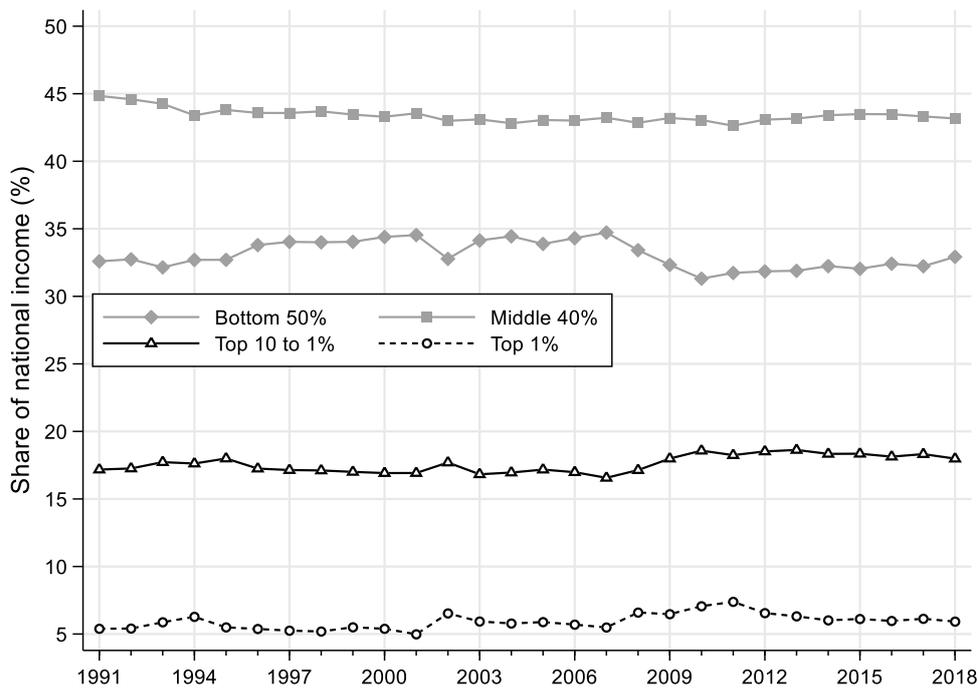
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### 3.2. Post-tax national income

Figures 3.3 and 3.4 present the same information as Figures 3.1 and 3.2, but for post-tax national income. This provides information on the distribution across individuals of 'beneficial receipt' of income. The relative rise in top income shares is less pronounced for this income measure, but notable is that the income share of the bottom 50%, after rising slightly between 1991 and 2007, subsequently fell to 2010, and has largely not recovered.

Consistent with the findings of Figure 3.3, Figure 3.4 shows differences in income growth across the four income groups are more subdued for post-tax national income than for pre-tax national income. Nonetheless, the increase in mean income was greatest for the top 1%, followed by the top 10% to 1%. The middle 40% had the lowest increase in mean income.

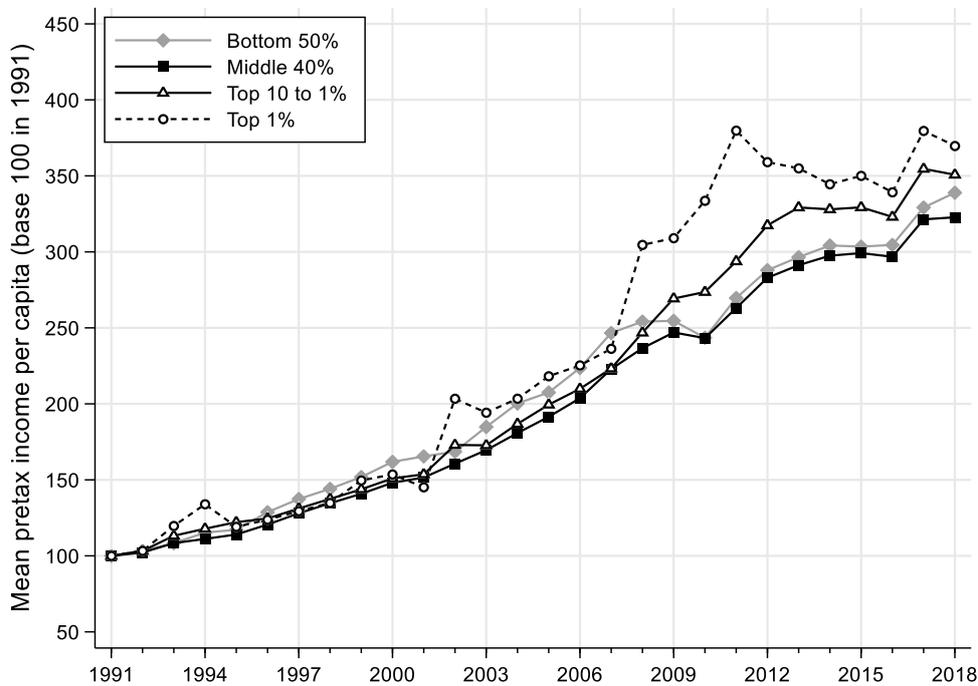
**Figure 3.3 Post-tax national income shares 1991-2018**



Notes: Distribution of post-tax national income (after all taxes and transfers) among adults. Equal-split-adults series (income of married couples divided by two).

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**Figure 3.4 Mean adult post-tax national income by income group 1991-2018**



Notes: Distribution of post-tax national income (before all taxes and transfers, except age pensions) among adults. Equal-split-adults series (income of married couples divided by two).

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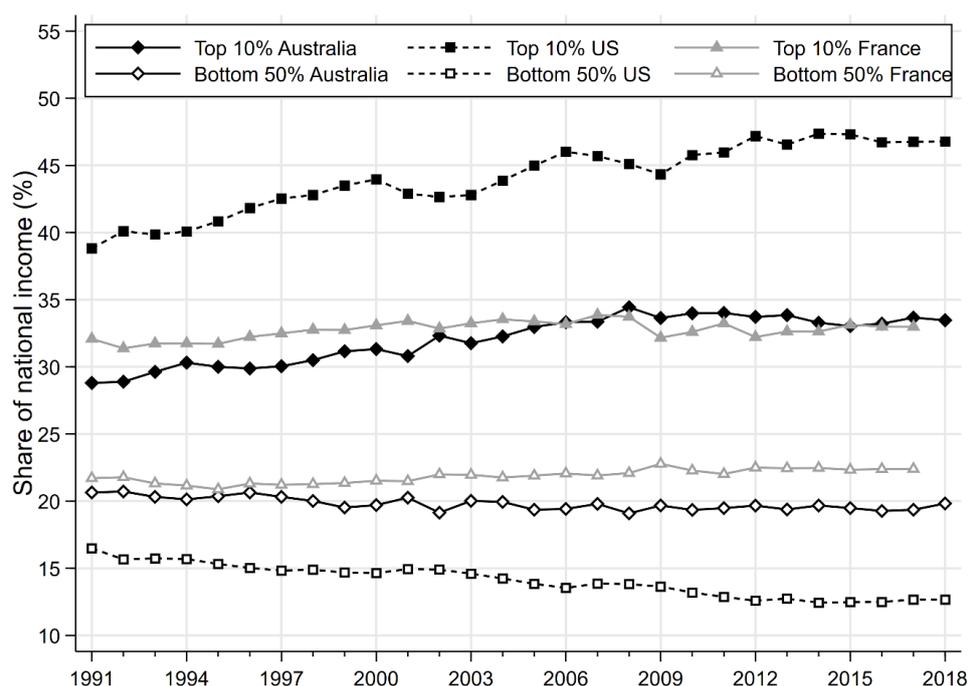
## 4. International comparisons: Australia, US and France

### 4.1. Pre-tax national income

In this section we compare US, French and Australian income shares of four income groups: top 1%, top 10%, top 50% to 10% ('middle 40%') and bottom 50%. Figures 4.1 and 4.2 examine pre-tax national income, the first figure examining the top 10% and bottom 50% and the second figure the top 1% and middle 40%. The top 10% income share is considerably higher in the US than in Australia and France, which have similar top 10% income shares. The income share of the top 10% has also risen considerably in the US. It has also risen in Australia, albeit to a smaller degree, while it has remained relatively stable in France, such that the top 10% income share has gone from being somewhat higher in France than in Australia in the early 1990s to slightly lower in the late 2010s. Similar patterns are evident for the top 1% in Figure 4.2, although the income share of the top 1% in France remains slightly above that of the top 1% in Australia throughout the 1991 to 2018 period.

For the bottom 50%, France and Australia are again relatively similar and somewhat different to the US. However, there is a slight but steady rise in the income share of the bottom 50% in France from the mid 1990s, compared with a very slight decline in Australia. Across the entire period, the 'middle 40%' (top 50% to 10%) has had the highest income share in Australia and lowest income share in the US. In all three countries, this income groups has experienced a decline in income share, with the drop greatest in the US and smallest in France.

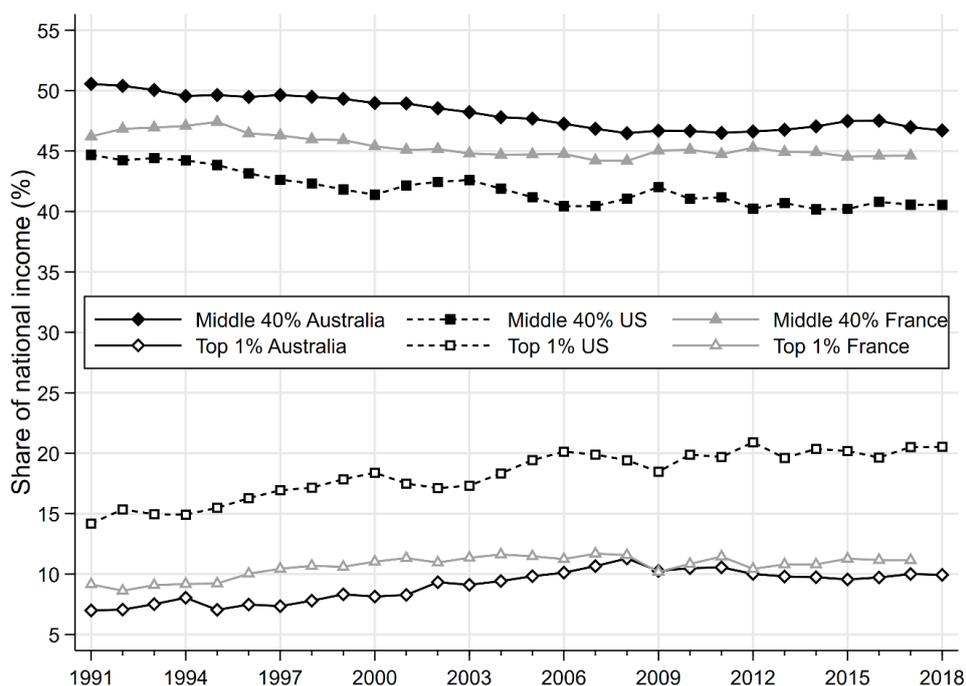
**Figure 4.1 Top 10% and bottom 50% income shares: Australia, US and France 1991-2018**



Notes: Distribution of pretax national income (before all taxes and transfers, except age pensions) among adults. Equal-split-adults series (income of married couples divided by two).

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**Figure 4.2 Top 1% and middle 40% income shares: Australia, US and France 1991-2018**



Notes: Distribution of pretax national income (before all taxes and transfers, except age pensions) among adults. Equal-split-adults series (income of married couples divided by two).

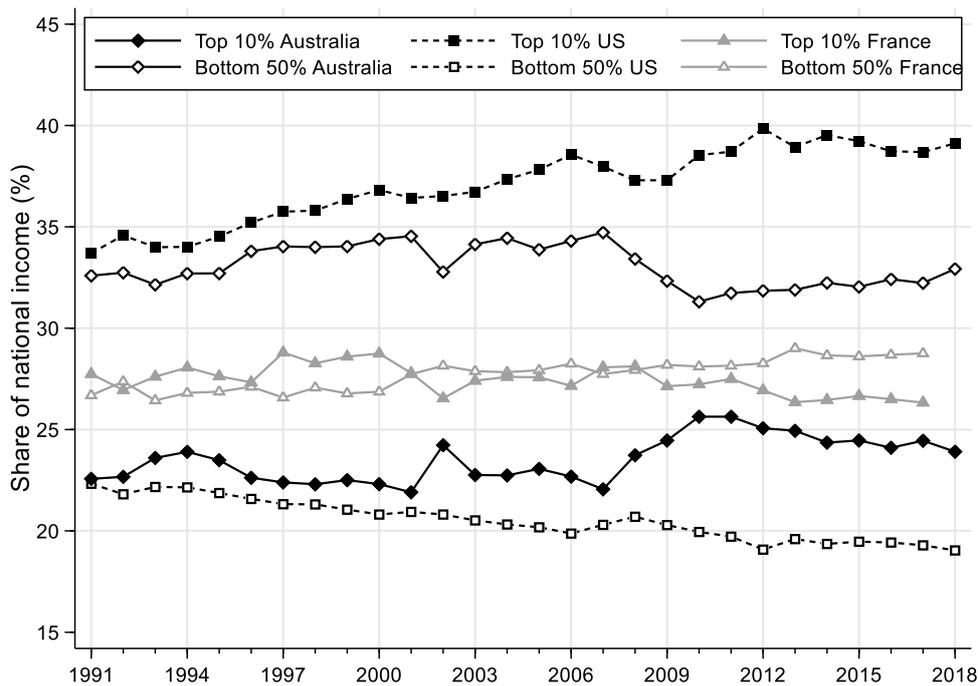
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#### 4.2. Post-tax national income

Comparisons across the US, France and Australia in the distribution of post-tax national income are presented in Figures 4.3 and 4.4. Differences across the three countries are stark. The top 10% in the US received nearly 34% of income in 1991, and this had risen to nearly 39% in 2018. In France, the top 10% received approximately 27% of income in 1991 and this share fell slightly to approximately 26% in 2018. In Australia, the top 10% income share was approximately 23% between 1991 and 2001, but then increased to nearly 26% in 2010 and subsequently declined only slightly. For the top 1% (Figure 4.4), the US again has a much higher income share and greater growth in the income share than France and Australia. The top 1% share is higher in France than in Australia, but the gap narrows between 1991 and 2018, being approximately 1 to 2 percentage-points in the most recent years.

The income share of the bottom 50% is highest in Australia and lowest in the US. There is little net change evident over the full period for France and Australia, but a considerable decline for the US. At the end of the period, the income share of the bottom 50% was 33% in Australia, 29% in France and 19% in the US. For the middle 40%, income shares are very similar across the three countries, although across the entire period, France has the highest income share and the US the lowest, and the gap widened slightly between 1991 and 2018.

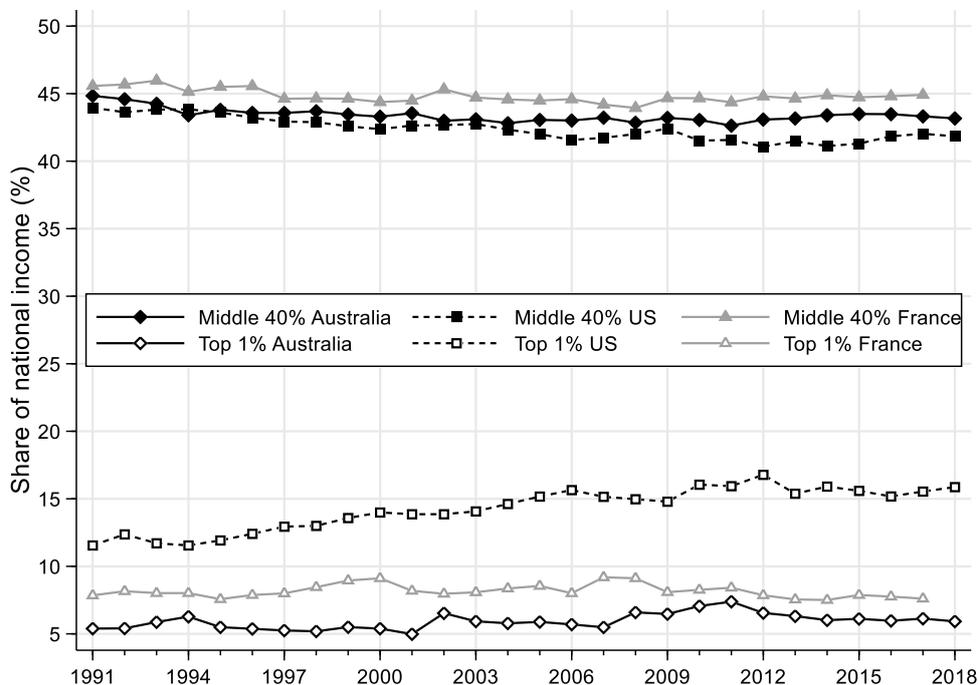
**Figure 4.3 Top 10% and bottom 50% income shares: Australia, US and France 1991-2018**



Notes: Distribution of post-tax national income (after all taxes and transfers) among adults. Equal-split-adults series (income of married couples divided by two).

Stata graph intcomp\_ptninc\_sh1

**Figure 4.4 Top 1% and middle 40% income shares: Australia, US and France 1991-2018**



Notes: Distribution of post-tax national income (after all taxes and transfers) among adults. Equal-split-adults series (income of married couples divided by two).

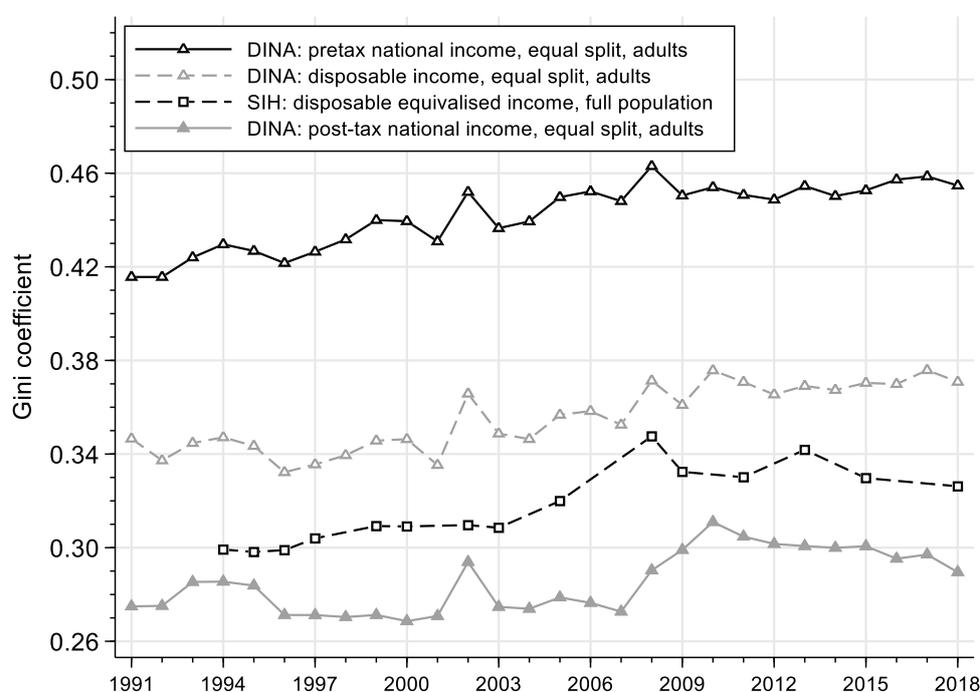
Stata graph intcomp\_ptninc\_sh2

## 5. Comparisons with household survey estimates of inequality

Of considerable interest is how inferences on levels and trends in inequality are affected by moving from traditional household survey based estimates to DINA-based estimates of inequality. Figure 5.1 compares the Gini coefficient for three of the DINA income concepts with the Gini coefficient for equivalised disposable income captured in the SIH (where the modified OECD scale is used to equivalise income; see Hagenars et al. 1994).

As would be expected, comparing across the DINA income concepts, moving from pre-tax national income to post-tax disposable income and then to post-tax national income is associated with decreases in the Gini coefficient. Notably, the Gini coefficient for post-tax national income is consistently below the Gini coefficient for equivalised disposable (cash) income. Between 1994 and 2018, Gini coefficients for both post-tax national income and equivalised disposable income increased, although more so for equivalised disposable income.

**Figure 5.1 DINA and SIH Gini coefficients 1991-2018**



*Stata graph Gini1a*

## 6. Conclusion

We have produced the first DINA estimates for Australia consistent with the DINA Guidelines described in Alvaredo et al. (2020), spanning the period 1991 to 2018. Further refinement is certainly possible and should be a priority for further research. This notwithstanding, our estimates suggest Australia has a somewhat similar distribution to France, with both countries having considerably more equitable distributions than the US. Australia has, however, had greater growth in inequality than France.

The DINA Guidelines recommend production of synthetic microfiles, but confidentiality requirements of ABS and ALife data access preclude this. However, it would be possible to produce a synthetic file which, while an aggregation of the data, would have a sufficient number of

‘observations’ and sufficient information for each observation to allow a variety of distributional analyses. This is a potentially valuable avenue for future research.

A further important future research direction is to attempt to extend the DINA estimates to earlier years. Unit record income survey data is more sparse prior to the 1990s, and indeed non-existent prior to 1975. Similarly, unit record tax data only extends back to 1991. Methods for producing DINA estimates will therefore need to rely on more aggregated forms of data, such as the tax tables used to produce the original (cash income) top income shares for WID.

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## Appendix A Data appendix

### 1. Appendix A.1 Preliminary adjustments to top 1% in Alife

A few adjustments are performed in Alife before it is combined with survey data for the top 1%.

Incomes and income components are not top coded in Alife, with one exception: in each year, the 24 largest ‘employment termination’ (redundancy) payments in the entire tax filer population are reduced to the level of the 25<sup>th</sup>-largest payment value. Between 1991 and 2017, this represented a total adjustment of between \$8 million and \$57 million in total and (noting that ALife is a 10% sample) affected between 0 and 7 individuals in ALife each year (see Table A.1). We distribute the portion of Employment Termination Payment that was cut due to top-coding: we take 10% of the total shortfall and divide it between all top-coded observations in Alife.

**Table A1. ATO adjustment of Employment Termination Payments (1991-2017, in current dollars)**

Tax year	Total adjustment	Mean adjustment
1991	-8,241,221	-343,384
1992	-14,613,357	-608,890
1993	-11,291,962	-470,498
1994	-15,332,505	-638,854
1995	-15,336,185	-639,008
1996	-10,649,353	-443,723
1997	-16,235,498	-676,479
1998	-16,477,313	-686,555
1999	-27,519,147	-1,146,631
2000	-42,319,718	-1,763,322
2001	-15,676,018	-653,167
2002	-27,836,179	-1,159,841
2003	-24,939,858	-1,039,161
2004	-18,548,200	-772,842
2005	-20,565,614	-856,901
2006	-21,123,878	-880,162
2007	-32,612,964	-1,358,874
2008	-47,913,907	-1,996,413
2009	-51,932,913	-2,163,871
2010	-51,184,871	-2,132,703
2011	-56,628,558	-2,359,523
2012	-34,672,593	-1,444,691
2013	-20,742,471	-864,270
2014	-36,156,344	-1,506,514
2015	-14,594,126	-608,089
2016	-23,385,390	-974,391
2017	-19181113	-799213

*Notes:* Employment termination payment is a lump sum payment made as a result of the termination of a person's employment.

*Source:* ATO (private communication).

As Alife is a 10% random sample of tax filers, it is subject to sampling error. We address this issue by reconciling top income outliers (defined here the top 100 individuals in terms of taxable gross income in Australia each year) with the ATO full population for which the ATO has provided us mean income values (separately for the top 100 to 50 and the top 50 individuals). We average income for top 100 to 50 and top 50 individuals in Australia to adjust incomes of the top 10 and top 5 individuals in Alife. All income components are scaled up by a constant factor. This approach fixes the top 0.001% but sampling error may still affect income groups below the top 0.001%, with the issue likely to be more important the smaller the income group. In practice, top income shares for groups smaller than 0.1% of the population and above the top 0.1% may not be reliable.

## 7.1. Appendix A.2 Grossing-up factors

**Table A.1 Survey to National Account grossing-up factors (1991-2018)**

Year	Employee income	Mixed income	Non-pension capital income	Personal income tax	Cash benefits
1991	1.11	1.58	3.12	1.11	0.98
1992	1.11	1.40	3.33	1.03	1.12
1993	1.13	1.52	3.74	1.03	1.20
1994	1.16	1.48	4.07	1.09	1.28
1995	1.17	1.24	4.33	1.10	1.25
1996	1.18	1.41	3.01	1.15	1.25
1997	1.19	1.40	3.54	1.16	1.26
1998	1.22	1.54	3.65	1.21	1.26
1999	1.18	1.33	2.87	1.14	1.28
2000	1.15	1.44	3.81	1.14	1.29
2001	1.17	1.31	3.44	0.98	1.40
2002	1.16	1.54	4.14	1.09	1.39
2003	1.17	1.57	3.46	1.09	1.33
2004	1.20	1.79	3.56	1.13	1.45
2005	1.17	1.70	3.00	1.09	1.44
2006	1.19	1.59	3.17	1.10	1.43
2007	1.23	1.43	2.87	1.06	1.44
2008	1.26	1.87	2.74	1.19	1.65
2009	1.16	2.04	3.12	1.18	1.46
2010	1.18	2.13	3.25	1.14	1.29
2011	1.16	2.07	3.46	1.13	1.44
2012	1.21	2.05	3.48	1.22	1.52
2013	1.19	2.14	2.29	1.11	1.47
2014	1.22	2.22	2.03	1.12	1.54
2015	1.16	2.84	2.39	1.09	1.39
2016	1.20	2.88	2.43	1.13	1.41
2017	1.20	3.11	2.77	1.16	1.36
2018	1.06	2.43	2.12	1.00	1.31

Notes: Constant factors by which each income component has to be multiplied in the survey data (complemented by tax data for the top 1%) to restore consistency with National Account. For instance, a factor of 2 means that incomes have to be doubled.

## 7.2. Appendix A.3 Superannuation balance regression estimates

**Table A.3.1 Superannuation balance regression estimates (adults under 60 years of age)**

	2003		2005		2009		2011		2013		2015		2018	
	Coef.	S.E.												
Age	877***	66.2	1,006***	86.3	1,248***	80.1	1,524***	101.3	1,653***	109.1	2,269***	106.7	2,407***	122.1
Labour income (in \$1000s)	-1,085***	69.5	-1,311***	77.4	-1,292***	62.1	-1,306***	69.2	-1,438***	70.4	-1,487***	70.9	-1,156***	67.9
Labour income (in \$1000s) squared	-1.605***	0.15	-1.022***	0.07	-0.936***	0.04	-0.571***	0.04	-1.218***	0.05	-0.210***	0.01	-0.342***	0.02
Age x labour income (\$1,000s)	52.1***	1.6	58.3***	1.7	55.6***	1.4	56.8***	1.5	63.8***	1.6	56.7***	1.5	52.3***	1.4
Female	18,836***	3,021	16,500***	4,112	14,768***	3,727	20,371***	4,871	16,516***	5,169	23,457***	5,166	9,454	5,901
Female x age	-749***	77.5	-610***	104.3	-607***	94.6	-768***	122.8	-621***	130.2	-941***	129.1	-458***	148.4
Zero labour income	9,357***	1,420	12,802***	1,836	8,102***	1,614	15,911***	2,181	11,066***	2,296	1,442	2,179	6,373**	2,622
Constant	-24,115***	2,589	-27,837***	3,446	-30,001***	3,174	-39,837***	4,075	-41,734***	4,363	-45,519***	4,400	-54,605***	5,032
Sample size	17,491		14,800		23,666		20,896		19,783		23,072		18,883	
Adjusted R <sup>2</sup>	0.273		0.287		0.272		0.272		0.322		0.303		0.346	

Notes: Ordinary Least Square estimates. 'x' denotes interaction terms. \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.

**Table A.3.2 Superannuation balance regression estimates (adults over 59 years of age)**

	2003		2005		2009		2011		2013		2015		2018	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Age	-2,056***	351.0	-3,003***	495.4	-2,536***	394.7	-3,867***	579.6	-5,141***	571.4	-4,070***	493.5	-4,543***	610.4
Superannuation income (in \$1000s)	30,484***	1794.3	19,279***	2282.6	17,411***	1675.7	11,634***	1765.5	7,727***	1632.4	11,170***	1478.1	24,626***	1430.3
Superannuation income (in \$1000s) squared	-14.27***	2.66	5.69***	2.09	-3.72	3.93	-31.72***	1.65	-24.73***	1.21	-16.23***	2.16	-17.41***	0.89
Age x superannuation income (\$1,000s)	-358***	25.2	-202***	33.0	-135***	24.5	-7	25.8	24	23.7	-12	21.1	-188***	20.3
Female	-114,742***	30,504	-105,895**	42,516	-25,846	34,549	-92,275*	49,359	-83,757*	49,301	-35,324	43,142	-98,349*	53,585
Female x age	1,470***	434	1,377**	603	262	488	1,146	706	1,066	704	485	606	1,381*	757
Zero labour income	-972	4,545	17,927**	7,060	-5,213	5,400	6,226	7,247	-19,649***	6,943	-30,156***	6,906	-30,028***	8,696
Labour income (in \$1000s)	1,787***	82	3,080***	147	1,961***	77	2,228***	95	1,801***	78	1,685***	87	1,965***	85
Sample size	4,792		4,386		10,265		7,307		7,479		10,811		7,952	
Adjusted R <sup>2</sup>	0.314		0.298		0.307		0.357		0.356		0.367		0.469	

Notes: Ordinary Least Square estimates. 'x' denotes interaction terms. \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.

### 7.3. Appendix A.4 Imputed rent regression estimates

**Table A.4.1 Weekly imputed rent regression estimates (2005-06)**

	Gross imputed rent				Net imputed rent			
	(1)		(2)		(1)		(2)	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Tenure type (ref. is owner without a mortgage)								
Owner with a mortgage	-0.003	0.010			-0.198***	0.009		
Renter	-1.361***	0.095			0.450***	0.096		
Other	-0.048*	0.028			0.218***	0.023		
Has a mortgage	0.000		0.009	0.010			-0.274***	0.010
State of residence (ref. is NSW)								
VIC	-0.121***	0.012	-0.119***	0.012	-0.001	0.010	-0.003	0.010
QLD	-0.093***	0.012	-0.092***	0.012	0.004	0.010	0.006	0.010
SA	-0.205***	0.013	-0.204***	0.013	-0.046***	0.012	-0.049***	0.012
WA	-0.244***	0.013	-0.242***	0.013	-0.013	0.012	-0.017	0.012
Tas	-0.184***	0.016	-0.179***	0.016	-0.016	0.016	-0.021	0.016
ACT & NT	0.008	0.018	0.008	0.018	0.056***	0.013	0.057***	0.013
Area of residence (ref. is Capital city)								
Balance of State	-0.198***	0.009	-0.198***	0.009	-0.033***	0.008	-0.035***	0.008
Number of bedrooms	0.128***	0.005	0.131***	0.005	0.028***	0.004	0.025***	0.004
Household gross income decile (ref. is 1)								
2	-0.005	0.017	-0.001	0.017	-0.001	0.016	-0.004	0.016
3	-0.043**	0.017	-0.036**	0.017	-0.017	0.016	-0.026	0.016
4	-0.018	0.017	-0.019	0.017	-0.037**	0.016	-0.042***	0.016
5	0.001	0.018	0.000	0.018	-0.044***	0.016	-0.052***	0.016
6	0.004	0.018	0.005	0.018	-0.054***	0.016	-0.057***	0.016
7	-0.007	0.018	-0.011	0.018	-0.073***	0.016	-0.080***	0.016
8	0.015	0.018	0.012	0.019	-0.050***	0.016	-0.055***	0.016
9	0.051***	0.019	0.048**	0.019	-0.058***	0.016	-0.072***	0.016
10	0.109***	0.019	0.109***	0.019	-0.022	0.016	-0.042***	0.016
Landlord type (ref. is real estate agent)								
No landlord	3.962***	0.095	5.313***	0.013	2.311***	0.381	1.862***	0.379
State or territory housing authority								
Parent	5.140***	0.020	5.167***	0.020	1.596***	0.391	1.590***	0.379
Other person	5.300***	0.034	5.307***	0.035	1.423***	0.392	1.420***	0.380
Other	0.053***	0.019	0.058***	0.019	1.682***	0.419	1.621***	0.418
Other	3.941***	0.029	3.946***	0.029	1.492***	0.392	1.492***	0.380
Mortgage weekly repayments					-0.439***	0.005	-0.396***	0.006
Gross imputed rent					-1.636***	0.381	-1.170***	0.379
Sample size	9,857		9,857		9,857		9,857	
Adjusted R2	0.969		0.968		0.690		0.692	

Notes: Ordinary Least Square estimates. Model (1) is with tenure type, model (2) is without tenure type. In the net imputed rent models all variables are interacted with gross imputed rent, with the exception of mortgage weekly repayments and gross imputed rent. \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.

## Appendix B Supplementary results

**Table B.1 Mean pre-tax adult income by income group (1991-2018)**

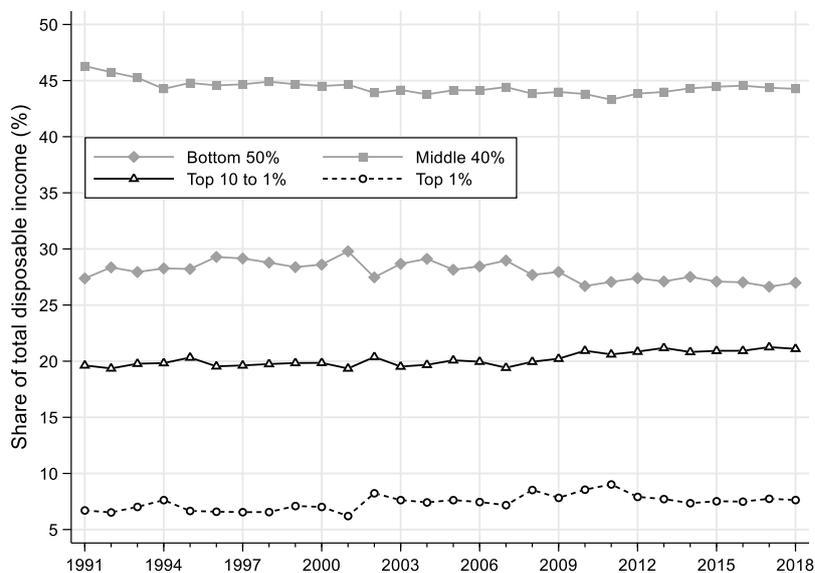
	Income group			
	Bottom 50%	Middle 40%	Top 10 to 1%	Top 1%
1991	10,013	30,648	58,783	169,100
1992	10,289	31,291	60,259	175,499
1993	10,636	32,764	64,370	196,357
1994	11,084	34,107	68,185	221,381
1995	11,692	35,641	73,267	202,231
1996	12,533	37,557	75,633	226,847
1997	12,912	39,501	80,180	235,179
1998	13,291	41,058	83,999	258,895
1999	13,473	42,555	87,500	288,690
2000	14,357	44,623	93,969	296,446
2001	15,482	46,751	95,708	316,357
2002	15,459	49,026	103,525	377,141
2003	16,939	51,013	106,557	385,189
2004	18,060	54,116	114,969	426,029
2005	18,360	56,517	122,063	465,367
2006	19,519	59,385	129,763	508,236
2007	21,555	63,744	137,523	579,936
2008	22,178	67,506	149,413	658,880
2009	23,340	69,213	154,368	608,444
2010	23,145	69,775	156,402	627,454
2011	25,031	74,690	167,475	676,721
2012	26,804	79,414	179,585	681,323
2013	26,907	81,104	186,167	681,091
2014	27,956	83,548	185,911	691,415
2015	27,753	84,544	185,858	680,138
2016	27,423	84,521	185,975	690,464
2017	28,735	87,256	195,381	742,157
2018	28,999	85,458	191,301	726,329

**Table B.2 Mean post-tax national adult income by income group (1991-2018)**

	Income group			
	Bottom 50%	Middle 40%	Top 10 to 1%	Top 1%
1991	13,001	22,375	38,129	107,408
1992	13,430	22,870	39,378	110,949
1993	14,086	24,247	43,168	128,571
1994	14,991	24,874	44,934	143,905
1995	15,234	25,520	46,582	127,939
1996	16,737	26,984	47,503	132,960
1997	17,866	28,639	50,016	138,993
1998	18,735	30,121	52,412	144,807
1999	19,744	31,514	54,829	160,736
2000	21,045	33,135	57,556	164,949
2001	21,510	33,907	58,578	155,909
2002	21,916	35,946	65,944	218,459
2003	24,030	37,935	65,865	208,598
2004	26,039	40,460	71,230	218,494
2005	26,978	42,846	76,056	234,364
2006	29,072	45,582	80,032	242,023
2007	32,064	49,871	85,126	253,757
2008	33,036	52,943	94,121	327,161
2009	33,103	55,263	102,685	331,948
2010	31,655	54,424	104,325	358,374
2011	35,053	58,858	112,007	407,937
2012	37,439	63,318	121,040	385,682
2013	38,549	65,168	125,530	381,280
2014	39,553	66,565	125,055	370,049
2015	39,451	66,945	125,563	375,964
2016	39,597	66,403	123,164	364,344
2017	42,797	71,912	135,213	407,720
2018	44,063	72,217	133,742	397,077

## Appendix C Results for post-tax disposable income

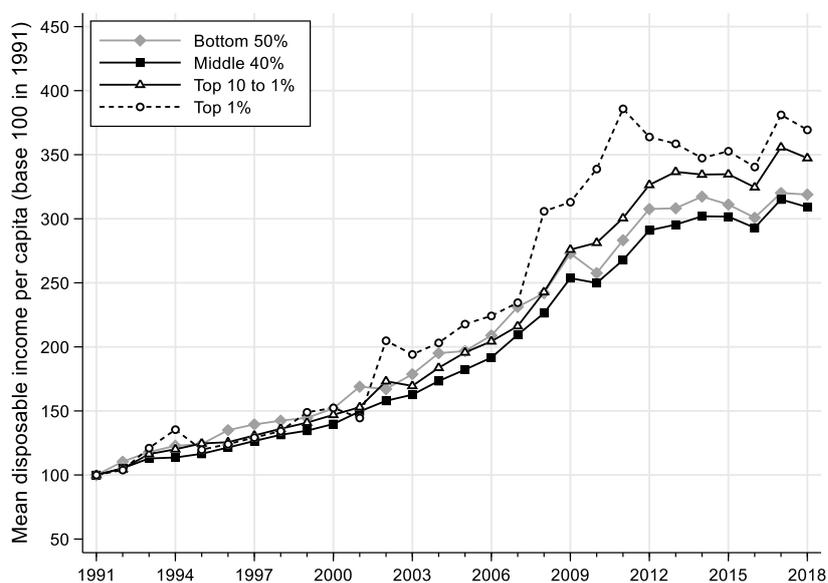
**Figure C.1 Income shares 1991-2018**



Notes: Distribution of post-tax disposable income (after all taxes and transfers) among adults. Equal-split-adults series (income of married couples divided by two).

*Stata graph net\_incsch\_a*

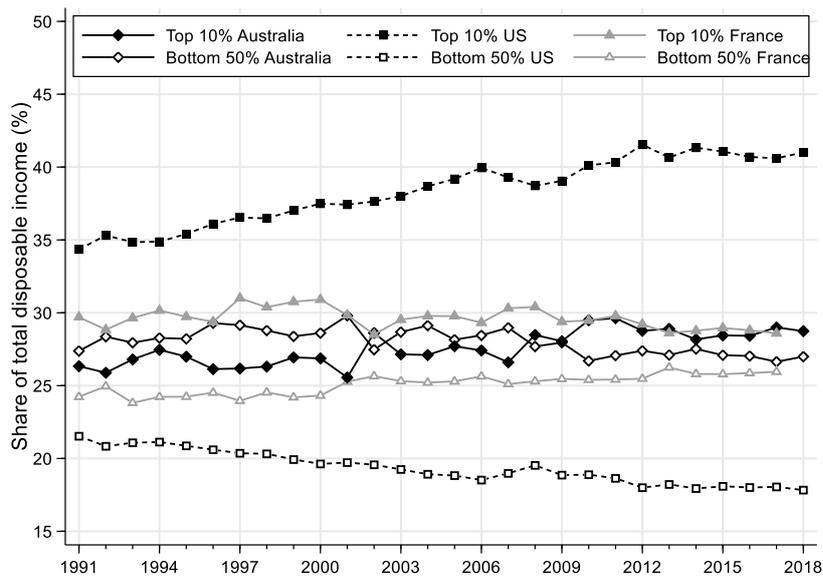
**Figure C.2 Mean adult income by income group 1991-2018**



Notes: Distribution of post-tax disposable income (before all taxes and transfers, except age pensions) among adults. Equal-split-adults series (income of married couples divided by two).

*Stata graph net\_mean\_index\_a*

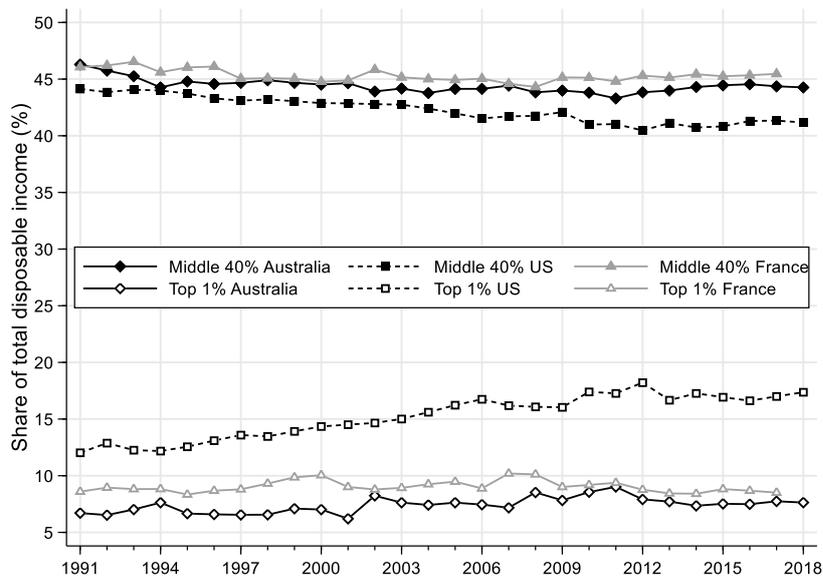
**Figure C.3 Top 10% and bottom 50% income shares: Australia, US and France 1991-2018**



Notes: Distribution of post-tax disposable income (after all taxes and transfers) among adults. Equal-split-adults series (income of married couples divided by two).

*Stata graph intcomp\_net\_sh1*

**Figure C.4 Top 1% and middle 40% income shares: Australia, US and France 1991-2018**



Notes: Distribution of post-tax disposable income (after all taxes and transfers) among adults. Equal-split-adults series (income of married couples divided by two).

*Stata graph intcomp\_net\_sh2*

**Table C.1 Mean post-tax disposable adult income by income group (1991-2018)**

	Income group			
	Bottom 50%	Middle 40%	Top 10 to 1%	Top 1%
1991	8,406	17,781	33,534	102,814
1992	9,279	18,719	35,227	106,799
1993	9,914	20,075	38,996	124,399
1994	10,321	20,204	40,264	139,235
1995	10,435	20,721	41,783	123,140
1996	11,348	21,595	42,115	127,571
1997	11,726	22,499	43,877	132,853
1998	11,969	23,355	45,646	138,042
1999	12,159	23,930	47,244	153,152
2000	12,772	24,862	49,283	156,676
2001	14,202	26,600	51,270	148,601
2002	14,047	28,076	58,075	210,590
2003	15,020	28,926	56,856	199,588
2004	16,401	30,823	61,592	208,857
2005	16,540	32,408	65,618	223,925
2006	17,563	34,073	68,522	230,513
2007	19,438	37,244	72,500	241,131
2008	20,341	40,248	81,425	314,466
2009	22,944	45,104	92,527	321,789
2010	21,655	44,424	94,325	348,374
2011	23,813	47,618	100,767	396,697
2012	25,861	51,739	109,462	374,103
2013	25,911	52,530	112,893	368,642
2014	26,675	53,687	112,177	357,170
2015	26,153	53,646	112,264	362,665
2016	25,289	52,095	108,856	350,035
2017	26,912	56,026	119,327	391,835
2018	26,810	54,963	116,489	379,823