Online Appendix

The UK's wealth distribution and characteristics of high-wealth households

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Appendix A: comparing the Wealth and Assets Survey with other datasets

A.1. Comparing total wealth

The Office for National Statistics (ONS) official estimate of total wealth in Great Britain 2016–18 is £14.6 trillion. Using our definition of wealth, which includes business assets and adjusts the value of physical wealth, we estimate total wealth in the Wealth and Assets Survey (WAS) at £14.4 trillion. Our concern is that this misses some wealth at the top, primarily due to survey under-coverage. In Section 4 of our paper, we describe our method for estimating this missing wealth by adding in wealth captured in the Sunday Times Rich List (STRL), and using a Pareto adjustment to impute any additional missing wealth. After adjusting for missing wealth, we estimate total wealth at £15.1 trillion.

These estimates are considerably higher than in external data sources. In the national accounts, personal sector net worth is just £10.0 trillion in 2017. Alvaredo, Atkinson and Morelli (2018), who estimate total wealth based on inheritance tax data, find £5.5 trillion of UK wealth in 2012. Extrapolating this forward to 2017, using annual growth in personal sector net worth from the national accounts, gives a total of £7.6 trillion in 2017. These discrepancies reflect differences in what is included and how this is measured. Table A1 compares each wealth component in our total with the corresponding component in the national accounts, though conceptual differences make such a comparison extremely difficult. The exclusion of physical wealth in the national accounts explains only a small proportion of the difference. Property wealth is around £1.2 trillion higher in the WAS relative to the national accounts, consistent with the finding that the WAS overestimates housing wealth relative to external house price indices (see Section 4.3). Below, we consider what happens to our standard and Pareto-adjusted estimates of total wealth and top shares when gross housing wealth is rescaled to correct for this overestimation.

The largest discrepancy between our estimates and the national accounts is in pension wealth, which is over £2 trillion higher in the WAS than in the national accounts. This is despite the fact that 'pension wealth' in the national accounts also includes the value of life insurance policies, which are a component of financial wealth in the WAS. In part, this discrepancy reflects differences in the types of pension included. The national accounts exclude unfunded defined benefit pensions paid by general government (including civil service pensions, for instance). However, this cannot fully explain the difference, as supplementary estimates indicate that these pensions were worth only £1.2 trillion in 2018.[1] A possible explanation for the variation is the different methods used to compute the value of defined benefit pensions and pensions in payment, which are much harder to value than wealth held in defined contribution pensions (see Section 3.3). The formulae used for valuing these types of pension in the WAS is highly sensitive to changes in annuity rates, which have fallen significantly since the

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[1] For more details on the pension wealth sources included in the core national accounts and supplementary estimates of excluded pension wealth see https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/pensionsinthenationalaccounts afullerpictureoftheuksfundedandunfundedpensionobligations/2018.

financial crisis. This has increased the value of pensions relative to the national accounts, where current annuity rates are just one input into a more detailed and comprehensive valuation procedure.

Excluding pension wealth from both data sources reduces our WAS total (before Pareto adjustment) to £8.3 trillion, and the national accounts total to £6.3 trillion. This is much closer to the estimate in Alvaredo et al. (2018), which excludes pension wealth. Below, we consider how our top share estimates compare to Alvaredo et al. (2018) when we exclude pension wealth from our definition.

Table A1. Total wealth in the WAS and the national accounts, £ trillion

	WAS total (our definition)	Pareto-adjusted WAS	National Accounts
Total	14.4	15.1	10.0
Property wealth (net)	5.1	5.1	3.9
Pension wealth	6.1	6.1	3.7
Financial wealth (net)	1.7	1.7	2.4
Business wealth	1.0	1.0	0.04
Physical wealth	0.5	0.5	N/A
Net STRL adjustment (add wealth captured in the STRL but not in the WAS)	N/A	0.4	
Pareto adjustment	N/A	0.4	N/A

Note: This table does not offer a full reconciliation of national accounts concepts with the WAS, as this is beyond the scope of this work. Our definition of 'business wealth' in the national accounts includes machinery and equipment, cultivated biological resources, intellectual property products, and inventories owned by unincorporated businesses that are not used for final consumption by households. This excludes assets held by incorporated businesses, the values of which are recorded in the household balance sheet as equities, and are included in financial wealth. Pension wealth in the national accounts also includes the value of insurance schemes, which are included under financial wealth in the WAS. In this table, we do not take a stance on how STRL wealth and additional Pareto wealth should be allocated across different asset classes. In Figure 16, we illustrate what the composition of wealth might look like if we assume all STRL and Pareto wealth reflects financial and business wealth.

Source: WAS; STRL; UK National Accounts.

A natural question to ask is, if total wealth in the WAS is already higher than in the national accounts after reconciling some of the obvious differences, what is this 'missing wealth' that we are allocating in our Pareto adjustment? Conceptual and methodological differences between the national accounts and survey data are endless, and reconciling these to understand how the figures compare when we actually compare like-for-like is an important task for future research. In the absence of such a reconciliation, it is possible that the missing wealth at the top that we estimate in our Pareto adjustment is indeed captured in the national accounts, but that the WAS also measures sources of household wealth that the national accounts are not trying to capture, or uses valuation methods that produce alternative, higher measures of household wealth.

We do not believe that the national accounts tell us the 'true' value of wealth that we would expect to find in the absence of any under-reporting or under-coverage using our WAS-based definition of wealth. Our WAS-based wealth total is, in fact, higher than total wealth as measured and defined in the national accounts. As a result, we have not taken the approach used by Credit Suisse,[2] who fit a Pareto distribution to the top tail but rescale total adjusted wealth to target the national accounts total. Nor do we attempt to match an external total for business wealth when adjusting on this measure, as no comparable total exists. Because the target wealth total is below observed total wealth, this approach effectively redistributes wealth from the bottom of the distribution to the top, while subtracting rather than adding anything to the total.

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[2] Davies, Lluberas and Shorrocks, 2019.

A.2. Top shares using alternative measures of wealth

In this section, we present some alternative estimates of the share of wealth at the top of the distribution in order to compare with Alvaredo et al. (2018). This is across two dimensions: (i) rescaling the value of housing wealth in order to match average house prices from Nationwide house price data;[3] and (ii) excluding pensions.[4]

Rescaling housing wealth has a small impact on top shares (Figure A1). Before adjusting for missing wealth at the top, the top 10 per cent (1 per cent) share rises (falls) by 1 percentage point in the period of overlap with Alvaredo et al. (2018). Their estimates are based on estates data, which presumably do not include overly optimistic estimates of housing wealth.

Figure A1. Share of net personal wealth held by richest 1 per cent and 10 per cent, rescaling housing wealth and including adjustments using the STRL: UK and GB
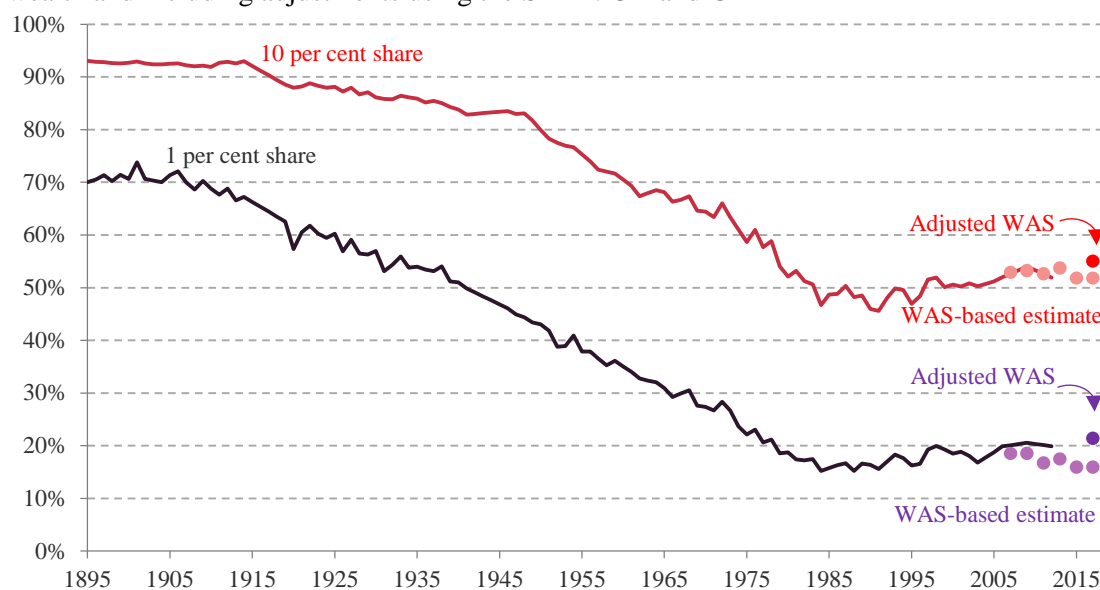
Note: Lines show World Inequality Database estimates, which are based on the whole of the UK. Dots show WAS-based estimates, which exclude Northern Ireland, and are based on scaling gross property wealth in the WAS down by the ratio of the WAS average house price in Round 5 and the contemporaneous average property price in Nationwide data. This equates to a reduction in gross property wealth by around 30 per cent.

Source: Alvaredo et al. (2018), obtained from the World Inequality Database, 2020; WAS; Nationwide; STRL.

Excluding pension wealth (Figure A2) raises our top shares significantly. In 2016–18, the top 1 per cent share was 26 per cent excluding pension wealth, compared to 18 per cent including pension wealth. This is not surprising, given that pension wealth is distributed more equally across the wealth distribution than other sources of wealth, such as financial and business wealth (see Figure 4). Excluding pension wealth also affects the trend in wealth concentration: top shares of non-pension wealth rose significantly between 2008 and 2014, from 23 per cent to 26 per cent for the top 1 per cent and 52 per cent to 58 per cent for the top 10 per cent, continuing the rise in wealth inequality observed since the early 1980s. This is before taking into account wealth at the top, which is missing from the WAS. Our Pareto-adjusted top shares for 2016–18 for the top 10 per cent (1 per cent) are 61 per cent (31 per cent).

In Figure A3, we combine the adjustments made to our wealth definition in the previous two graphs by rescaling housing wealth and excluding pensions. This definition is the most consistent with the wealth definition used in Alvaredo et al. (2018). Accordingly, we find that top shares using this

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[3] The average self-reported house price in the WAS is higher than average UK property prices in other data, for example, the data compiled by Nationwide. This means that housing wealth could be overvalued in the WAS, for example as a result of survey respondents overestimating the value of their own properties.

[4] The long-run comparison time series in these charts is compiled from inheritance tax data, which exclude pension wealth. WAS estimates might underestimate top wealth shares relative to the estimate based on IHT data because pension wealth is more evenly distributed than other forms of wealth.

definition line up closely with the top shares found in Alvaredo et al. (2018) during the years in which the series overlap. Again, these estimates suggest that the rise in inequality observed since the 1980s has not abated in recent years, and if anything has accelerated.

Figure A2. Share of net personal wealth held by richest 1 per cent and 10 per cent, excluding pensions and including adjustments using the STRL: UK and GB
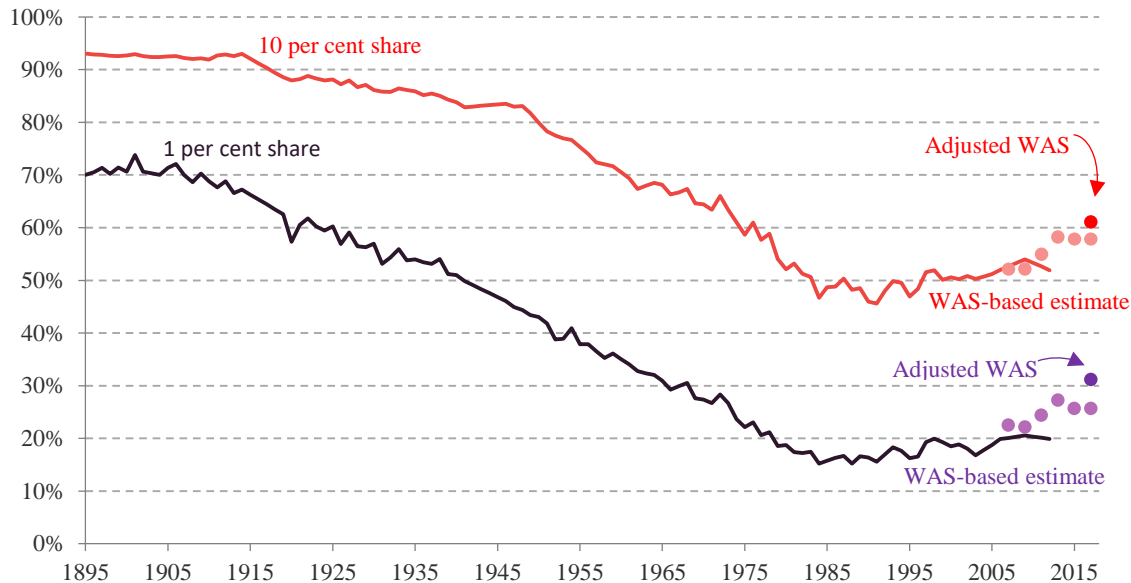

Note: Lines show World Inequality Database estimates, which are based on the whole of the UK. Dots show WAS-based estimates, which exclude Northern Ireland, and exclude all pension wealth, including pensions in payment, occupational and personal pensions.

Source: Alvaredo et al. (2018), obtained from the World Inequality Database, 2020; WAS; STRL.

Figure A3. Share of net personal wealth held by richest 1 per cent and 10 per cent, excluding pensions, rescaling housing wealth, and including adjustments using the STRL: UK and GB
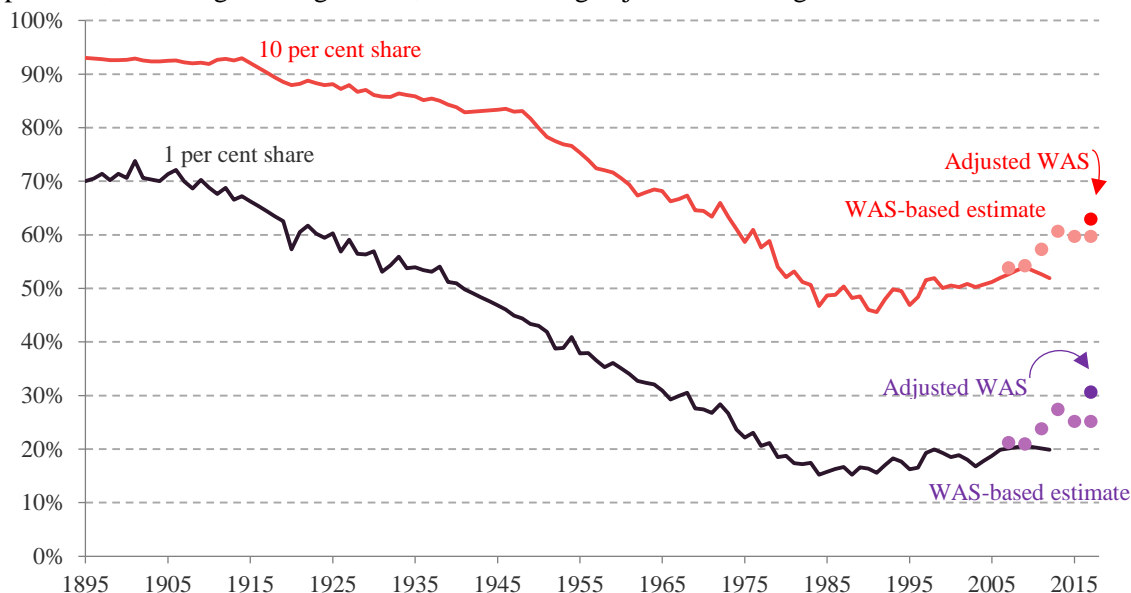
Note: Lines show World Inequality Database estimates, which are based on the whole of the UK. Dots show WAS-based estimates, which exclude Northern Ireland, and are based on scaling down gross property wealth in the WAS by the ratio of the WAS average house price in Round 5 and the contemporaneous average property price in Nationwide data. This equates to a reduction in gross property wealth by around 30 per cent. The WAS estimates exclude all pension wealth, including pensions in payment, occupational and personal pensions.

Source: Alvaredo et al. (2018), obtained from the World Inequality Database, 2020; WAS; Nationwide; STRL.

Appendix B: inequality in wealth – individual-level estimates

In this appendix we reproduce some of the distributional analysis presented in the main body of the paper (Section 3) using individuals as our unit of analysis, rather than family units.
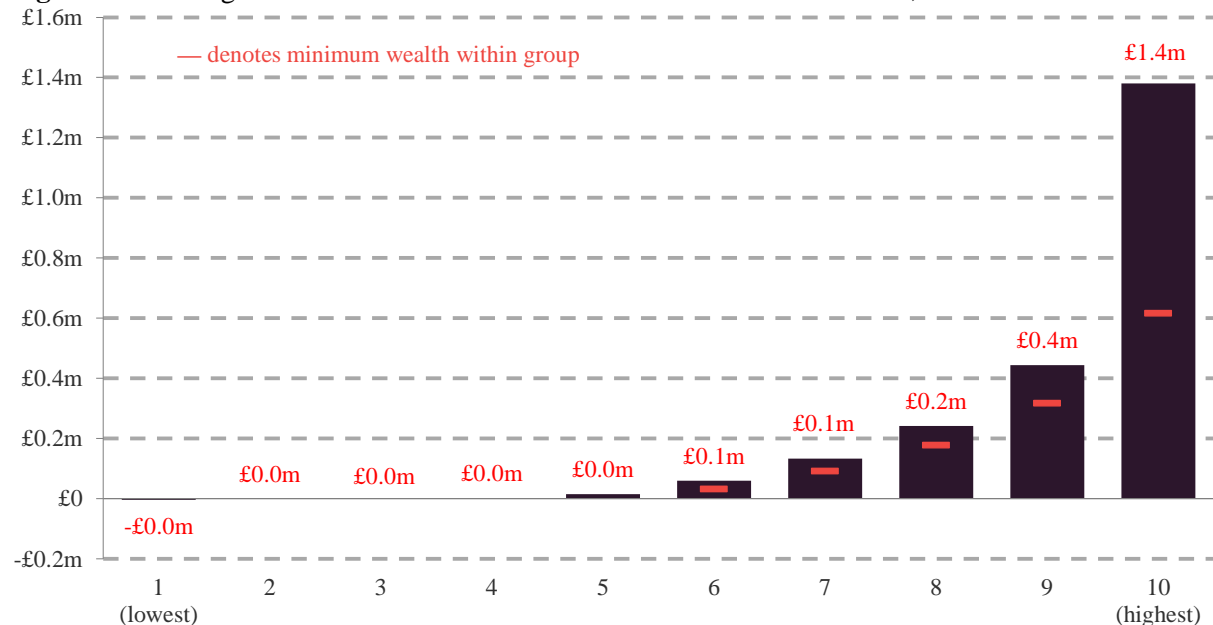
Figure B1. Share of total net individual wealth by each net wealth decile since 2006–08: GB
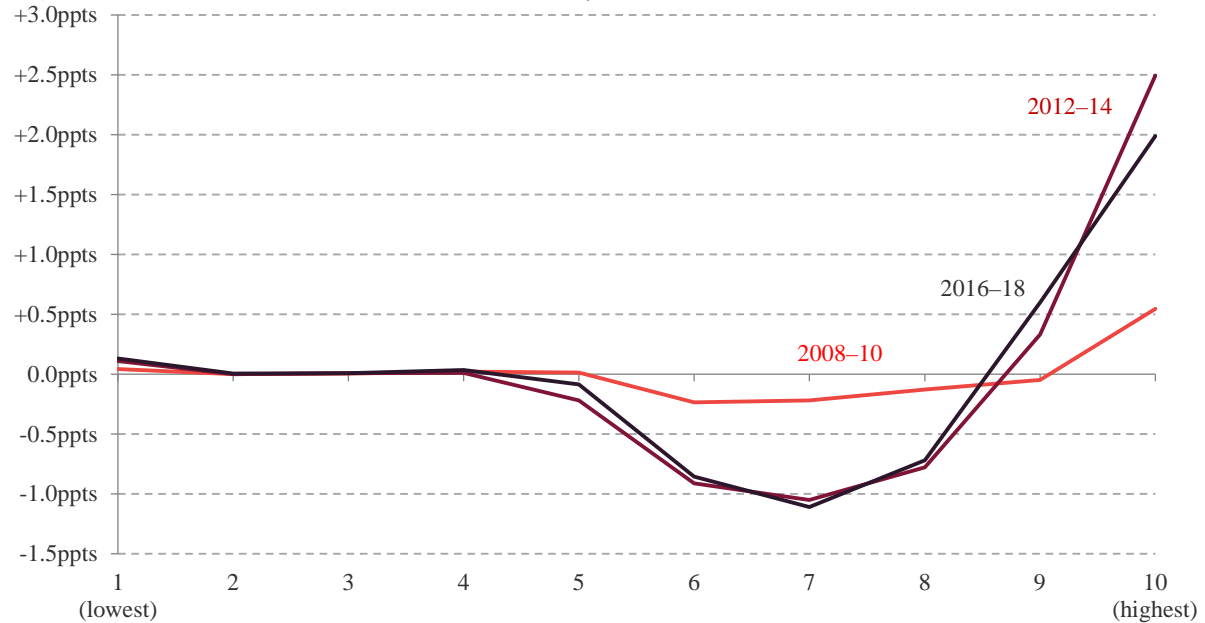
Note: Wealth is measured at the individual level. Total wealth includes net financial assets, net property assets, pension assets, and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc). Private business assets are excluded due to material improvements in the coverage of these assets since the early rounds of the survey making cross-round comparisons difficult.

Source: WAS.

Figure B2. Average net individual wealth within each net wealth decile: GB, 2016–18

Note: Wealth is measured at the individual level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).
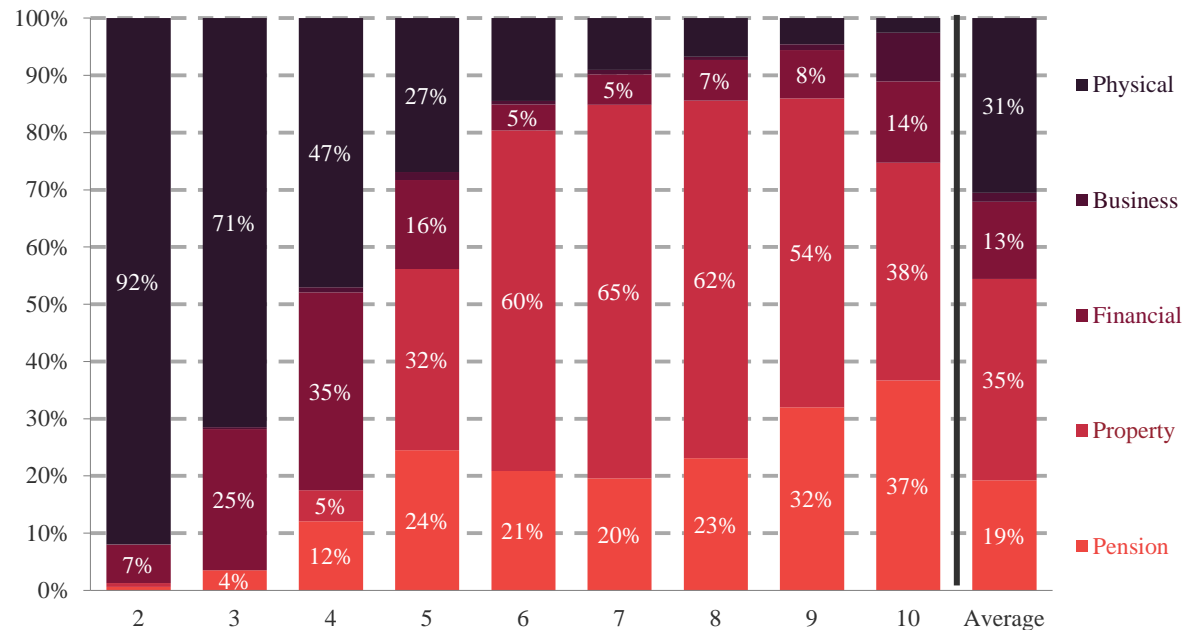
Source: WAS.

Figure B3. Average net individual wealth within each net wealth percentile for the wealthiest 10 per cent: GB, 2016–18

Note: Wealth is measured at the individual level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).

Source: WAS.

Figure B4. Average share of total net wealth contributed from different asset classes by individual net wealth decile: GB, 2016–18


Note: Individuals are allocated to deciles based on wealth measured at individual level. The lowest decile is excluded as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities.

Source: WAS.

Appendix C: inequality in wealth – household-level estimates

In this appendix, we reproduce some of the distributional analysis presented in the main body of the paper (Section 3) using households as our unit of analysis, rather than family units.
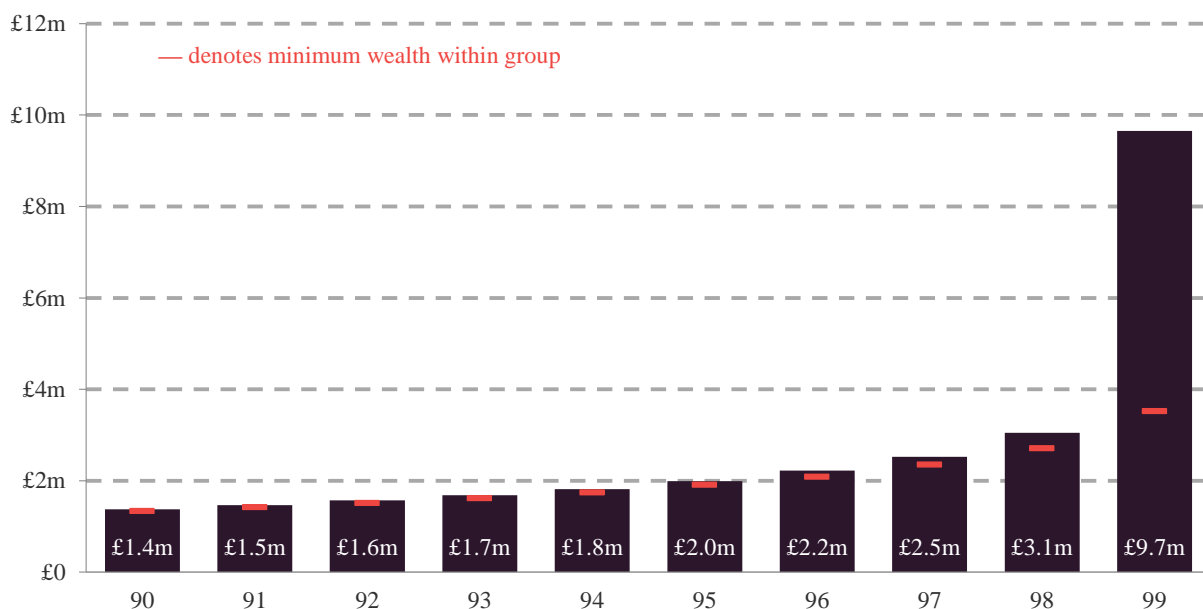
Figure C1. Average net household wealth within each net wealth decile: GB, 2016–18
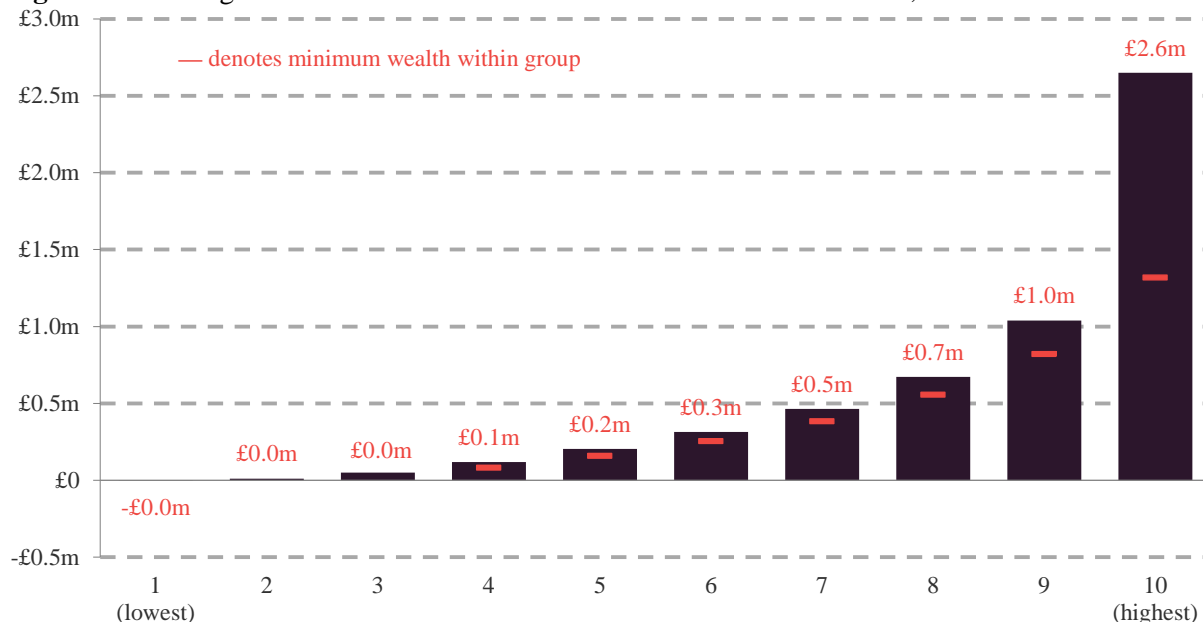
Note: Wealth is measured at the household level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).
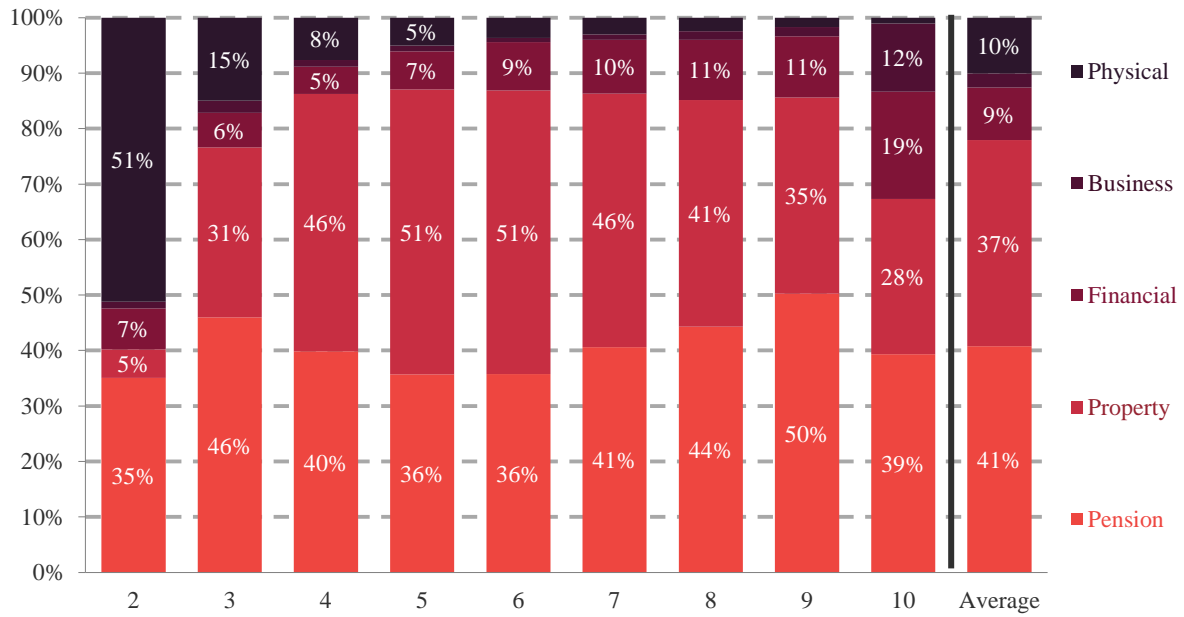
Source: WAS.

Figure C2. Average net household wealth within each net wealth percentile for the wealthiest 10 per cent: GB, 2016–18

Note: Wealth is measured at the household level. Total wealth includes net financial assets, net property assets, pension assets, business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).

Source: WAS.

Figure C3. Average share of total net wealth contributed from different asset classes by household net wealth decile: GB, 2016–18

Note: The lowest decile is excluded, as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities.

Source: WAS.

Appendix D: inequality in wealth – family-level estimates excluding main residential property wealth and pension wealth

In this appendix, we reproduce some of the distributional analysis presented in the body of the paper (Section 3) using a modified definition of wealth which excludes main residential property and/or pension wealth.
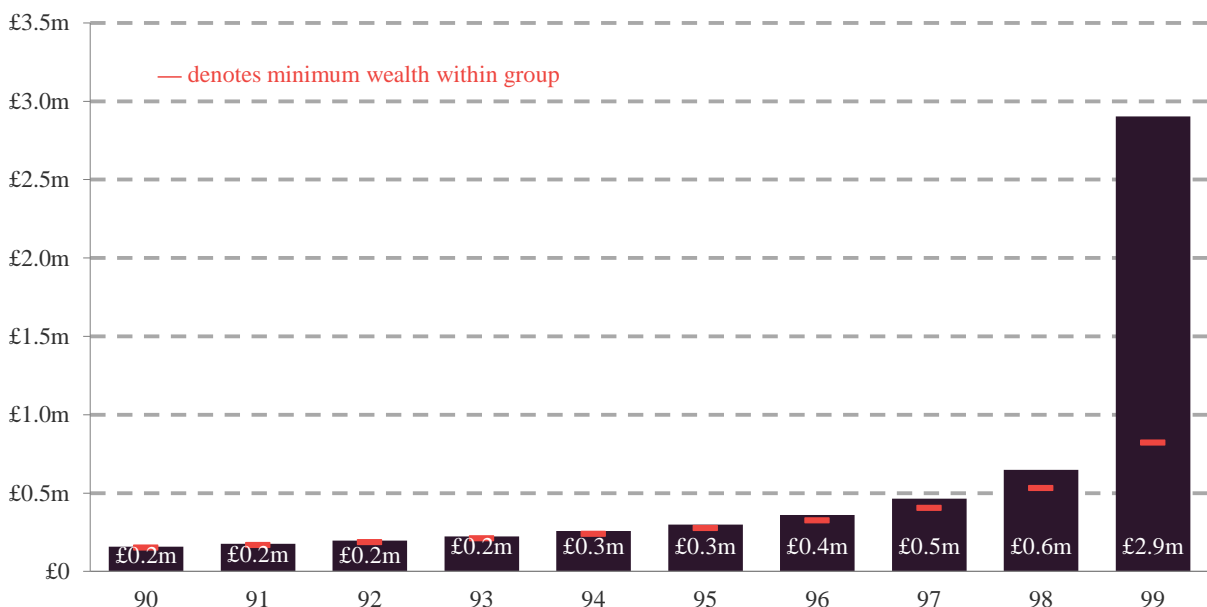
Figure D1. Average net wealth per adult per family within each net wealth decile: GB, 2016–18
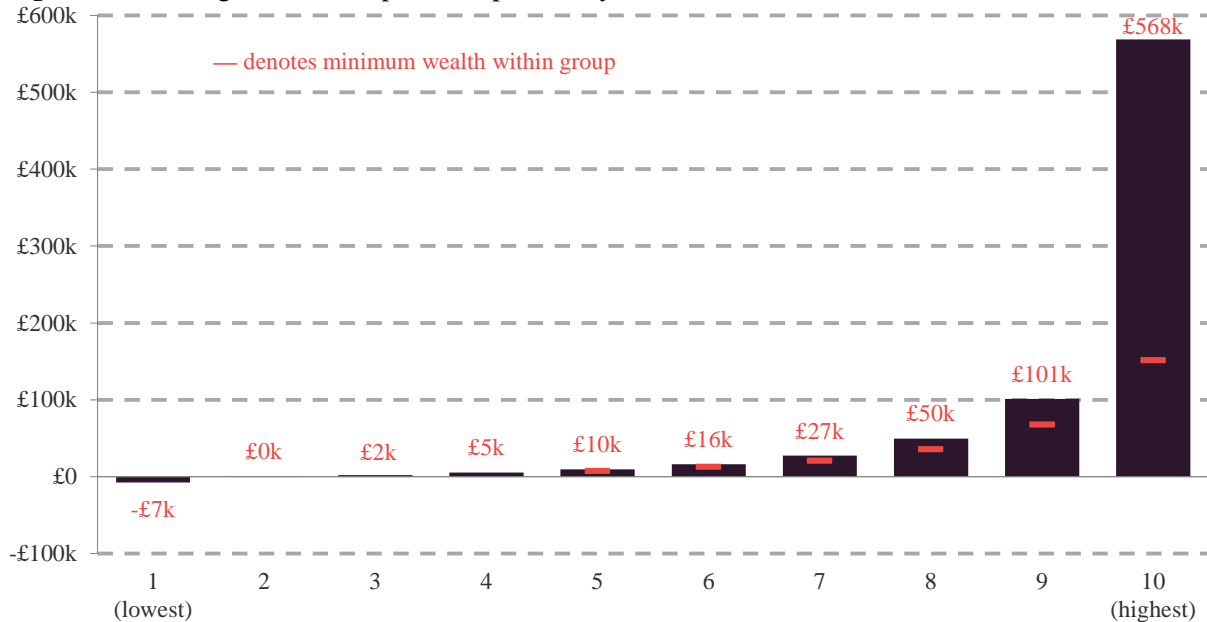
Note: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets (excluding primary residence and any mortgage attached to it), business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).

Source: WAS.

Figure D2. Average net wealth per adult per family within each net wealth percentile for the wealthiest 10 per cent: GB, 2016–18

Note: Wealth is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets (excluding primary residence and any mortgage attached to it), business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).

Source: WAS.

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Figure D3. Average share of total net wealth, excluding primary residences and pensions, contributed from different asset classes by family net wealth decile: GB, 2016–18
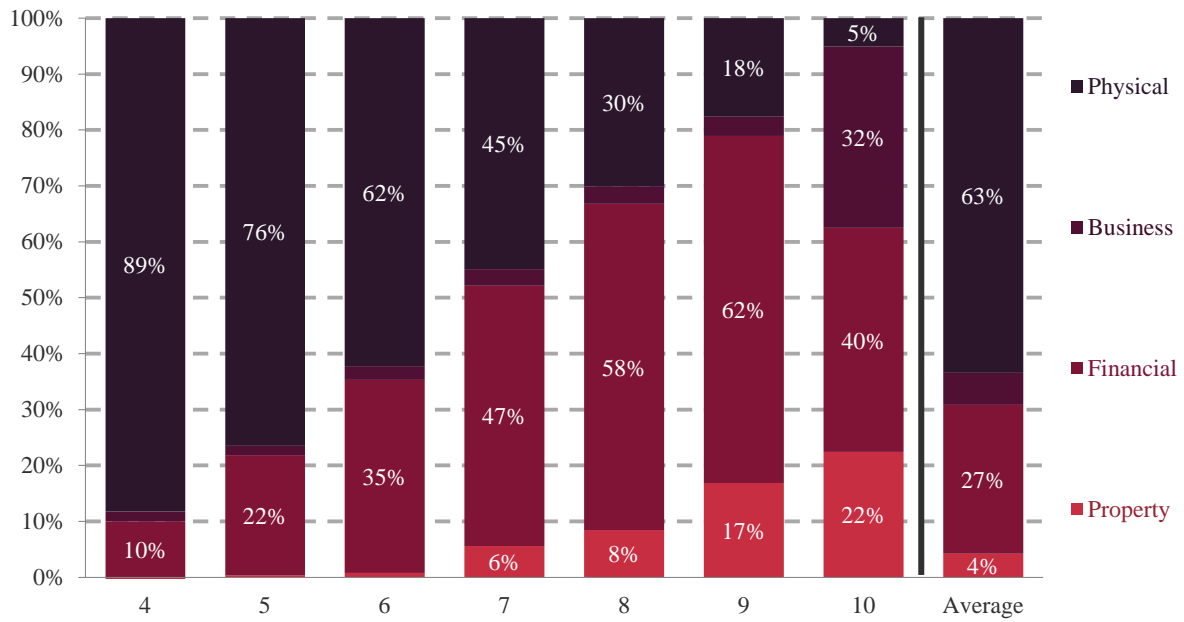

Note: The lowest three deciles are excluded as net wealth is negative for some components are negative. Property wealth here is measured for non-primary residence properties net of their mortgage debt and financial wealth is net of other financial liabilities. Pension wealth is excluded.

Source: WAS.

Appendix E: characteristics of high-wealth families excluding main property and pension wealth

In this appendix, we present evidence on the characteristics of high-wealth families as in the main body of the paper (Section 3.4) using an alternative definition of wealth that excludes main residential property and pension wealth.
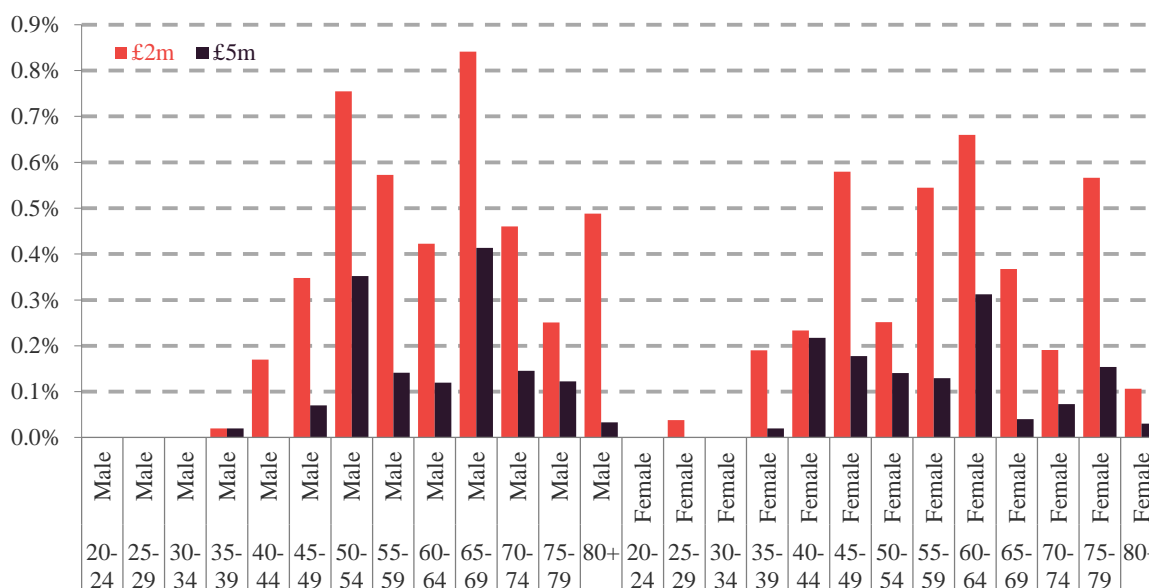
Figure E1. Share of age and sex groups that live in high-wealth families (above £250,000 per adult): GB 2016–18
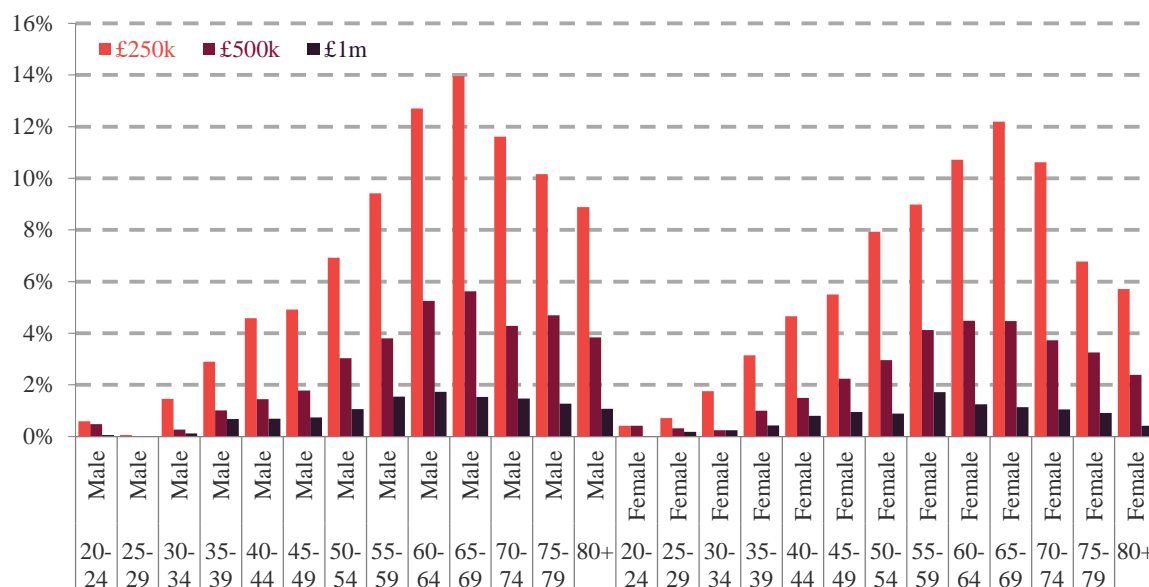
Note: Wealth thresholds are measured as total wealth per adult within the family. Wealth is measured excluding net wealth from the primary residence and pension wealth.

Source: WAS.

Figure E2. Share of age and sex groups that live in high-wealth families (above £2 million per adult): GB 2016–18

Note: Wealth thresholds are measured as total wealth per adult within the family. Wealth is measured excluding net wealth from the primary residence and pension wealth.
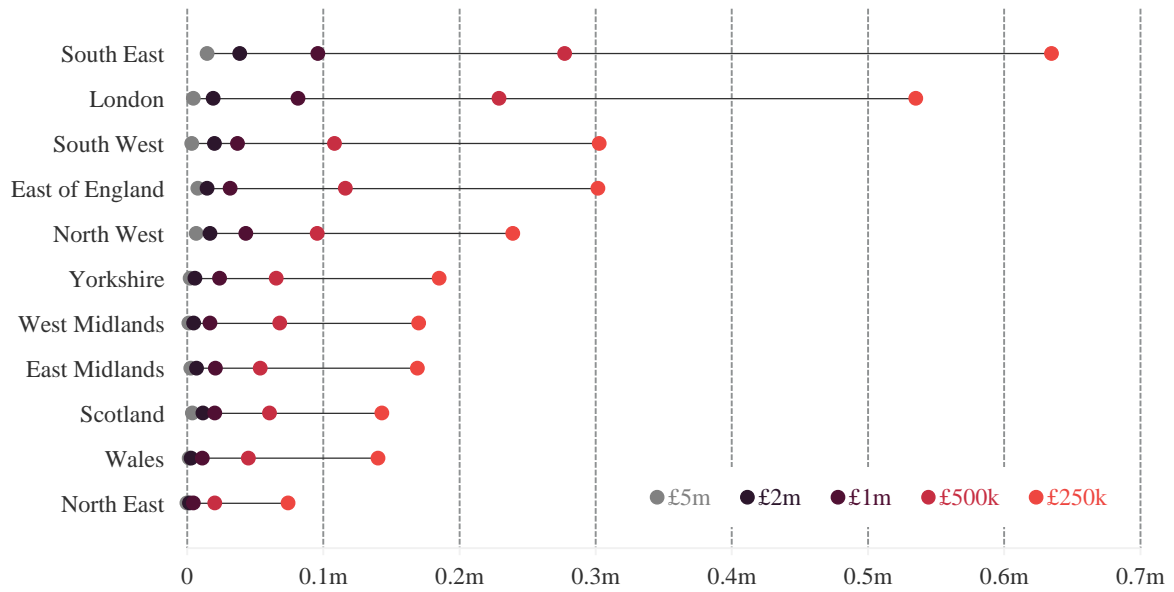
Source: WAS.

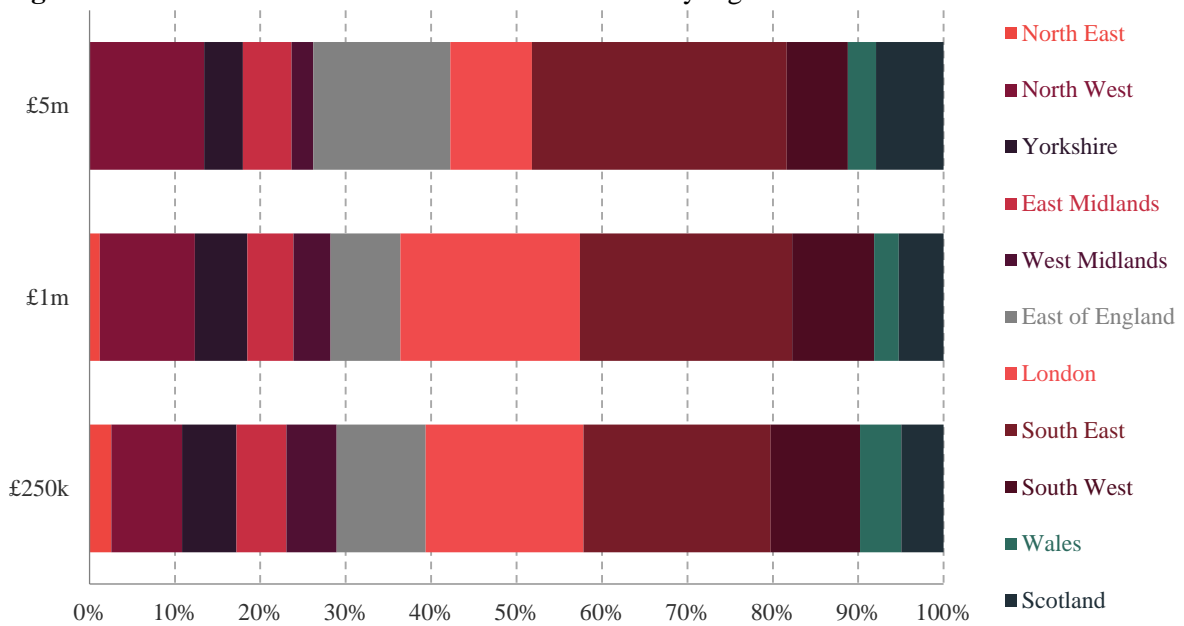**Figure E3**. Number of high-wealth individuals by threshold level, calculated at the family level: GB, 2016–18

Note: Wealth is measured excluding net wealth from the primary residence and pension wealth.
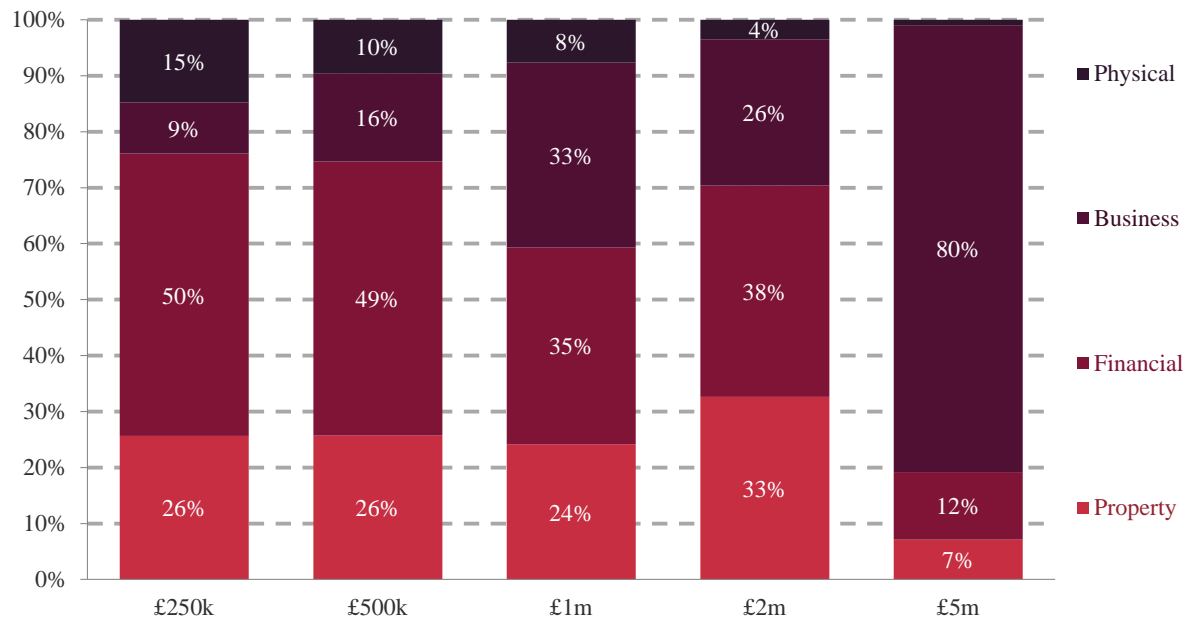
Source: WAS.

Figure E4. Share of all families above wealth threshold by region: GB 2016–18

Note: Wealth is measured excluding net wealth from the primary residence and pension wealth.

Source: WAS.

Figure E5. Composition of net wealth by groups captured by each threshold: GB, 2016–18

Note: Wealth is measured excluding net wealth from the primary residence and pension wealth. It is measured at the family level – single or couple adults and any dependent children within a household. Total wealth includes net financial assets, net property assets (excluding net wealth from the primary residence), business assets and an adjusted measure of physical wealth (including cars, home contents, collectibles, etc.).

Source: WAS.

Appendix F: relationship between age and wealth

In this appendix, we present some additional evidence on the relationship between age and wealth, and the distribution of wealth among those at the peak of their life cycle of wealth accumulation.

Table F1 shows where in the distribution an individual who is aged 40–44 with median family wealth (£126,000) would be if we were to place them in the wealth distribution for a different age group. This highlights the fact that what is considered 'typical wealth' for someone aged 40–44 would be 'high wealth' for someone a decade or two younger, and 'low wealth' for someone a decade or two older. This pattern reflects the life-cycle evolution of wealth holdings: people accumulate wealth during the early stages of their working lives, and decumulate in retirement.

Table F1. Where in the conditional wealth distribution, conditioning on age group, an individual aged 40–44 with median family wealth would be

Age	Percentile of distribution that matches 40–44 median
20–24	99
25–29	93
30–34	80
35–39	64
40–44	50
45–49	40
50–54	35
55–59	28
60–64	24

Note: Wealth is measured at the family level, and percentiles are defined relative to the number of families.

Source: WAS.

To better understand the distribution of lifetime resources, it is instructive to look at the distribution of wealth among individuals at the peak of the accumulation phase, immediately before retirement; at this point, measured wealth provides a better indication of the total amount of resources available to individuals over their life cycle, which is likely to be a good proxy for welfare. This group is also likely to pay a disproportionately large share of any wealth tax (as well as other capital taxes), so it is particularly policy-relevant.[5] An important caveat here is that wealth accumulation among younger cohorts is much lower than it was for the individuals aged 55–65 in our sample, so it is not clear how stable these patterns will be over time.[6]

Figure F1 shows the composition of wealth by asset class across the wealth distribution, as per Figure 4, focusing on adults in the pre-retirement phase (aged 55–64). Unsurprisingly, pension and property wealth account for a much larger share of wealth for this age group (89 per cent) than for the population as a whole (69 per cent), while the role of physical assets diminishes (in relative terms). Unlike the general population, those at the lower end of the distribution of adults aged 55–64 have accumulated a significant proportion of their wealth in property, this being the dominant asset among those in the third and fourth deciles. This is likely to reflect a combination of the life-cycle accumulation of wealth, as well as higher rates of homeownership among older cohorts.

Strikingly, throughout much of the distribution, adults aged 55–64 hold a consistent share of their wealth in a combination of pensions and property (around 90 per cent), with the role of pensions in that mix becoming more important higher up the distribution. It is only in the top decile of this age group that financial and business wealth start to become more important, accounting for 20 per cent of wealth.

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[5] Advani, Hughson and Tarrant, 2021.
[6] Bourquin, Joyce and Sturrock, 2020.

Figure F2 illustrates the geographical distribution of high-wealth individuals in the 55–64 age range. The pattern is broadly the same as for the population as a whole (Figure 12), with the exception of individuals with wealth above £5m, where those aged 55-64 are much more likely to live in London compared to other individuals with the same level of wealth.

Figure F1. Average share of total net wealth contributed from different asset classes by family net wealth decile, adults aged 55–64: GB, 2016–18
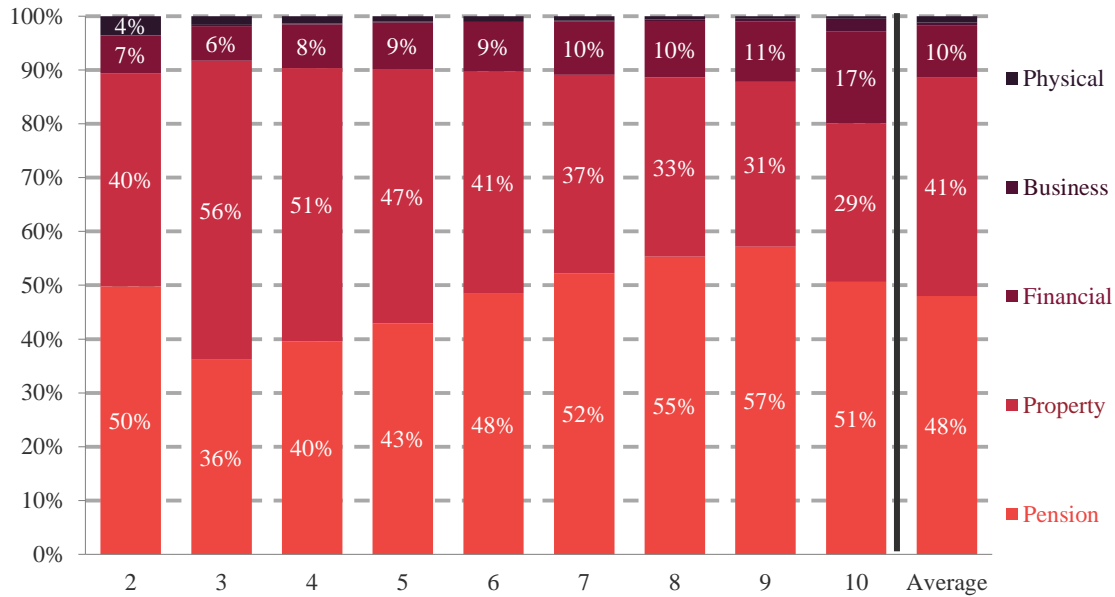
Note: Individuals are allocated to deciles based on wealth measured at family level. The lowest decile is excluded as net wealth is negative. Property wealth here is measured net of mortgage debt and financial wealth is net of other financial liabilities.

Source: WAS.

Figure F2. Share of all families above wealth threshold by region, individuals aged 55–64: GB 2016–18
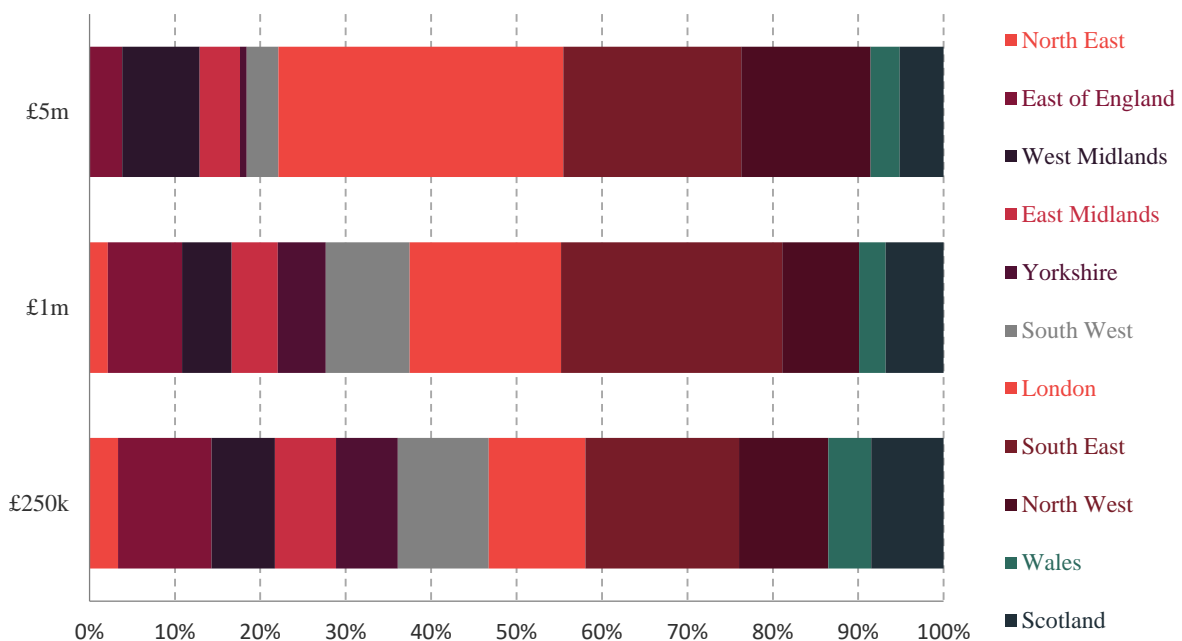
Note: Wealth thresholds are measured as total wealth per adult within the family.

Source: WAS.

Appendix G: sensitivity of Pareto estimation to alternative thresholds and definitions

As discussed in Section 4, there are two key challenges in estimating the Pareto distribution that underlies the top tail of the wealth distribution: first, accounting for the difference in definition/coverage of wealth between the WAS and the STRL; second, identifying the appropriate threshold above which the true wealth distribution in the UK can be approximated with a Pareto distribution. This appendix presents sensitivity analysis for both of these issues.

Figures G1 and G2 present alternative definitions of wealth in the WAS combined with the STRL and the fitted Pareto distribution. Figure G1 restricts wealth in the WAS to only private business wealth as we can be confident that this is captured in the STRL because this forms the key input to many top-wealth families' assets. Figure G2 takes the opposite approach and includes all wealth identified in the WAS. The definition of wealth used in the main body of the paper remains our preferred specification, given the coverage of the STRL. However, these results show that the Pareto distribution is a reasonably good approximation regardless of WAS wealth definition.

Finally, Table G1 tabulates the resulting estimate of wealth missing from the WAS and STRL samples, based on the fitted Pareto distribution generated under different wealth definitions and thresholds. We observe that the Pareto index is considerably lower when estimated using business (and financial) assets than when total wealth is used. This is partly because the former is much more concentrated than the latter.

In estimating total wealth, we sum up the predicted values of wealth for each observation in the data, according to the fitted Pareto distribution. An alternative method would be to calculate the total top tail wealth implied by the form and parameters of the Pareto distribution, which is given by $N \cdot \alpha/(\alpha - 1) \cdot w_{min}$, where N is the sum of household weights above the Pareto threshold and $\alpha/(\alpha - 1) \cdot w_{min}$ is the average wealth above the threshold, for $\alpha > 1$. However, for $\alpha < 1$, as in our case, a finite solution for the mean does not exist, and so we adopt an empirical approach to estimating the total wealth expected to be held by those in the top tail. Even for α above but close to one, the two approaches can yield very different results. This is because low values of α imply that wealth is highly concentrated, and hence fitted Pareto distributions can imply that a significant – and often implausible – proportion of wealth in the top tail is held by individuals with wealth far exceeding the maximum value observed in the data. This is an important issue to consider in using Pareto methods to estimate the top tail of the wealth distribution.

As discussed in Section 4 of the paper, the Pareto adjustment results are very sensitive to the definition of wealth, and to a lesser extent also sensitive to the threshold above which the true underlying wealth distribution matches a Pareto distribution. This table provides an indication of that sensitivity as well as the key estimation statistic – the Pareto index alpha – which should be stable at the appropriate cut-off threshold.[7] As the table shows, there is no clear indication of the appropriate threshold when total household wealth is used. With our preferred measure of business wealth, the choice of threshold makes very little difference to the Pareto index.

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[7] Vermeulen, 2018.

Figure G1. Estimated Pareto distribution using WAS business assets and the STRL (lower-bound threshold of £1 million)
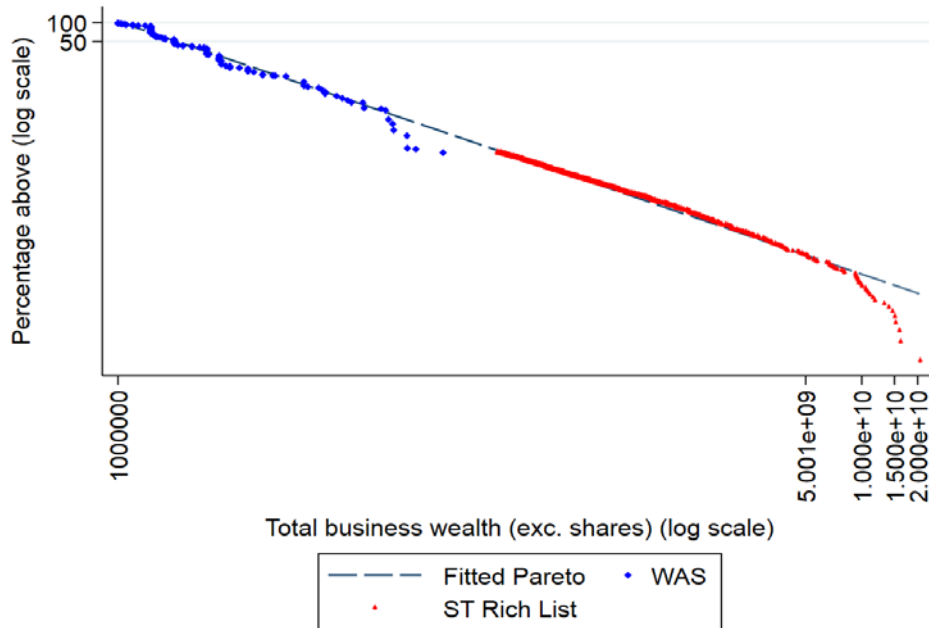
Note: Estimation suggests there is missing wealth in WAS/STRL relative to the fitted Pareto distribution amounting to £470 billion.

Source: WAS; STRL.

Figure G2. Estimated Pareto distribution using WAS measure of total wealth and the STRL (lower-bound threshold £1 million)
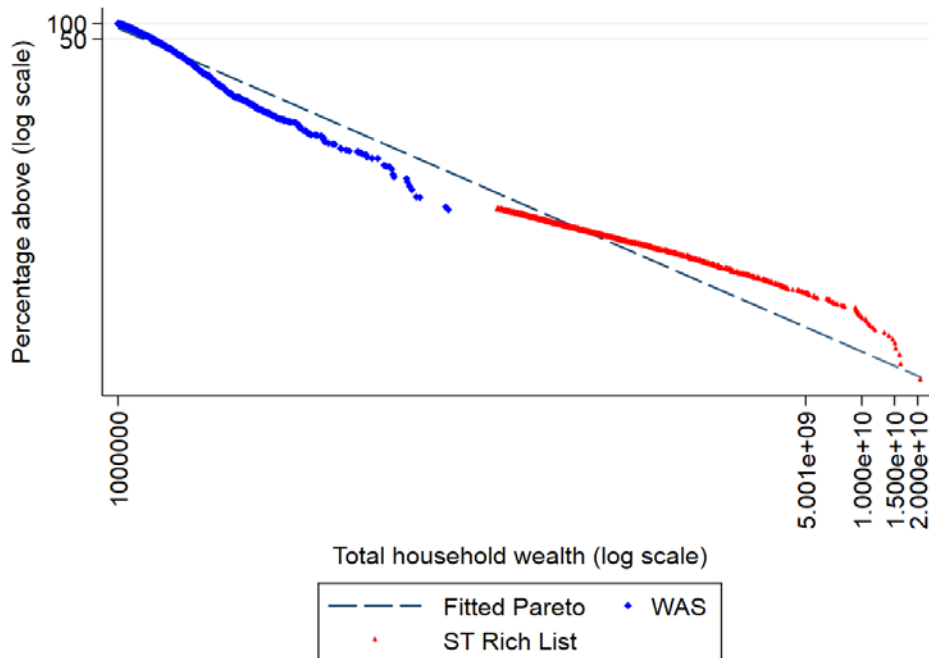
Note: Estimation suggests there is missing wealth in WAS/STRL relative to the fitted Pareto distribution amounting to £950 billion.

Source: WAS; STRL.

Table G1. Summary results from Pareto adjustment based on different threshold levels and definitions of wealth

Threshold	Definition of WAS wealth	Additional wealth	Pareto index alpha
500k	Business and financial	+£330 billion	0.98
1m	Business and financial	+£360 billion	0.97
2m	Business and financial	+£400 billion	0.97
3m	Business and financial	+£430 billion	0.98
4m	Business and financial	+£440 billion	0.99
5m	Business and financial	+£440 billion	0.99
500k	Business assets only	+£460 billion	0.93
1m	Business assets only	+£470 billion	0.94
2m	Business assets only	+£490 billion	0.97
3m	Business assets only	+£490 billion	0.98
4m	Business assets only	+£480 billion	0.99
5m	Business assets only	+£470 billion	0.99
500k	Total wealth	+£1.0 trillion	1.57
1m	Total wealth	+£950 billion	1.56
2m	Total wealth	+£220 billion	1.45
3m	Total wealth	-£150 billion	1.32
4m	Total wealth	-£250 billion	1.20
5m	Total wealth	-£230 billion	1.14
6m	Total wealth	-£170 billion	1.10
7m	Total wealth	-£90 billion	1.07
8m	Total wealth	-£50 billion	1.05
9m	Total wealth	£0 billion	1.04

Note: Estimates of additional wealth are similar across different thresholds using our preferred definition of business wealth including shares. Excluding shares does not have a significant effect on the estimates. Estimates based on total wealth are notably different and relatively more unstable when different thresholds are used.

Source: WAS; STRL.

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