Understanding Society

Working Paper Series

No. 2019 – 07

July 2019

Household Income Volatility in the UK, 2009-2017

Silvia Avram[1]
Mike Brewer[1]
Paul Fisher[1]
Laura Fumagalli[1]

[1]University of Essex

Understanding Society
THE UK HOUSEHOLD LONGITUDINAL STUDY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Non-technical summary

The amount of risk and uncertainty faced by individuals is an important question both for understanding individual economic behaviours. Given that most individuals are risk-averse and that self-insurance is infeasible for many, an increase in risk and uncertainty has negative consequences for individual welfare. Income instability, or the extent to which individuals experience sizable income swings, has usually been interpreted as a proxy for risk and insecurity, and there are associations between income instability and clinical depression, poor health, food insecurity, mortgage delinquency, reduced educational achievement of children, poorer child health outcomes, and problem behaviour in adolescents and children.

This paper estimates instability or volatility in individual and household incomes in the UK between 2009 and 2017 using data from the first 8 waves of Understanding Society. We examine volatility not just in individual earnings but also in household disposable income, and how labour income, income from non-labour but private sources, and income from transfers and taxes affect it. This allows us also to examine the extent to which the tax-benefit system stabilizes incomes, and how this changed through the period of 'austerity' and benefit cuts.

In line with previous work, we find that volatility of household labour income is always lower than that of individual labour income, suggesting that other household members provides some insurance against swings in one's own earnings. Taxes and transfers reduce volatility significantly, with most of the impact due to social security cash benefits or income-dependent refundable tax credits. These reduce around a quarter of the volatility of household private income for the working age and 40 percent for those aged 60 or over. Across the period, there is a decline in volatility. For the working-age, this is driven by a falling volatility of individuals' own earnings; for those aged 60 or over, by a falling volatility of private unearned income. On the other hand, taxes and benefits became less well correlated with earnings, and became a less important component of disposable income, both of which have limited their ability to counteract swings in labour income.

Household Income Volatility in the UK, 2009-2017[1]

Silvia Avram, Mike Brewer, Paul Fisher and Laura Fumagalli[2]

Abstract: We study the volatility of individual- and household-level income in the UK between 2009 and 2017 using data from a large longitudinal household panel survey. The volatility of earnings for the working-age has fallen in this period, largely due to a fall in the prevalence of large negative earnings shocks. For older aged individuals, we also find a large fall in the volatility of private income, mainly as a result of a fall in large positive income shocks. The tax and benefit system significantly reduces volatility, especially for household containing older individuals. We find evidence that the tax and benefit system has become less well equipped to counteract swings in labour income, but the most important reason why disposable income volatility has fallen over this period is changes to the volatility of employment.

Key words: income volatility, income risk, taxes, transfers, insurance, recession, austerity, longitudinal data

[1] The authors are grateful for funding from the UK Economic and Social Research Council (award no. ES/K005146/1) for "Understanding Society: the UK Household Longitudinal Study, phase 3." and for the Research Centre on Micro-Social Change (MiSoC) at the University of Essex (award number ES/L009153/1). Understanding Society is an initiative funded by the Economic and Social Research Council and various Government Departments, with scientific leadership by the Institute for Social and Economic Research, University of Essex, and survey delivery by NatCen Social Research and Kantar Public. The research data are distributed by the UK Data Service.

[2] All authors are from the University of Essex. Brewer is also a Research Fellow at the Institute for Fiscal Studies. Correspondence to: mbrewer@essex.ac.uk.

1. Introduction

The amount of risk and uncertainty faced by individuals and households is an important economic question both for understanding individual economic behaviours and for the welfare consequences. Given that most individuals are risk-averse and that self-insurance is unlikely or infeasible for many, an increase in risk and uncertainty has negative consequences for individual welfare. Income instability, defined as the extent to which individuals and households experience sizable income swings, has usually been interpreted as a proxy for risk and insecurity (Dynan et al., 2012, Jensen and Shore, 2015). Previous studies have documented an association between income instability and clinical depression (Prause et al., 2009), poor health (Halliday, 2007), food insecurity (Dahl et al., 2014, Leete and Bania, 2010), mortgage delinquency (Diaz-Serrano, 2005), reduced educational achievement of children (Hardy, 2014), poorer child health outcomes (Wolf and Morrissey, 2017), and problem behaviour in adolescents and children (Gennetian et al., 2015, Hill et al., 2013).

The vast majority of the literature on income instability focuses on the US (e.g. (Gottschalk and Moffitt, 2009, Bania and Leete, 2009, Dahl et al., 2011, Dynan et al., 2012, Ziliak et al., 2011, Gosselin and Zimmerman, 2008, Shin and Solon, 2011). Whereas the exact estimates differ somewhat depending on data and methodology, most indicate a substantial rise in the instability of (male) earnings between the 1970s and the 1990s, as well as increased instability of household incomes. Low paid or low skilled workers typically experience higher levels of income instability and have been affected by increases in instability to a greater extent (Hill et al., 2017, Hannagan and Morduch, 2015). Major studies from outside the US (Chauvel and Hartung, 2014, Van Kerm, 2003, OECD, 2011, Daly and Valletta, 2008) show similar findings.

The evidence on trends in earnings and income instability in the UK is much sparser and less conclusive. Early work using pseudo-panels and administrative data suggests that earnings have become more unstable in the later part of the 1980s (Blundell and Preston, 1998, Dickens, 2000). More recent work using panel data is inconclusive. Jenkins and Cappellari (2014) compute the volatility of male and female earnings between 1991 and 2008 and conclude it has been constant during this period, whereas labour market volatility (i.e. including individuals with zero earnings) has fallen primarily due to stronger employment attachment. Blundell and Etheridge (2010) study the transitory variance (another measure of instability) of earnings and disposable income and conclude that while the former is flat, the latter is u-shaped falling in the early 1990s and rising subsequently. Finally, Jenkins (2011) examines trends both in income volatility and in the transitory variance of earnings and disposable income between 1991 and 2003. He concludes that there is no trend in the instability of earnings, especially among prime-aged male earners. Whereas volatility measures of disposable income also indicated no trend, the transitory variance measure fell slightly over the period. Bartels and Bönke (2013) find that the transitory variance of male earnings increased significantly between 1993 and 2004 but that of household net income remained flat. Finally, Daly and Valetta (2008) find that the transitory variance of male earnings increased in the early 1990s and fell subsequently.

We contribute to this literature by examining the levels and trends of volatility in the UK between 2009 and 2017. As far as we know, this is the first paper to examine the extent to which household disposable incomes in the UK have become more or less unstable since the Great Recession. To measure income instability, we use “volatility”, defined as the standard deviation of the arcpercentage annual change in income (see Section 3 for details). Following the literature, we start by examining individual earnings. We then look at volatility in

household disposable income, and how labour income, income from non-labour but private sources, and income from transfers and taxes affect it.

We also examine the extent to which the tax-benefit system is able to stabilize incomes in the event of a labour market exit shock. Previous work has found that the volatility of earnings is usually higher than that of household disposable income suggesting that other sources of income, in particular taxes and benefits, play an important role in mitigating earnings shocks. [3] Many transfer programs are explicitly designed to cushion incomes in case of adverse shocks to earnings generated by unemployment, ill-health or child birth. While not explicitly designed as insurance, progressive taxation also plays an important role in the intertemporal smoothing of incomes (Knieser and Ziliak, 2002, Varian, 1980). Several studies have suggested that part of the increase in income volatility in the US can be explained by welfare reforms that reduced the coverage and the generosity of US income support programs (Hardy and Ziliak, 2014, Hardy, 2016, Bania and Leete, 2009). Similarly, Jenkins (2011) suggests that different levels and trends in income volatility in the US and UK can be partly explained by the much stronger British safety net. Finally, a significant body of evidence points to the direct consumption stabilization effect of many transfers (Bronchetti, 2012, Gruber, 2000, Browning and Crossley, 2001, Gundersen and Ziliak, 2003). We are especially interested in examining the role of transfers and taxes in mitigating income volatility during this period given that is has often been described as one of 'austerity' and benefit cuts (DeAgostini et al., 2017, Cribb et al., 2018).

To estimate our volatility measures, we use data from the UK Household Longitudinal Study (UKHLS) known as "Understanding Society" (University of Essex et al., 2018). UKHLS began in 2009 with a sample of approximately 40,000 households, and seeks to interview all

[3] Figure 4 of Jenkins (2011) appears to show the opposite result, but is actually comparing volatility in household income of all individuals with volatility in earnings for prime-age men.

household members annually (see Knies, 2017 for more details). We use data from the first 8 waves; see Fisher et al. (2019) for more information about the income data.

Our findings are as follows. First, in line with previous work, we find that volatility of household labour income is always significantly below that of individual labour income for those of working age, suggesting that the labour income of other household members provides some insurance against swings in own earnings. As expected, taxes and transfers reduce volatility significantly, with most of the impact due to social security cash benefits or income-dependent refundable tax credits. These reduce around a quarter of the volatility of household private income for the working age and 40 percent for those aged 60 or over.

Looking across the period, we see a decline in volatility in both earnings and disposable income. For the working-age, this is driven by a falling volatility of individuals' own earnings, and for those aged 60 or over, by a falling volatility of private unearned income. On the other hand, taxes and benefits became less well correlated with earnings, and became a less important component of disposable income, both of which limit their ability to counteract swings in labour income. This is not enough, though, to outweigh the first impact, and so overall the volatility of disposable incomes fell. Results are valid to most choices of alternative samples, except when we restrict to the very select group of individuals whose households provided valid, non-imputed, responses to all components of income in all waves.

The rest of the paper proceeds as follows. Section 2 describes the UK economic and policy context during the period we study. Section 3 reviews the data and our measure of volatility. We present volatility estimates for earnings and household labour and private income in Section 4. Section 5 examines the role of the tax-benefit system in reducing volatility over the period. In sections 6, we decompose the variance of disposable income changes into the

variances and co-variances of its income components. We present sensitivity checks on our main estimates in Section 7. Section 8 concludes.

2. The UK economic and policy context after the Great Recession

The period we study in this paper, 2009-2017, includes most of the strongest economic downturn in the post-war era -the Great Recession of 2008-2012-, as well as the subsequent economic recovery (2012-2017). The Great Recession was atypical in that the fall in output has been passed through to earnings rather than employment. In 2011-12, employment was just 2 pp lower than its pre-recession peak. In contrast, median earnings were 8% lower than before the recession (Cribb et al., 2017). Since 2012, earnings have recovered but in 2016 they remained around 3 percent lower compared to 2007/8 whereas the employment rate was 2 percentage points higher (Cribb et al., 2018). Employment and earnings growth since 2012 has been strongest for low income households (Cribb et al., 2018).

The evolution of incomes depends not only on labour market changes but also on the tax-benefit system. Taxes and benefits significantly cushioned the fall in earnings during the recession. At the 10^{th} percentile, the fall in earnings was around 12% but the fall in earnings plus transfers (benefits and tax-credits) was only around 4% (Cribb et al., 2017). Pensioner incomes were especially protected during the recession. Starting in 2011, the Coalition Government introduced reforms of the tax-benefit system that aimed to contain the fiscal deficit. These reduced the real value of both in-work and out-of-work benefits and made access to some disability related benefits more difficult. On the other hand, state pensions were protected by a 'triple lock' and the income tax personal allowance increased significantly for the working age (for a detailed list of all the policy reforms see DeAgostini et al., 2017). On average, families lost around 1.2 percent of their income due to benefit cuts between 2011 and 2015 and gained around 1.7 percent as a result of lower income taxes

(DeAgostini et al., 2017, Cribb et al., 2018). However, low income families were disproportionately disadvantaged. For example, among families with no earners, benefit income fell around 6% or £620 per year (Cribb et al., 2018). Lone parents, who are more likely to have low incomes, lost on average 2 percent of their disposable income due to benefit cuts (DeAgostini et al., 2017).

Given the economic and policy context, what should we expect regarding income volatility? Some authors have suggested that volatility rises during recession and falls during periods of economic growth (Gottschalk and Moffitt, 2009, Jenkins, 2011). However, the evidence that economic downturns increase volatility is weak (for a study that finds the opposite result, see Carey and Shore, 2013). Since the Great Recession affected earnings more than employment, it might be expected that any negative effects would be spread more widely, thus limiting the extent of the shock to any one household. Since low income household generally experience higher volatility, strong growth of employment and earnings in this group might be expected to reduce average volatility. However, during this period the UK also experienced an increase in temporary forms of employment (including zero-hours contracts) and especially in self-employment (Hudson-Sharp and Runge, 2017). In addition to increasing labour market income volatility, unstable and insecure work may also make it harder to claim the correct benefits (Ben-Ishai, 2015).

It is not entirely clear to what extent policy reforms affected income volatility. Cuts to benefits are most likely to affect low income families who have higher levels of volatility. On the other hand, the expansion of the tax credits that occurred during the late 1990s and 2000s produced a system that is well positioned to respond to falls in earnings albeit not to falls in employment (Cribb et al., 2017). Cuts to out of work benefits might not affect volatility so much as the level of income. Cuts to in-work benefits embedded in Universal Credit are not captured by our data which ends in 2017. Finally, changes in the administration of benefits

that make it harder for potential recipients to access them may be more important than changes in the rules. Yet, the evidence on this point remains anecdotal.

3. Data and methodology

To estimate our volatility measures, we use data from Understanding Society, the UK Household Longitudinal Study (UKHLS). UKHLS began with a sample of approximately 40,000 households, and now collects a wealth of information from all members of these households annually, including demographic, labour market and detailed income data. The study started in 2009 and we use data from the first 8 waves. Fisher et al. (2019) has considerable information about the income data, including a comparison of the estimated distribution of income in UKHLS with that in the official dataset for the UK, HBAI.

There is no established consensus on how to measure income instability. Some studies have directly examined raw income changes whereas others have attempted to distinguish between anticipated and unanticipated changes. Separating unexpected shocks from expected income growth is theoretically important but in practice the distinction may not be so clear-cut (for example, despite retirement being a well anticipated income shock most individuals fail to save enough, making a strong case for public old-age insurance). The separation of anticipated and unanticipated income changes is also not straightforward to estimate using income data alone. It relies on fitting an income dynamic process that is data demanding. Results are often sensitive to the actual parametric specification of these models(Shin and Solon, 2011, Moffitt and Zhang, 2018).

Contrarily, measures based on raw income changes (volatility) are non-parametric, simple to compute, require only two consecutive years to estimate and are defined at the individual level. Some can also easily incorporate zero incomes, an important feature in our case. For

these reasons, we use a measure of income volatility[4], the standard deviation of the arcpercentage change in income:

$$V_t = \sqrt{Var[100 * \frac{Y_{it} - Y_{it-1}}{(Y_{it} + Y_{it-1})/2}]}$$

where Y_{it} is income at time *t* for individual *i* . We divide the change in income by the mean of the two years rather than by income in the first year (Y_{t-1}) because this has been shown to minimize the influence of outliers and allows for the inclusion of observations where income is zero in either year (Ziliak et al., 2011, Jenkins and Cappellari, 2014). It also ensures the measure is symmetric: the size of any change does not depend on the ordering of incomes in year *t-1* and *t*. When income is zero in both years, we set the arcpercentage change equal to zero as well (as this implies no change). The arcpercentage change can take values between -200% and + 200% Individuals with no income in year *t-1* but positive income in year *t* will have an arcpercentage change of +200%. Similarly, individuals with positive income in year *t-1* and no income in year *t* will have an arcpercentage change of -200%. While not originating in an income dynamics model, our measure of volatility has been shown to be closely related to the variance of transitory shocks in more complex models[5] (Ziliak et al., 2011, Moffitt and Zhang, 2018).

We calculate volatility measures for five income concepts: individual labour earnings (including self-employment), household labour earnings, household private income (defined as the sum of household labour earnings and all other non-labour private sources of income such as private pensions, property and investment income, alimony and other smaller sources

[4] The term volatility has usually been used by studies looking at raw (or age-adjusted) income changes while the transitory variance has been used to denote 'random' shocks following a decomposition based on an income dynamics process.

[5] More specifically, Ziliak et al. (2011) show that "volatility" includes changes in income stemming from changes to the time loadings of the permanent variance component (i.e. the 'prices' of unobserved skill) and changes to the time factor loadings and shocks of the transitory variance component.

of income such as education maintenance grants or inter-household transfers, household total gross income (defined as the sum of household private income and all state benefits received by members of the household, including tax credits), and household disposable income (defined as total gross income minus income taxes and national insurance contributions). For those of working-age, the sources of household private income other than labour income are typically marginal and, as such, volatility trends and levels in household labour and private income will be very similar. But non-labour private sources of income are important for older individuals, and they will play an important role in determining volatility for those aged 60 or more.

An overview of our income concepts can be found in Table 1.

Table 1: Definition of income concepts

Income	Definition
Individual labour earnings	Gross monthly labour income: sum of usual gross earnings, self-employment income and earnings from second jobs
Household labour earnings	Sum of total personal monthly income from labour income received by all household members
Household private income	Sum of household labour earnings, private benefit income received by all household members, pension income received by all household members, investment income received by all household members and miscellaneous income received by all household members
Household total gross income	Sum of household private income and social benefit income received by all household members
Household disposable income	Net household income; taxes deducted only on earnings

These income concepts have been constructed using the UKLHS derived income variables. The derived income variables summarize and aggregate the detailed income information

collected by the survey, including earnings, pensions, benefits and other income[6]. UKHLS also imputes missing values due to item and individual[7] non-response in these derived variables but not in their components[8]. We make use of these imputed values throughout our main analysis but present some robustness checks in Section 7. Information on income taxes and national social insurance contributions is not collected directly by the survey. However, the UKHLS makes available net income estimates derived from a mixture of direct reporting by respondents and, when reported net income is missing, imputations based on gross incomes and household and individual characteristics. The imputations seek to replicate as close as possible the methodology developed by the Department for Work and Pensions (DWP) for computing Households Below Average Income (HBAI) estimates (see Fisher et al. (2019))).

All the derived income variables refer to current monthly values. We use monthly Before Housing Costs HBAI CPI values to deflate all incomes to average 2017 levels. Volatility estimates are presented by year of issue. In most cases, this is the year the interview actually took place. However, due to field work constraints, a small number of households are interviewed in the subsequent year.

All incomes are equivalised using the 'modified OECD' scale[9]. This essentially means that demographic changes (such as for example the birth of a child) will appear as income shocks (including in the labour market income estimates) even though income may have remained unchanged. Finally, to avoid unusual arcpercentage change measures, we set all negative incomes to zero; this affects only between 0.18% and 0.07% of observations (depending on the income concept).

[6] See the User Guide on more info on the derivation of these variables: https://www.understandingsociety.ac.uk/documentation/mainstage/user-guide
[7] Missing values for non-respondent households are not imputed.
[8] The detailed imputed income components are unavailable.
[9] The 'modified OECD' scale assigns a weight of 1 to the first person, 0.5 to subsequent adults and 0.3 to children (defined as aged 13 or under).

Our sample consists of all individuals aged 25 and over who have valid information on all of our five income concepts in at least two consecutive years. Given the divergent evolution of median incomes for the working age and pensioner households, we carry out our analysis separately for individuals aged 25-59 and individuals aged 60+. We do not include individuals younger than 25 in our analyses as many of them are students or apprentices and their larger than average volatility of earnings or income does not necessarily translate into economic instability or insecurity. We are left with 23,942 working age individuals (and approx. 103,000 observations) and 13,164 individuals aged 60 or over (and approx. 60,000 observations) with a non-zero longitudinal weight. Note that individuals who are working age in one year may move into the 60+ group in subsequent years. We use longitudinal weights throughout to account for selective attrition. However, unweighted results are very similar (available from the authors). For all our estimates, we calculate bootstrapped standard errors based on 1,000 replications.

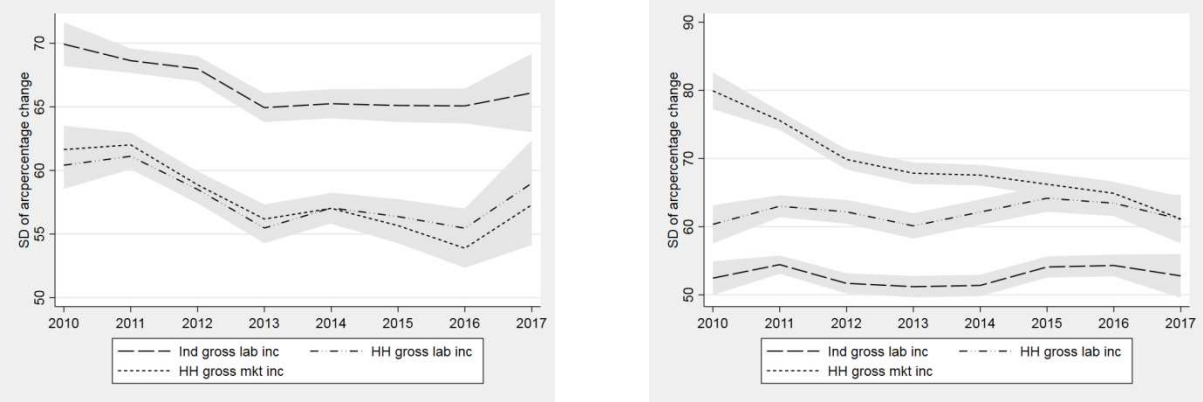
4. Volatility of UK private incomes after the Great Recession

We start by examining trends in the volatility of earnings and other private sources of incomes. Figure 1 maps the yearly volatility in individual labour income, household labour income and household private income between 2010 and 2017 separately for the working age and 60+. Among the working age, the volatility of individual labour income fell from 2010 to 2017 by almost 6 percent; household labour and private income volatility fell by similar magnitudes by 2016, but then ticked up in 2017. Household labour income volatility is always significantly below that of individual earnings suggesting labour and wage shocks are not positively correlated within the household (formal correlations are shown in section 6). The labour income of other household members provides some insurance against swings in

own earnings. Non-labour private income sources have a negligible effect on volatility for those of working age.

Among individuals aged 60+, individual labour income volatility initially fell slightly from 2010 to 2013 and increased thereafter. As a result, volatility of individual labour income was only slightly higher in 2017 compared to 2010. A very similar trend can be observed for household labour income. Household private income volatility on the other hand fell substantially from 81 to 61, a fall of almost a quarter. Further analysis has shown that the trend is mostly due to private pension income[10]. Household labour income volatility is consistently higher than individual labour income volatility, the opposite pattern to that found among the working age. The difference comes mostly from individuals who are themselves retired but have a partner that is of working age and in work: for these individuals, individual labour income volatility will be zero but household labour income volatility will be positive. There is also a large effect of non-labour incomes on volatility for the 60+. In 2010, these incomes increase volatility significantly but by 2017 their effect is statistically indistinguishable from zero.

[10] The downward trend is still present if we omit data from wave 1, but is less pronounced.

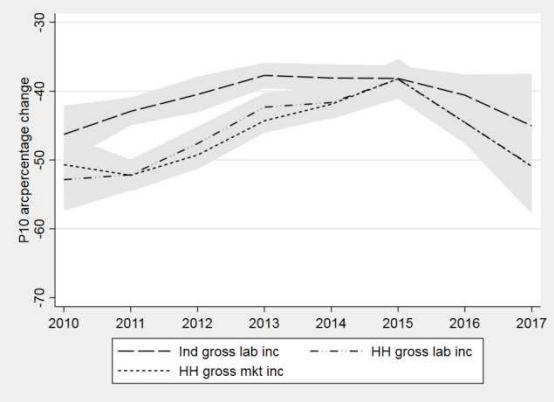


(a) Working age (25-59)

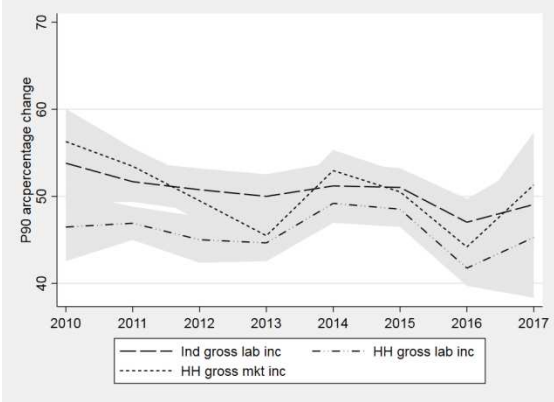
(b) Older age (60+)

Fig 1: Volatility of individual and household labour and private incomes, 2009-2017

The standard deviation is poorly suited to capture changes in the distribution of income shocks. To better understand what is driving the fall in volatility, Figure 2 plots the 10th and the 90th percentile of the distribution of arcpercentage changes for the working age. There is a clear reduction in the (absolute) size of income changes at the 10th percentile from 2010 to 2015, particularly for the measures at the household level, although the size of these large income reductions rose in 2016 and 2017, particularly for the measures at the household level. In contrast, changes to positive shocks are much more limited. There is a fall in size of income changes at the 90th percentile for gross private income, but little change for individual and household labour incomes.



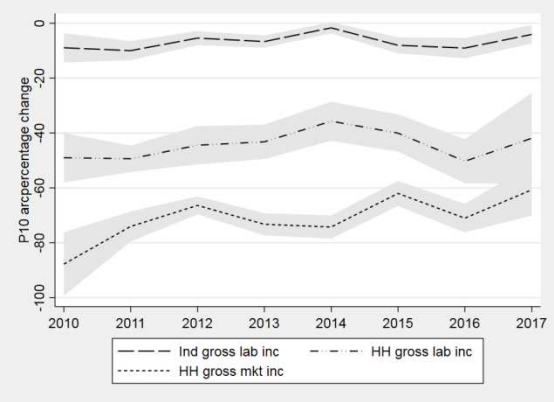
(a) P10



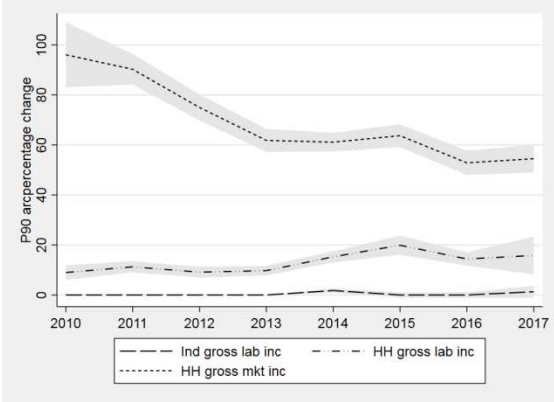
(b) P90

Fig 2: Quantiles of the arcpercentage change of individual and household labour and private incomes, 2010 to 2017. Working age (25-59)

Quantiles of the distribution of income changes for the older age group are shown in Figure 3. In this case, the decline in the volatility of household private income is attributable mainly to a fall in large positive income shocks. The 90^{th} percentile of the distribution of arcpercentage changes is almost halved from 2010 to 2017. In contrast, the decline over time in the magnitude of negative income shocks is much smaller.

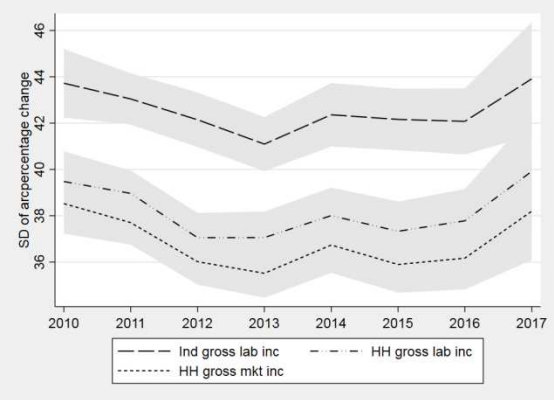


(a) P10

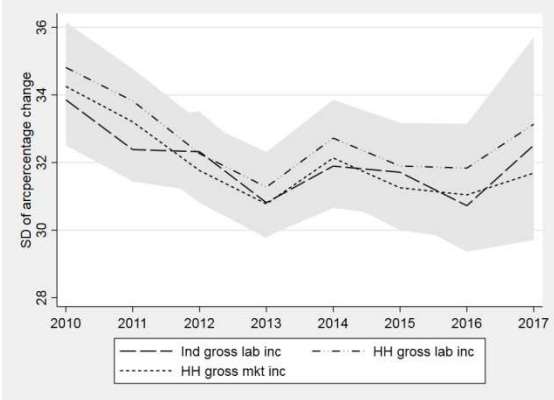


(b) P90

Fig 3: Quantiles of the arcpercentage change of individual and household labour and private incomes, 2010 to 2017. Older age (60+)



(a)Continuously in work



(b)Continuously employed

Fig 4: Volatility of individual and household private incomes, 2010-2017; Working age (25-59) who are continuously in work (a) or continuously employed (b)

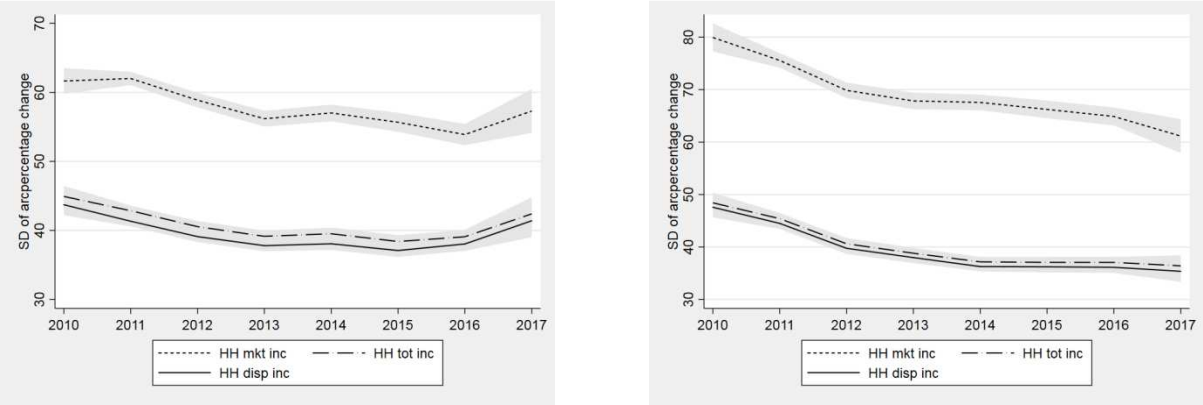
The volatility estimates presented in Figure 1 include all individuals with valid income information satisfying the age condition. In contrast, many of the previous studies of earnings volatility have focused on continuously employed individuals. To facilitate comparisons with previous results, Figure 4 plots volatility estimates for individuals who are continuously in

work (employed or self-employed) and for employees only. Our estimates using employees only (Figure 4b) are very similar to Jenkins and Cappellari (2014). They find that the earnings volatility of men and women continuously employed is around 30, the same as we do. Estimates in Figure 4a are higher because they include self-employed individuals who, on average, have higher labour income volatility. Note also that the fall in income volatility for this group is much smaller than for the whole population, and in some cases statistically indistinguishable from zero. This suggests that changes in income volatility over this period are not driven by the earnings of employees, but are instead driven by changes in labour market attachment and the self-employed. Indeed, among the working age, the share of labour market exits fell from around 4 percent to around 3 percent and the share of those continuously in work increased from 73.5 to 76.5 percent. The proportion of individuals 60+ who were continuously employed also rose slightly (by around 1 percentage point) as did the share employed across this group. We did not find any evidence of shifts in the share of jobs with unstable or variable earnings the exception of an increase in the share of self-employed.

5. The role of taxes and benefits in reducing income volatility

In this section, we review the role the tax benefit system played in reducing income volatility during the 2010-2017 period. We compare the volatility of gross household private incomes with that of household gross total incomes which include all public transfers and that of household disposable incomes which additionally incorporate national insurance contributions and income taxes. Figure 5 plots these measures separately for the working age and 60+. As expected, taxes and transfers reduce volatility significantly with most of the effect attributable to transfers: just under a third of the volatility of household private income is reduced by transfers, as opposed to just 1-2 percent being due to taxes. The relative reduction in volatility from taxes and benefits remained constant throughout the period at

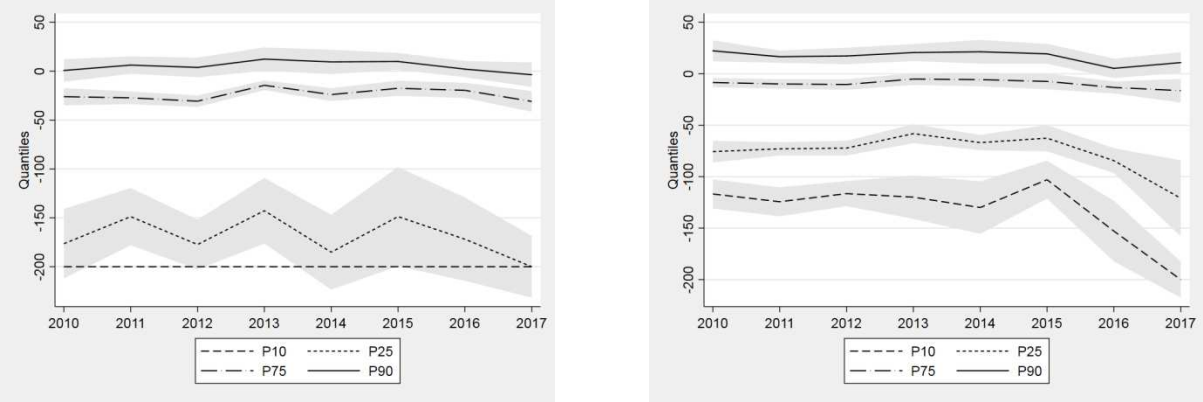
around 33-34 percent. Transfers play an even larger role in reducing volatility for the 60+ group: the volatility of household private income is reduced by almost 40 percent by transfers, reflecting the importance of state pensions for those who retire. As in the case of the working age, the absolute change in income volatility brought about by taxes and benefits did not change throughout the period.



a) Working age(25-59) (b) Older age(60+)

Fig 5: Volatility of household incomes before and after taxes and benefits, 2010-206

Next, we review the ability of the tax-benefit system to mitigate volatility stemming from labour market exit transitions. We do so by looking at the distribution of shocks to household private and disposable incomes (i.e. excluding and then including transfers and taxes) for those households where at least one member was affected by a labour market. By construction, individuals who exit employment entirely have an arcpercentage change of individual labour earnings of -200 percent. Because their labour market exits are likely of a different nature, we examine working-age and 60+ individuals separately.



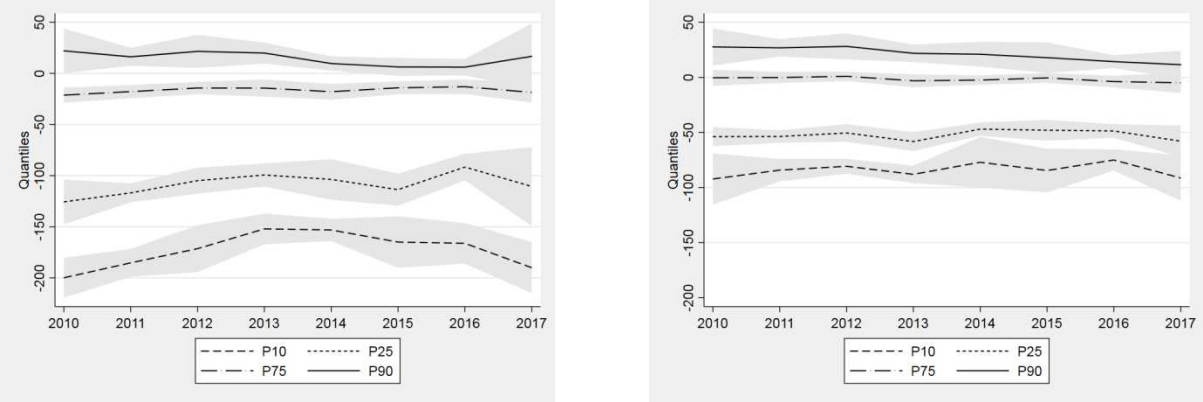
(a) Household gross market income (b) Household disposable income

Fig 6: Quantiles of household private income and household disposable income changes of labour market leavers of working age

Figure 6 shows selected quantiles of the arcpercentage change in household gross private and disposable incomes for working age individuals experiencing a labour market exit. Taxes and benefits greatly reduce the size of the shocks in the left tail. The 10th percentile of the distribution of changes is approximately halved when taxes and benefits are added from -200 percent to -120 percent (although these income falls are larger in 2016 and 2017), and the 25th percentile falls from -150 percent to -75 percent (again, these are larger in 2016 and 2017). At the opposite end, there is virtually no effect of taxes and benefits when shocks to household gross market income are small. This pattern is consistent with a targeted tax-benefit system, where effects are concentrated in the left tail. Over the period we study, the distribution of income changes associated with labour market exit shocks remained roughly the same, both for household gross market income and household disposable income. The role of taxes and benefits in reducing income shocks also remained unchanged.

As expected, labour market exits are associated with smaller shocks to household incomes in the older age group (Figure 7). The size of the shocks in the left tail is falling throughout the period. The 10th percentile of the distribution of income changes fell from around -200

percent to -100 percent, whereas the 25th percentile fell from -130 percent to around -50 percent. Conversely, the upper tail of the distribution of income changes remained unchanged. Taxes and benefits therefore play an important role in mitigating income shocks associated with labour market exit among individuals aged 60+.



(a) Household gross market income (b) Household disposable income

Fig 7: Quantiles of household private income and household disposable income changes of labour market leavers aged 60+

6. Decomposing trends in the volatility of household disposable income

An important issue for understanding changes in the volatility of disposable income is the extent to which shocks to various income sources are correlated or not and how correlations changed over time. To gain insight, we decompose the variance of disposable income into the sum of the component variances and its co-variances. We decompose disposable income as the sum of own earnings (I1), earnings of other household members (I2), non-labour private income (I3), transfers (I4) and taxes (I5). The variance of changes in disposable income can be written as the sum of the variances of five weighted income components and

the corresponding covariances, where the weights are the shares of the income components in disposable income. Formally, we have

$$Var(Y_{it}) = \sum_{j=1}^{J} Var(s_{ijt} I_{ijt}) + 2 \sum_{j=1}^{J-1} \sum_{k=1}^{j-1} Cov(s_{ijt} I_{ijt,}\, s_{ikt} I_{ikt})$$

where $Var(Y_{it})$ is the variance of the arcpercentage change in disposable income in year *t*, $Var(s_{ijt} I_{ijt})$ is the variance of the arcpercentage change in the income component *j* in year *t* weighted by its share in total disposable income, $Cov(s_{ijt} I_{ijt}, s_{ikt} I_{ikt})$is the covariance of the weighted changes in income *j* and *k* in year *t* and *J* is the number of income components which in our case is five. (see Hardy and Ziliak, 2014 for the full decomposition formula). Tables 2 and 3 show the evolution of i) variances of the constituent income sources, ii) their co-variances and iii) their shares between 2010 and 2017 for the working age and 60+.

Table 2: Decomposition of the volatility of household disposable income for the working age

	2010	2011	2012	2013	2014	2015	2016	2017
V (I_1)	4889.35	4709.85	4622.77	4216.56	4257.15	4238.91	4234.55	4368.11
V(I_2)	5424.88	5473.71	5287.38	4946.63	5114.54	5142.45	5114.27	5129.31
V(I_3)	11338.5	11197.66	10751.65	10522.59	10517.1	10540.32	10665.66	9966.82
V(I_4)	6237.27	5985.19	5942.38	6344.98	6096.99	6520.29	6229.5	6075.75
V(I_5)	6063.03	6316.79	6189.62	5880.28	6385.86	6416.04	6566.09	7043.88
C(I_1, I_2)	-13.09	-116.7	-114.97	-150.61	-90.21	-117.89	4.71	42.75
C(I_1, I_3)	-457.39	-305.71	-343.97	-379.02	-266.98	-233.07	-202.88	-312.85
C(I_1, I_4)	-958.79	-715	-735.23	-607.75	-647.68	-599.39	-462.02	-475.25
C(I_1, I_5)	2349.8	2268.08	2176.35	1895	2040.12	1945.15	1925.23	2306.8
C(I_2,I_3)	-275.58	-119.94	-138.85	-29.34	-115.6	-62.33	-163.07	143.61
C(I_2, I_4)	-698.6	-573.81	-549.83	-476.95	-537.24	-752.74	-635.82	-476.53
C(I_2, I_5)	2256.49	2415.4	2124.8	1987.98	2108.06	2055.59	2123.31	2045.88
C(I_3, I_4)	979.1	685.96	827.81	1171.51	1026.28	1045.53	1178.99	922.91
C(I_3, I_5)	-139.28	-199.91	-262.82	-300.76	-122.49	-36.95	61.83	0.28
C(I_4, I_5)	-881.16	-766.48	-682.05	-569.4	-614.81	-600.4	-648.96	-484.55
S(I_1)	46.24	46.79	48.08	49.7	50.96	51.2	50.29	51.72
S(I_2)	45.97	45.13	45.1	44.87	44.63	44.94	45.18	45.57
S(I_3)	5.75	6.07	6.56	6.59	6.57	6.63	6.58	6.55
S(I_4)	19.26	20.05	19.73	19.33	18.67	18.26	17.72	16.9
S(I_5)	23.33	22.64	22.39	21.99	21.61	21.48	21.4	21.57

Source: Authors' calculations based on UKHLS.

Between 2010 and 2017, the variances of arcpercentage changes fell for all private income components. The variance of own-earnings changes fell by 11 percent, and that of other sources of private income fell by 6 percent. By contrast, the variance of benefit income changes hardly changed, and the variance of tax changes increased slightly.

The covariance terms capture the extent to which changes in various income sources are correlated or not. We find that there is no correlation between shocks to earnings in the same household. The covariance between individual earnings and the earnings of other household members is very close to zero throughout the period confirming that households with multiple earners are able to effectively insure against individual earnings shocks. The covariance between earnings and non-labour income changes is negative and falling in absolute value. As expected, benefit income changes are negatively correlated with changes in earnings and non-labour private income. However, the correlation is much weaker in 2017 compared to 2010: the covariance between changes in own earnings and changes in benefit income was halved whereas the covariance between changes to the earnings of other household members and changes to benefit income fell by more than a quarter. The covariance between taxes and earnings changes also fell throughout the period, albeit the magnitude of the fall was smaller (between 9 and 23 percent depending on the earnings concept)[11]. Finally, the share of earnings in household disposable income rose slightly, as did the share of non-labour private income, whereas the share of benefits and of taxes fell. In our dataset, the share of benefits fell by 2.4 percentage points while the share of taxes fell by 1.8 percentage points.

[11] Income tax in the UK is levied at the individual level, but the variable measuring tax payments that we use is calculated at the household level.

Table 3: Decomposition of the volatility of household disposable income for those aged 60+

	2010	2011	2012	2013	2014	2015	2016	2017
V (I_1)	2750.19	2962.45	2670.52	2621.2	2639	2924.81	2948.91	2785.47
V(I_2)	2890.5	3099.89	2960.03	2930.84	3023.42	3210.92	3099.28	2949.06
V(I_3)	8473.99	7375.72	6236.46	6011.02	5818.32	5562.44	5396.11	4957.13
V(I_4)	3890.01	3557.95	2767.7	2561.88	2707.44	2700.16	2764.27	2910.18
V(I_5)	4431.4	4528.57	4411.72	4354.84	4375.47	4619.21	4605.69	4432.53
C(I_1, I_2)	64.64	156.77	147.48	95.75	169.69	162.6	44.78	246.03
C(I_1, I_3)	-398.72	-193.45	-212.75	-235.33	-220.92	-257.93	-289.32	-116.17
C(I_1, I_4)	-317.79	-272.63	-252.56	-182.32	-202.55	-243.45	-270.95	-208.69
C(I_1, I_5)	1412.2	1500.46	1351.26	1231.49	1300.53	1397.36	1325.57	1291.39
C(I_2,I_3)	-213.51	-175.3	-96.49	-174.07	-243.18	-328.8	-252.61	-204.35
C(I_2, I_4)	-295.32	-196.65	-213.7	-273.72	-307.79	-245.12	-202.8	-260.23
C(I_2, I_5)	1809.82	1879.58	1827.52	1737.71	1907.81	1861.92	1789.64	1777.08
C(I_3, I_4)	731.56	554.76	250.59	274.54	297.18	242.23	221.75	234.88
C(I_3, I_5)	-193.28	-263.67	-245.27	-260.01	-302.62	-339.76	-300.49	-216.32
C(I_4, I_5)	-311.57	-258.91	-295.09	-281.87	-265.11	-278.38	-205.12	-275.72
S(I_1)	8.54	8.7	8.48	8.91	9.29	9.91	9.54	9.8
S(I_2)	13.09	12.72	11.97	12.01	12.07	12.21	12.89	14.12
S(I_3)	30.73	31.51	32.73	33.21	33.41	33.67	33.88	33.59
S(I_4)	51.5	50.66	50.36	49.54	49.11	48.34	47.7	46.73
S(I_5)	4.53	4.4	4.03	3.95	4	4.18	4.28	4.4

Source: Authors' calculations based on UKHLS.

The volatility of earnings among those aged over 60 increased slightly from 2010 to 2017, mostly due to increased employment rates. On the other hand, the variance of non-labour private income fell by 42 percent. Similarly, the variance of benefit income changes fell by a quarter while that of taxes remained relatively stable.

The share of benefit income fell among the 60+ by almost 5 percentage points, and the share of earnings and other private income sources has increased. As expected, benefit income changes are negatively correlated with changes in earnings but *positively* correlated with changes in non-labour private incomes; this may reflect individuals starting to receive both state pension and private pensions at the same age. Over the period we study, the covariance of benefit income changes with own earnings changes has remained relatively stable whereas that with non-labour private income changes fell significantly but continues to remain positive. Finally, the covariances between taxes and market incomes changes have changed by little.

Together, these results suggest that the ability of the British tax-benefit system to automatically stabilize incomes of the working age has diminished. Taxes and benefits represented a smaller share of disposable income in 2017 compared to 2010 and changes in taxes and benefits are much less well correlated with changes in earnings. These results are consistent with the policy changes taking place in this period: cuts to working age benefits and increases in the maximum amount exempted from income tax. In contrast, the capacity of the tax-benefit system to smooth the short-run volatility of incomes of individuals aged 60+ was largely unchanged: the share of benefit income fell for this group as well, but changes in taxes and benefit have become slightly better correlated with changes in private incomes. This pattern is consistent with individuals in the 60+ group being much less affected by benefit cuts, and also benefiting less from the increase in the personal allowance.

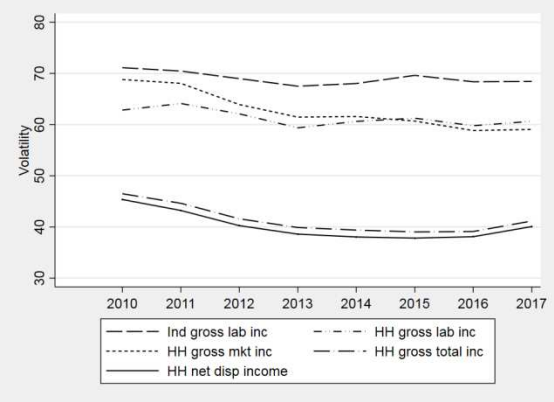
Overall, the changes in the volatility of household disposable income were the result of two conflicting trends. On the one hand, declining earnings and non-labour income volatility reduced the instability of household disposable incomes. On the other hand, taxes and benefits became less well correlated with earnings, and became a less important component of disposable income, both of which limit their ability to counteract swings in labour income for the working age. This is not enough, though, to outweigh the first impact, and so overall the volatility of disposable incomes fell.

7. Robustness and sensitivity checks

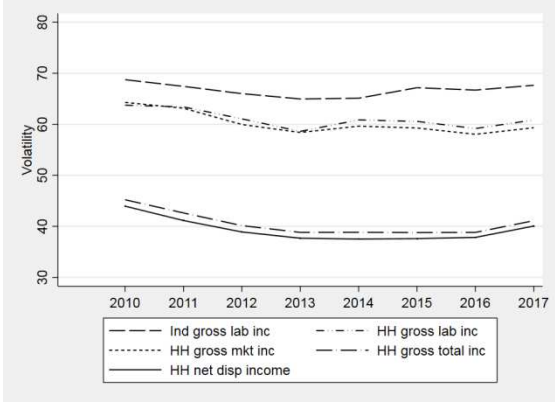
In this section, we present results from alternative specifications as a sensitivity check on our main findings.

We first present volatility trends by income source when the sample is restricted to be '*balanced'*. This provides a check that differential attrition is not affecting our results. Because most of the income concepts we use are household level but households themselves are not a longitudinal unit of observation, it is not immediately clear how '*balanced*' should be defined. We therefore include all individuals for whom an individual interview exists in all 8 waves regardless of any components of household income being imputed (which would be due to non-response from the individual herself or other household members[12]). We review the impact of income imputation on results later on.

[12] We have also experimented with including all individuals for whom income data (collected or imputed) exists in all 8 waves. Results (available from the authors upon request) are unchanged.



(a) Full sample



(b) Balanced sample

Fig 8: Volatility of individual and household incomes, 2009-2017, full and balanced panels

Using a balanced panel makes virtually no difference for the estimation of income volatility. As might be expected, the level of volatility is slightly lower but the differences are negligible (between 0.5 and 4.5 depending on income and year). The trends are almost identical.

We next review the sensitivity of our results to income imputations. Our income concepts are aggregations of individual income sources. As a result, rather than being binary, the imputation flag indicator records the proportion of income that has been imputed. It ranges from 0 to 1. Figure 9 shows how volatility trends in our five income concepts change when we restrict our sample to observations where imputed income accounts for i) less than 50 percent ii) less than 20 percent , iii) 0 percent (i.e. there is no imputed income) and iv) 0 percent in all waves. Note that the fourth specification is very restrictive as it requires valid income information in all waves not only of the individual but also of all the other members of her household: only 1,358 individuals out of 40,672 satisfy this condition (See Table 4).

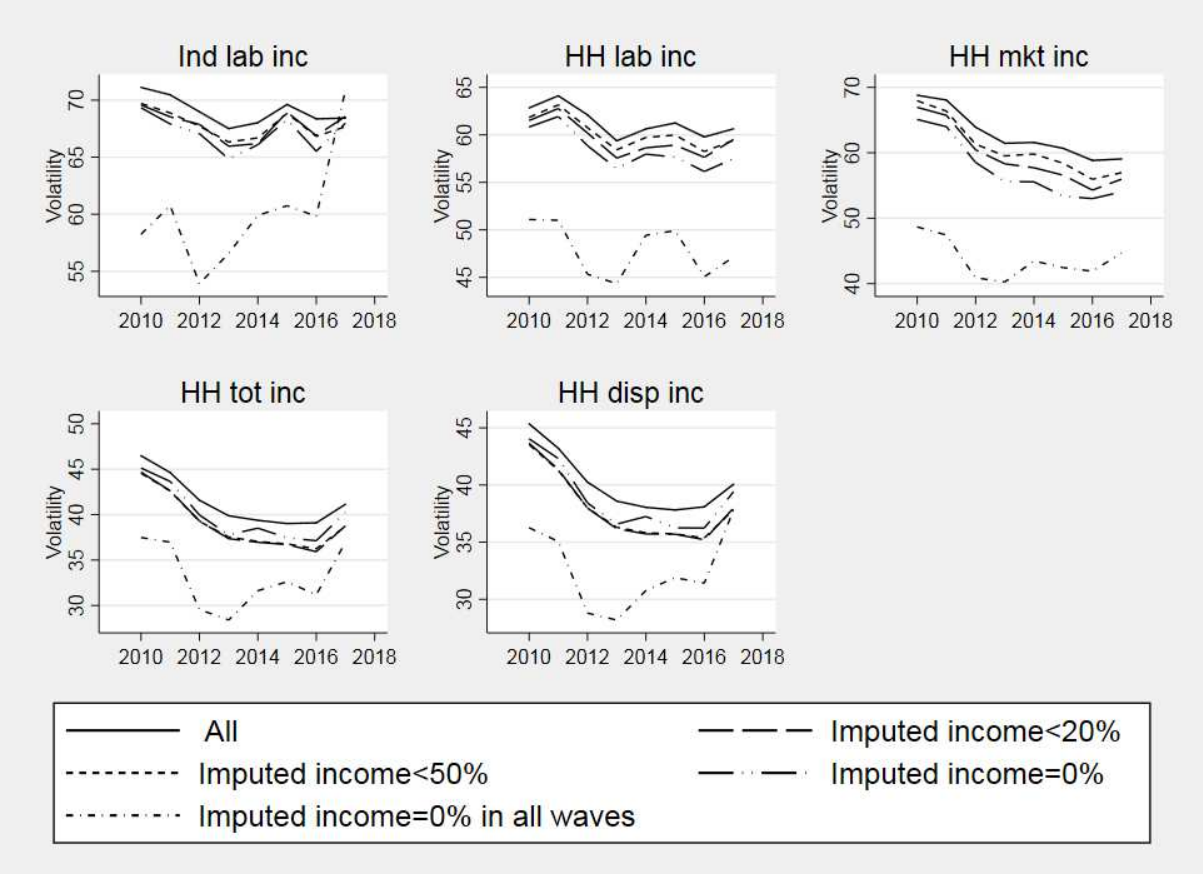


Fig 9: Impact of income imputations on the volatility of individual and household income 2009-2017

As expected, volatility levels drop slightly when we impose restrictions on the amount of imputed income. Trends however are remarkably similar for all income concepts. The only exception is the fourth specification where we restrict our sample to individuals in households where all members supplied valid income data in all waves. The level of volatility is much lower for this subsample and the volatility of individual labour income is increasing rather than falling. However, this is a very small and selected sample compared to the rest.

Table 4: Number of individuals and observations, various alternative specifications

Sample	# individuals	# observations
Balanced sample	16,594	111,368
Imputed income <20%	32,679	122,051
Imputed income<50%	35,953	144,809
Imputed income=0%	28,123	86,151
Imputed income=0% in all waves	1,358	8,845

Source: Authors' calculations based on UKHLS.

8. Discussion and conclusions

Using individual and household longitudinal data, we examine the volatility of earnings, household disposable income and intermediate income concepts between 2009 and 2017. We find that the volatility of individual earnings declined by around 6 percent among the working age. Similar declines occurred in the volatility of household gross labour and private incomes. The fall in volatility is driven primarily by a reduction in the size of negative shocks to earnings stemming from increased labour market attachment and fewer labour market exits, although there are signs that this trend started to reverse after 2015. These findings are consistent with strong employment and earnings growth among low-income households during this period. We found no evidence of a change in job quality indicators beyond an increase in self-employment.

The fall in the volatility of household gross private income was even greater for those aged 60+ at just under a quarter. For this group, the decline has been driven by a fall in the size of positive shocks to private pension income; it is not clear what is the ultimate cause.

Consistent with the existing body of evidence, we find that the tax-benefit system plays a significant role in reducing the volatility of labour and other private income, although this is dominated by the transfer system (that is social security benefits, means-tested safety net benefits, and income-related refundable tax credits) rather than taxes. The reduction in volatility is higher for older individuals (at around 40 percent) compared to working age individuals (at around 30 percent). In the specific case of labour market exits, the tax-benefit system greatly reduces the size of negative shocks - the 10^{th} percentile of income changes is approximately halved after taxes and benefits – although there are worrying signs in 2016 and 2017 that this insurance against large negative shocks is declining.

Consistent with the fact that policy reforms over this period cut working-age benefits and increased the amount of income that is free from tax, we find that, among the working-age population, changes to tax payments and (especially) payments of cash benefits became less well correlated with changes in earnings Despite this, the total extent by which income volatility was reduced by the tax-benefit system remained largely unchanged throughout the period.

Our main volatility estimates are somewhat higher than the headline results of Jenkins and Cappellari (2014), who analyse the BHPS, but this is because we include the self-employed in our calculations: our volatility estimates based only on employees are very similar to theirs. Like Jenkins and Cappellari (2014) did for an earlier time period, we find no change in the volatility of earnings among the continuously employed (including the self-employed), but a falling volatility of labour income due to an increased share of individuals who are continuously in work. Our data do not show any substantial increase in more insecure forms of work beyond an increase in self-employment which has not affected aggregate earnings volatility. Jenkins (2011) finds the volatility of disposable income seems to be primarily driven by the volatility of earnings among prime-aged males. Likewise, we find that

disposable income volatility is largely determined by trends in earnings volatility: cuts to working age benefits do not seem to affect the volatility of disposable income much, although benefit changes have become less well correlated with earnings changes. Further research is needed to check that our findings are replicated using other measures of income instability such as transitory variances from income dynamics models.

References:

BANIA, N. & LEETE, L. 2009. Monthly Household Income Volatility in the U.S., 1991/92 vs. 2002/03. *Economics Bulletin,* 29**,** 2100-2112.

BARTELS, C. & BÖNKE, T. 2013. Can Households and Welfare States Mitigate Rising Earnnings Instability? *Review of Income and Wealth,* 59**,** 250-282.

BEN-ISHAI, L. 2015. Volatile Job Schedules and Access to Public Benefits. Washington DC.: Center for Law and Social Policy.

BLUNDELL, R. & ETHERIDGE, B. 2010. Consumption, Income and Earnings Inequality in Britain. *Review of Economic Dynamics,* 13**,** 76-102.

BLUNDELL, R. & PRESTON, I. 1998. Consumption Inequality and Income Uncertainty. *The Quarterly Journal of Economics,* 113**,** 603-640.

BRONCHETTI, E. T. 2012. Workers' Compensation and Consumption Smoothing. *Journal of Public Economics,* 96**,** 495-508.

BROWNING, M. & CROSSLEY, T. F. 2001. Unemployment Insurance Benefit Levels and Consumption Changes. *Journal of Public Economics,* 80**,** 1-23.

CAREY, C. & SHORE, S. H. 2013. From the Peaks to the Valleys: Cross-State Evidence on Income Volatility and the Business Cycle. *Review of Economics and Statistics,* 95**,** 459-562.

CHAUVEL, L. & HARTUNG, A. 2014. Dynamics of Income Volatility in the US and in Europe, 1971-2007: The Increasing Lower Middle Class Instability. *33-rd IARIW General Conference.* Rotterdam.

CRIBB, J., HOOD, A. & JOYCE, R. 2017. Recessions, Income Inequality and the Role of the Tax-Benefit System. London: Institute for Fiscal Studies.

CRIBB, J., NORRIS KEILLER, A. & WATERS, T. 2018. Living Standards, Poverty and Inequality in the UK: 2018. London: The Institute for Fiscal Studies.

DAHL, M., DELEIRE, T. & MOK, S. 2014. Food Insufficiency and Income Volatility in US Households: The Effects of Imputed Income in the Survey of Income and Program Participation. *Applied Economic Perspectives and Policy,* 36**,** 416-437.

DAHL, M., DELEIRE, T. & SCHWABISH, J. A. 2011. Estimates of Year-to-Year Volatility in Earnings and Household Incomes from Administrative, Survey, and Matched Data. *The Journal of Human Resources,* 46**,** 750-774.

DALY, M. C. & VALLETTA, R. G. 2008. Cross-National Trends in Earnings Inequality and Instability. *Economics Letters,* 99**,** 215-219.

DE AGOSTINI, P., HILLS, J. & SUTHERLAND, H. 2017. Were We Really All in it Together? The Distributional Effects of the 2010-15 UK Coalition Government's Tax-benefit Policy Changes. *Social Policy & Administration,* 52**,** 929-949.

DIAZ-SERRANO, L. 2005. Income Volatility and Residential Mortgage Delinquency Across the EU. *Journal of Housing Economics,* 14**,** 153-177.

DICKENS, R. 2000. The Evolution of Individual Male Earnings in Great Britain: 1975-1995. *The Economic Journal,* 110**,** 27-49.

DYNAN, K., ELMENDORF, D. & SICHEL, D. 2012. The Evolution of Household Income Volatility. *The B.E. Journal of Economic Analysis and Policy,* 12**,** 1-40.

FISHER, P., FUMAGALLI, L., BUCK, N. & AVRAM, S. 2019. Understanding Society and its income data. Understanding Society Working Paper 2019-08.

GENNETIAN, L. A., WOLF, S., HILL, H. D. & MORRIS, P. 2015. Intrayear Household Income Dynamics and Adolescent School Behavior. *Demography,* 52**,** 455-583.

GOSSELIN, P. & ZIMMERMAN, S. 2008. Trends in Income Volatility and Risk, 1970-2004. *Urban Institute Working Paper*.

GOTTSCHALK, P. & MOFFITT, R. 2009. The Rising Instability of U.S. Earnings. *Journal of Economic Perspectives,* 23**,** 3-24.
GRUBER, J. 2000. Cash Welfare As a Consumption Smoothing Mechanism for Divorced Mothers. *Journal of Public Economics,* 75**,** 157-182.
GUNDERSEN, C. & ZILIAK, J. P. 2003. The Role of Food Stamps in Consumption Stabilization. *Journal of Human Resources,* 38**,** 1051-1079.
HALLIDAY, T. J. 2007. Income Volatility and Health. *IZA Discussion Paper Series,* 3234.
HANNAGAN, A. & MORDUCH, J. 2015. Income Gains and Monthy-to-Month Income Volatility: Household Evidence from the US Fianancial Diaries. *NYU Wagner Research Paper,* 2659883.
HARDY, B. L. 2014. Childhood Income Volatility and Adult Outcomes. *Demography,* 51**,** 1641-1665.
HARDY, B. L. 2016. Income Instability and the Response of the Safety Net. *Contemporary Economic Policy,* 35**,** 312-330.
HARDY, B. L. & ZILIAK, J. P. 2014. Decomposing Trends in Income Volatility: The "Wild Ride" at the Top and Bottom. *Economic Inquiry,* 52**,** 459-476.
HILL, H. D., MORRIS, P., GENNETIAN, L. A., WOLF, S. & TUBBS, C. 2013. The Consequences of Income Instability for Children's Well-being. *Child Development Perspectives,* 7**,** 85-90.
HILL, H. D., ROMICH, J., MATTINGLY, M. J., SHAMSUDDIN, S. & WETHING, H. 2017. An Introduction to Household Economic Instability and Social Policy. *Social Service Review,* 91**,** 371-389.
HUDSON-SHARP, N. & RUNGE, J. 2017. International Trends in Insecure Work: A Report for the Trades Union Congress. London: National Institute of Economic and Social Research.
JENKINS, S. 2011. Has the Instability of Personal Incomes Been Increasing? *National Institute Economic Review,* 218**,** R33-R43.
JENKINS, S. & CAPPELLARI, L. 2014. Earnings and Labour Market Volatility in Britain with a Transatlantic Comparison. *Labour Economics,* 30**,** 201-211.
JENSEN, S. T. & SHORE, S. H. 2015. Changes in the Distribution of Earnings Volatility. *Journal of Human Resources,* 50**,** 811-836.
KNIES, G. 2017. Understanding Society. The UK Household Longitudinal Study Waved 1-7 User Guide. Institute for Social and Economic Research.
KNIESER, T. J. & ZILIAK, J. P. 2002. Explicit Versus. Implicit Income Insurance. *The Journal of Risk and Uncertainty,* 25**,** 5-20.
LEETE, L. & BANIA, N. 2010. The Effect of Income Shocks on Food Insufficiency. *Review of Economics of the Household,* 8**,** 505-526.
MOFFITT, R. & ZHANG, S. 2018. Income Volatility and the PSID: Past Research and New Results. *AEA Papers and Proceedings,* 108**,** 277-280.
OECD 2011. Earnings volatility: Causes and Consequences. *In:* OECD (ed.) *OECD Employment Outlook 201*. Paris: OECD Publishing.
PRAUSE, J., DOOLEY, D. & HUH, J. 2009. Income Volatility and Psychological Depression. *American Journal of Community Psychology,* 43**,** 57-70.
SHIN, D. & SOLON, G. 2011. Trends in Men's Earnings Volatility: What does the Panel Study of Income dynamics Show? *Journal of Public Economics,* 95**,** 973-982.
UNIVERSITY OF ESSEX , NATCEN SOCIAL RESEARCH & KANTAR PUBLIC 2018. Understanding Society: Waves 1-8, 2009-2017 and Harmonised BHPS: Waves 1-18, 1991-2009, . UK Data Service, SN: 6614.
VAN KERM, P. 2003. An Anatomy of Household Income Volatility in European Countries. *CHER Working Paper*. Differdange: CEPS/INSTEAD.

VARIAN, H. R. 1980. Redistributive Taxation and Social Insurance. *Journal of Public Economics,* 14**,** 49-68.
WOLF, S. & MORRISSEY, T. 2017. Economic Instability , Food Insecurity, and Child Health in the Wake of the Great Recession. *Social Service Review,* 91**,** 534-570.
ZILIAK, J. P., HARDY, B. & BOLLINGER, C. 2011. Earnings Volatility in America: Evidence from matched CPS. *Labour Economics,* 18**,** 742-754.