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Report

How should housing affordability be measured?

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3 September 2018

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Acknowledgements

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Executive summary

Housing affordability is widely recognised as one of the most important issues facing households today. However, before we can assess the extent of the problem or propose solutions, we need to be clear how affordability should be measured. Perhaps the most important principle is that any metric needs to be relevant to, and reflect the circumstances of, groups widely thought to experience affordability problems, particularly low-income households and first-time buyers. Therefore, the measure should capture the distribution of outcomes across households rather than concentrating simply on averages; rising house prices, for example, have different effects on different groups. This paper critically examines the measures of affordability most commonly employed internationally, before proposing two modifications: one for low income renters and one for potential first-time buyers.

Existing measures of affordability

Measure 1: House price to income/earnings ratio

The most commonly used indicator in the UK is the ratio of house prices to incomes or earnings – and indeed this is also used in many other countries. The ratio is easy to construct and has an intuitive interpretation, but it reveals little information on differences between households, and increases in the ratio over time do not necessarily imply a worsening of affordability. Furthermore, it is not an indicator that can readily be targeted by policy. For these reasons, price to earnings ratios are rarely advocated in the academic literature. Instead, two other approaches are more commonly used.

Measure 2: Proportion of Income Spent on Housing

Low income households spending a high proportion of their income on housing may face conditions of housing stress. In fact, many – even low income households - *choose* to spend a high percentage, but there is still evidence in England that low income households with high housing expenditure ratios are more likely to face stress than those on high incomes. In some countries, notably Australia, the 30:40 rule is used; this calculates the proportion or number of households in the bottom two income quintiles spending more than 30% of their income on housing.

Measure 3: "Residual income" for housing

The third approach is known as the "residual income" method. Measures based on ratios suffer from the disadvantage that calculated unaffordability is independent of the *level* of income. By contrast the residual income approach concentrates on the *difference* between incomes and housing costs rather than the ratio. It subtracts from disposable income the monetary value of a pre-defined standard of non-housing needs; this, therefore, determines how much is left to spend on housing. Since housing typically has a first claim on income, if the amount actually paid exceeds affordable housing costs, then the residual income left over for non-housing consumption will be inadequate. However, there are still problems using the approach, notably in the definition of an appropriate non-housing budget standard which might, for example, be based on a poverty indicator and, in practice, the measure has rarely been constructed on a regular basis to enable comparisons over time and across countries.

Measure 4: Incorporating supply

Most regularly used measures of affordability concentrate primarily on housing demand and pay less attention to the supply of homes available to the lowest income groups or to the imbalance between demand and supply. But, in principle, measures can be constructed that incorporate both demand and supply elements by, for example, examining vacancy rates or by comparing the distribution of available housing by costs with the distribution of household incomes; this attempts to relate the number of housing units potentially affordable by different income groups to the total number of households in each income group. In practice, this fourth approach has been used less widely internationally.

New measures of affordability

As noted above, measures are needed that are applicable to low income households - who are most likely to be long-term renters - and to potential first-time buyers; it is unlikely that the same indicator will be relevant to both groups. Nevertheless, any indicator has to be straightforward to construct on a regular basis (at least annually) and to be understandable intuitively to a wide audience. Two measures are proposed in the paper.

Measure 1: Low-income renter affordability

Although there are theoretical issues relating to the use of expenditure ratios (Method 2 above), in practice, a variant of the 30:40 rule appears to work well in England as a measure of housing stress. However, the measure needs to be more nuanced than the basic rule. It is

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not the case that only those in the bottom two income quintiles face stress; some of those in the third quintile (and in some cases even the fourth) face stress, but it is true that those on lower incomes are more likely to face stress. This implies that an expenditure measure, weighted by the income quintile, is more appropriate. For example, those in the bottom income quintile and spending more than 25% of their incomes on housing costs are twice as likely to face stress as those in the top quintile.

Measure 2: First-time buyer affordability

Measures relevant to potential first-time buyers need to distinguish between affordability problems arising from access to finance and problems meeting mortgage repayments. The former have been particularly important in recent years and lie behind policies such as Help to Buy. Furthermore, there are considerable differences in conditions around the country. There are no ready-made metrics that adequately capture the position for potential first-time buyers. To address this gap, we advance a measure based on the Lorenz curve (and drawing on Measure 4 above), a graphical representation of the distribution of income or wealth.

Under reasonable assumptions, our metric finds that, in the South East (outside London) in 2015/16, a renting household with an income at the sixth decile could not afford to purchase a property at any point in the property price distribution without paying more than 30% of its income in housing costs. By contrast, the position is fundamentally different for existing home owners who wish to move. The results, therefore, reinforce the nature of the intergenerational problem. Existing owners can use accumulated equity both to meet the deposit on a new (or additional) home and can achieve low mortgage payments at the same time. In the lower-priced North East of England, it is still the case that 30% of renters could not afford a property at the lowest price decile.

Introduction

There is a widespread perception that housing in Britain is unaffordable, but unaffordable for whom? At least in the owner-occupier market, housing cannot be unaffordable in aggregate or the price of dwellings would simply fall. The issue is one of distribution. And, in any case, how should affordability be measured? Perhaps the most widely-quoted statistic – not only in Britain - is the ratio of house prices relative to earnings and, indeed, the measure forms a basic element of new government proposals for the assessment of local housing need. In 2016, house prices in England, according to official statistics, were on average 7.7 times earnings and, for many, this simple summary indicator epitomises the extent of the housing crisis; it does not appear plausible that prices relative to earnings could be sustained at these levels. But, in fact, there is very little support for the use of price to earnings ratios in the academic literature and, indeed, for any measure that concentrates on averages alone, because different groups experience different conditions. More generally, there is a recognition that affordability consists of a set of inter-related elements, which include not only price, but also physical adequacy and overcrowding[1]. Thus, cost indicators alone can be highly misleading.

These two related problems are addressed in the paper; the measurement of affordability and the groups in society most affected by affordability problems. Some groups actually benefit from a rise in the price to earnings ratio, notably those who have already paid off their mortgages and make capital gains; there are now more households who are outright owners than those with mortgages, due to an ageing population, but two groups – the young and those on low incomes – continue to lag behind. Furthermore, an increasing proportion of middle-aged, outright owners with high incomes are likely to own a second home, whereas low-income households are unlikely to own even one, widening the dispersion of wealth, which depends heavily on property ownership. The market has generally worked adequately for the majority, but not for younger households and those on low incomes.

This paper is structured as follows. Following a brief discussion of the historical use and development of affordability indicators, in the next section, we discuss the strengths and weaknesses of four existing approaches to affordability measurement[2], before proposing two

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[1] See Bogdon and Can (1997), Leishman and Rowley (2012).
[2] There is a further option based on work incentives; this recognises that higher rents, if compensated by increases in benefit payments, raise the barriers that prevent low-income households from taking up

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new measures of affordability: one for low-income renters, the other for first time buyers. Their value is demonstrated using data from the English Housing Survey, although the concepts are equally valid for the other parts of the UK. The final section concludes.

Affordability in context

Modern affordability concepts have their roots in 19th century studies of household budgets[3] and the turn-of-the-century expression used in the US, 'one week's pay for one month's rent', an early example of the 25% rule, later to be used by both mortgage lenders and in housing policy. Housing expenditure to income rules-of- thumb arose from Ernst Engel's and Herman Schwabe's 19th century work on the relationship between categories of household expenditure and income (known as the Engel Curve); following Engel and Schwabe's 19th century research, a large number of empirical studies were conducted in the first half of the 20th century, but continued to suffer from both conceptual and practical difficulties, including the appropriate definitions of housing costs and income. Therefore, definitive conclusions on the relationship between the two variables have never been reached. Moreover, even if it is possible to derive an expenditure 'law' from the data, this cannot necessarily be extended to a statement of what households *should* spend for policy purposes. Nevertheless, rules-of-thumb are still widely used.

As an illustration, Figure 1 shows the relationship between the percentage share of housing expenditure in income (including both owners and renters) and the level of household incomes in 2015/16[4]. Information is taken from the English Housing Survey – a key source for policy in England - based on a survey of more than 13,000 households. The values are averaged across households in each income band; this produces fairly smooth, downward-sloping curves although, in fact, expenditure proportions exhibit a high degree of volatility for individual households *within* the bands, reflecting the fact that other variables influence expenditure in addition to income. In the case of renters, information is available on the actual rent due to the

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work because the marginal tax rate from working is high. Therefore, outcomes are specific to the structure of the benefit regime and would be expected to vary internationally. In practice, the approach has been used most commonly in the UK and concentrates on the income level at which working households cease to qualify for Housing Benefit and so no longer face very high marginal tax rates (Young et al, 2017; page 14).
[3] Hulchanski (1995).
[4] The figure considers only those households with a head under the age of 60 and with household incomes between £3,000 and £100,000 per annum. It also includes only those households where gross housing costs are greater than zero. The sample size is 6,718.

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landlord and the subsidised rent paid by the tenant after the subtraction of housing benefits. The figure shows, as might be expected, that the relationship differs considerably according to whether benefits are treated as an addition to income or as a reduction in rent. In the case where rents are measured net of benefits, the curve is much flatter. Note that there are data limitations with the EHS[5] and Figure 1 is compiled primarily on the basis of data availability and different sources could lead to different conclusions.
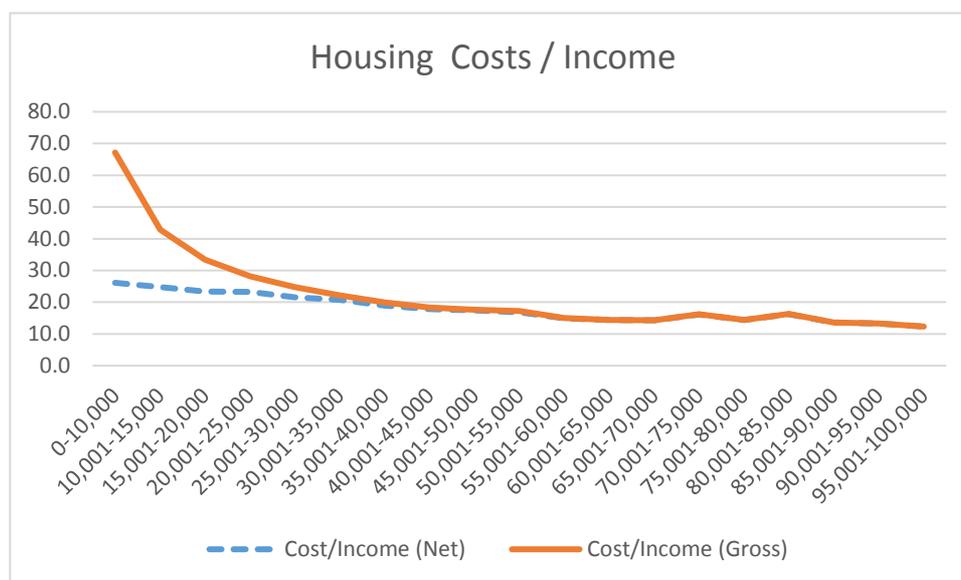

Figure 1: Housing Expenditure to Income Ratios (Rents Measured on a net and Gross Basis, %). Horizontal axis: household income, Vertical axis: housing expenditure as percentage of income

Even if the data problems could be overcome, considerable care is needed in using such indicators; notably, we cannot necessarily use information on a sample of households at a point in time to infer implications for the long-run aggregate relationship between housing demand and income. The survey data show how housing expenditures differ as income differs

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[5] .Owner-occupier costs are measured by mortgage payments here, although now more owners have paid-off their mortgages than have mortgages outstanding and, so, have no measured housing costs (and, therefore, are excluded from the figure). For owners, expected capital gains on the property are a form of negative cost, but are also excluded from the data used in the figure. Appropriate measures of owner occupier housing costs are discussed in a companion paper, Meen (2018). For both renters and owners, there is no information on property tax payments or maintenance expenditures which can be argued to be part of wider housing costs. Importantly, income is measured by actual income in the current year; it might be suggested that permanent income, which excludes temporary fluctuations, provides a better measure should it be available. Furthermore, income estimates are collected for the head of household, the head and a partner, and for all household members; it is not immediately clear which is the more appropriate. Additionally, income could be measured on a gross or net of tax basis; in practice, more information is available on gross incomes.

between households; aggregate time-series studies show how expenditure changes as aggregate income changes. To move from one to the other requires information on whose income changes – those at the top or bottom of the income distribution – since the effects differ. Aggregate inference is only possible if all incomes change proportionately[6] .

David Hulchanski[7] considers the validity of six uses of affordability rules of thumb - in his case housing expenditure to income ratios: (i) as a *description* of household expenditures; (ii) *analysis* of trends and comparison of different household types; (iii) *administration* of public housing by defining eligibility criteria and subsidy levels; (iv) *definition* of housing need for public policy purposes[8]; (v) *prediction* of the household ability to pay a rent or mortgage; (vi) as part of the *selection criteria* in the decision to provide a rental or mortgage. He suggests that the first three uses are valid, assuming that the indicators can be adequately measured and the appropriate methodologies developed, but the final three - definition, prediction and selection - represent inappropriate uses of the indicator. For example, performance indicators derived from averages do not necessarily provide good predictors of the ability to pay or the likelihood of default by an individual household. Nevertheless, it remains common practice for simple rules to be used for all six purposes. Later sections of this paper are particularly concerned with making progress on (v).

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[6] This is known as the aggregation problem; see Theil (1954).
[7] Hulchanski (1995).
[8] See Nelson (1994), for example, for a discussion of the use of expenditure ratios in US housing policy.

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9 How should housing affordability be measured?

Existing measures of affordability

1. House price to income/earnings ratio

Most housing market forecasters do not use detailed models of the housing market, but rely on rules of thumb and the house price to earnings ratio – as a measure of affordability - is the most common. The idea is that if house prices relative to earnings are above the long-run trend, then they must fall. In fact, it is straightforward to show that price to earnings ratios are a poor guide to prediction and as a measure of affordability; so why do they continue to be used, not least as a guide to housing shortages in policy decisions? Both New Zealand and more recently the UK have advocated the use of the ratio in land-use planning[9]. There are, in fact, a number of practical advantages to house price to earnings ratios; first, the underlying data are regularly published and are available on a broadly comparable basis internationally. For example, the United Nations developed a set of internationally comparable urban indicators, which included house price to income and rent to income ratios.[10] Second, there are no regular, published assessments of the accuracy of the forecasts produced by different methods and, so, the weaknesses of price to earnings ratios are not immediately apparent. Third, it is possible to tell an intuitively plausible story why there should be a constant long-run affordability ratio to which the economy returns; for example, mortgage lenders impose limits on borrowing in relation to incomes, which particularly affect demand by first-time buyers. Fourth, predictions on this basis are cheap to construct and require few technical skills. Finally, it might be argued that even if changes in the ratio over time have limitations, comparisons of different locations at one point in time still provide useful information[11].

Figure 2 illustrates the problems with the ratio[12]; in this case average house prices are measured relative to household disposable income (using average earnings instead does not change the central messages, but arguably household income is a better indicator since it includes all household income and not just the earnings of the main earner). The graph shows

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[9] See Murphy (2014).

[10] Malpezzi and Mayo (1997).

[11] However the most affordable local authority in England is Copeland in the North West; the district contains the Sellafield nuclear reprocessing plant, which appears to have been capitalised into house prices. Therefore neighbourhood characteristics matter.

[12] See Leishman and Rowley (2012) and Rowley and Ong (2012) amongst many others for discussions of affordability concepts and the associated measurement problems.

the aggregate position for the economy as a whole but, as noted above, it does not demonstrate the position of different groups in society. The graph also shows the average ratio constructed on the data between 1969 and 2000; over this period, there is, in fact, only limited evidence of an upward or downward long-run trend[13] and forms the basis of the view that affordability must return to the long-run level and, implicitly, provides a threshold for the affordability measure. Possible over-valuation during the booms in the early 1970s, the late 1980s and post-1996 particularly stand out, along with under-valuation in the first half of the 1990s. But it is also clear that the cycles have been very different in nature and certainly not regular; the 1970s and 1980s booms were relatively short and sharp, whereas the post-1996 boom was longer-lasting; the ratio, therefore, provides no basis for short-term forecasting. More importantly, the ratio has remained above the trend even after the Global Financial Crisis. The reason is simply that nominal interest rates have been very low, so that households can afford to purchase higher-priced dwellings for a given level of income; low interest rates are capitalised into house prices and, so, price to earnings ratios are misleading at times of low interest rates, over-stating affordability problems. Market rents relative to incomes have been suggested as an alternative; in equilibrium, we might expect these to equate to owner occupier housing costs and in fact this ratio does not show an increase relative to incomes.[14]
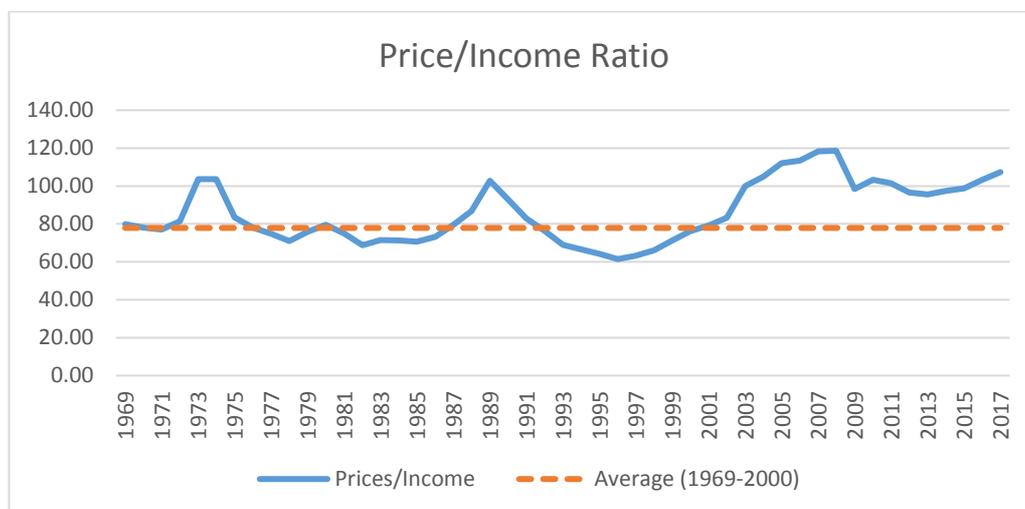
Figure 2: Ratio of UK House Prices to Household Disposable Income, 1969-2017 (2015=100).
Source: ONS

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[13] In fact, formally based on Augmented Dickey-Fuller Statistics, there is some evidence of an upward trend, but it depends on the time period chosen.
[14] The relationship between rents, house prices and owner occupier housing costs are discussed in more detail in the companion paper, Meen (2018). See also the arguments of Ian Mulheirn at: https://medium.com/@ian.mulheirn/two-housing-crisis-87a843a9d09b.

11 How should housing affordability be measured?

The rise in the price to earnings ratio in recent years is not limited to the UK and OECD data show that similar rises have occurred in at least some other countries, for example, Australia, Canada and Sweden, but the increases have not been universal; the USA, Germany and Japan have experienced a long-run decline since the early 1980s. There is no necessary reason why price to earnings ratios should be constant in the long run; indeed, economic theory suggests that in conditions where increases in housing supply are highly responsive to changes in demand (and this varies internationally), house prices should rise in line with construction costs rather than incomes.

2. Housing expenditure to income ratios

Housing *expenditure* may, under some circumstances, provide a better guide to affordability changes over time since owner-occupier expenditure at least includes the effects of changes in interest rates. Whereas Figure 2 implies worsening affordability in recent years, a measure that takes into account explicitly lower interest rates would show less evidence of a decline. In addition, measures based on expenditure ratios pay more attention to the distribution of outcomes across household types. Nevertheless, some of the weaknesses have already been outlined in the last section. To demonstrate these issues, it is helpful to introduce the budget constraint, widely used in consumer theory. In any year, a household is faced with the constraint on its expenditure, given by relationship (1):

> *Consumers' expenditure (excl. housing) + housing costs + saving from current income*
> *= post-tax household earned income + post-tax income from net financial assets* (1)

For a given level of income – either earned or from investments – shown by the right-hand side, the household can decide either to demand housing, other consumer goods or to save. Savings can be negative if the household borrows to finance its expenditure. Therefore, the relationship demonstrates that there is a trade-off: households can *choose* between housing and other consumption goods, and some households may choose a low level of housing if they prefer a higher level of non-housing goods[15]. In addition, some low-income households

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[15] See Hancock (1993) for a derivation from first principles using indifference curves and the budget constraint.

may choose to live in low-priced areas, rather than being forced to live there by necessity. To account for this, some studies attempt to look at the cost of a minimum standard of housing[16].

In practice though, there are constraints on the extent to which households can trade-off housing consumption for non-housing consumption. First, there may be binding government-imposed minimum housing standards so that households cannot consume housing below a given level. These may be imposed because of perceived externalities – inadequate housing is associated with poor health and low educational outcomes. But (1) stresses that there is a cost associated with standards (unless the housing is subsidised as in Figure 1) in terms of lower levels of non-housing consumption and reduced saving (or higher borrowing). Indeed, it is possible that minimum housing standards reduce non-housing consumption below poverty levels.

Second, households may not be able to achieve their desired levels of housing consumption and, indeed, choice of tenure because of insufficient access to credit markets; this particularly affects potential first-time buyers and may be a long-term problem. The constraints typically arise because of lender or central bank imposed deposit requirements and limitations on loan repayments as a percentage of income[17]. Deposit constraints have been particularly important with the average deposit for first-time buyers between 2000 and 2016 standing at approximately 20% of the purchase price and, since the Global Financial Crisis, borrowers have been required to pass stronger stress tests in terms of their ability to service loans. A consequence is that housing expenditures expressed relative to incomes appear more affordable than the true position, because such measures do not take into account credit market constraints and the fact that households are forced to consume sub-optimally in terms of the quality of housing and the location. The effects on non-housing consumption are ambiguous; households may either reduce consumption in order to save more to raise the deposit or give up on home ownership and increase non-housing consumption. A further consequence is that they may remain with parents for longer or rent, potentially sharing with others in a similar position. However, the main point is that housing expenditure to income ratios do not necessarily reflect optimal household choices and some measure of credit restrictions has to be taken into account.

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[16] See Lerman and Reeder (1987).
[17] See, for example, Bourassa (1996) or Meen (2001).

In practice, rather than measuring housing expenditures in absolute terms as in (1), affordability is usually measured relative to incomes[18] . Although scaling so that affordability is measured as a percentage can be useful, for example, in international comparisons, it also has disadvantages. Because the budget constraint in ratio form is independent of the *level* of income, this implies that it is possible that those on low incomes consume low *levels* of both housing and non-housing goods, but housing still appears affordable, whereas those on larger incomes consume higher levels, but housing appears unaffordable in percentage terms[19]. More generally, questions of housing affordability cannot be divorced from questions of housing standards[20]; those households observed to live in homes considered to be affordable may be experiencing unacceptable standards, but some of those households experiencing measured housing stress may be "over-consuming" housing at least on official measures.

The fact that high-income households can spend a high percentage of their income on housing without incurring shortages in non-housing consumption, has led to the use of the 30:40 rule, which considers only the proportions or number of households in the bottom two income quintiles (i.e. 'bottom' 40%) who are spending more than 30% of their income on housing[21]. The measure has commonly been used in Australia[22]; although the parameters are arbitrary, in Australia, it is the case that affordability problems for those in private rentals are not confined to those on the lowest incomes, but exist for those in the lowest two income quintiles at least.

1. Residual income left for housing

Despite the widespread use of ratio-based indicators, there is a general appreciation of their shortcomings; a rule that housing expenditures should not exceed 25% or 30% of incomes implies that non-housing expenditures should not be less than 75% or 70%, irrespective of the level of income or household type. We also noted that observed historical percentages cannot be used as an indication of the adequacy of housing or non-housing consumption standards.

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[18] In other words the budget constraint, (1), can be divided through by income so that the sum of the expenditure and savings shares adds to one.
[19] See Hancock (1993).
[20] See Stone (2006a).
[21] Most studies calculate the numbers or percentages of households whose expenditures lie above the threshold, i.e. they employ a headcount measure. Chaplin and Freeman (1999), however, propose a more sophisticated approach, which allows for how far above the threshold costs are for each household; this is based on the Foster, Greer and Thorbecke statistic used in poverty analysis.
[22] See, for example, Hulse et al. (2014).

This has led some authors[23] to advocate the use of measures that show the *difference* between incomes and housing costs rather than the ratio. Alternatively, ratio approaches can be combined with difference or residual income methods to construct a hybrid indicator[24]. This residual income approach subtracts from disposable income the monetary value of a pre-defined standard of non-housing needs; this, therefore, determines how much is affordable for housing. Since housing typically has a first claim on income, if the amount actually paid exceeds affordable housing costs, then the residual income left over for non-housing consumption will be inadequate.[25] Since actual housing costs reflect the quality and location as well as price, an alternative is to consider only the cost of basic physical housing in order to abstract from the issue of over- or under- consumption.[26]

This approach can also be seen in terms of a simplified version of relationship (1), ignoring savings and borrowing, and again shows the opportunity cost of housing expenditures; for a given non-housing budget standard, which determines the first element on the left-hand side of (1), affordable housing is determined by the constraint. However, the non-housing budget standard requires the specification of a basket of goods of essential items that have to be priced and which varies between households; in general, larger households have greater non-housing needs. It also follows that housing affordability will decline with household size, but will increase with income. Importantly, even if *aggregate* indicators of affordability show limited differences between ratio and residual income approaches, the *distributional* outcomes are typically very different[27].

The general principle that affordability should be household specific is appealing, but also implies that the method is more demanding in terms of construction, although the problems are not insurmountable; in particular, the approach requires the use of household specific budget standards, which are regularly updated. Although international approaches to the measurement of budget standards are often related, they are not identical and have to be

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[23] Michael Stone has been a particularly strong advocate; originally constructed primarily for the US, he has also conducted analysis of the UK and Australia, see Stone (2006, 2006a), Stone et al (2011), Burke et al (2011), Henman and Jones (2012). Kutty (2005) uses a similar approach, employing the US poverty threshold as a measure of minimum non-housing consumption. Thalman (2003) uses the residual income approach to develop indicators that distinguish affordability problems that arise from low incomes as opposed to high housing costs. The methods are applied to Switzerland.
[24] See Bramley and Karley (2005).
[25] See Stone et al (2011), page 36.
[26] See Thalmann (2003).
[27] See Stone (2006a).

seen in their own socio-economic context. Perhaps, because of the greater complexity, there are few examples where the residual income method has been applied consistently over time so that changes in conditions can be traced.[28] Nevertheless, in recent years, the approach has attracted greater attention in Australia, but there are no recent applications in the UK. Also, arguably, the residual income approach is more consistent with current mortgage lender practice and regulatory requirements, which take into account the amount borrowers have left over to cover their mortgages if interest rates increase after allowing for other out-goings.

Finally, the standard approach to residual income measurement underplays a central feature of the budget constraint, (1) – the ability to borrow; as noted in footnote 5 current income may over or under-state permanent income[29] and the ability to save or dis-save can be used to smooth consumption patterns. Therefore, residual income approaches may also lead to errors in affordability assessments, although Yates and Gabriel[30] argue that a significant proportion (but by no means all) of households are in stress for more than one year, suggesting that the transitory component of income is less important.

2. Housing supply measures

Each of the previous approaches concentrates primarily on housing demand and pays little attention to the supply of homes available to the lowest income groups or to the imbalance between demand and supply. These could be measured by vacancy rates for units at low rentals or the total number of properties available at different rent levels. However, many of the same problems observed in the demand indicators remain, for example, the measures provide little information on the quality, size or location of the units; furthermore although there have been applications in the US[31], regularly available data are inadequate for the task in the UK.

Alternatively, measures can be constructed that incorporate both demand and supply elements by comparing the distribution of available housing by costs with the distribution of household incomes; this attempts to relate the number of housing units potentially affordable by different income groups to the total number of households in each income group. In principle, the measure can be applied to both rental housing and to ownership. Under the

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[28] Michael Stone's work for the US provides an exception for 1983, 1990, 1993, 1994 and 2006.
[29] See Bogdon and Can (1997).
[30] Yates and Gabriel (2006).
[31] See Bogdon and Can (1997).

latter, the distribution of house prices in any location can be compared with the proportion of households in each income band that can afford those prices under assumptions about interest rates, the mortgage loan length and the required deposit. If the market "matches", we might expect, for example, households in the bottom income decile to be able to afford properties in the bottom price decile.

New Measures of Affordability

1. Low income renter affordability

A fundamental reason for interest in affordability is its potential impact on stress and wellbeing. In Australia, the 30:40 rule is commonly used as a measure of housing stress and attempts have been made to assess its association with wider indicators of well-being[32]. In fact, the relationship appears to be modest at least in the Australian case once standardisation for other demographic factors is taken into account; as might be expected, there is a significant positive relationship with the ability to pay the mortgage or rent on time[33], but the relationship is weaker for other indicators of financial deprivation and health outcomes. Furthermore, the relationships become even weaker when the dynamics are taken into account; there is little evidence that *changes* in measured housing stress over time are associated with an improvement in financial wellbeing. Steven Rowley and his colleagues have suggested improvements to the 30:40 rule more likely to be correlated with wellbeing, where longitudinal data are available allowing individual households to be tracked over time; rather than measuring affordability in any single year, what matters is the length of time that a household has been in stress. In addition, they argue that even those in the bottom two income quintiles may enter housing measured stress because of their own choices rather than being pushed into stress by external events. Only the second group are expected to experience wider financial stress[34].

Although the English Housing Survey does not provide longitudinal data[35], which would allow an analysis of the length of time that households have been in stress, some key features of the Australian studies can be replicated for England[36]. We are interested in the probability that

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[32] See Yates (2007), Rowley and Ong (2012) and Rowley et al (2015). Yates and Gabriel (2006) use the 30:40 rule as their preferred measure and argue that is robust to modest changes in specification.
[33] See Rowley and Ong (2012, Table 9).
[34] See also Borrowman et al (2017) for Australia, who show that most households who enter housing affordability stress escape within a year.
[35] See Bramley (2012) who estimates a similar model to that employed in this section, but uses data from the British Household Panel Survey for 1997 to 2003. It might be noted that equivalent analysis to ours could also be conducted using the Family Resources Survey.
[36] Australian studies on panel data, e.g. Borrowman et al (2017) in fact find that the majority of households escape stress within a year. Bramley (2012) also indicates that a significant part of English stress is transitory.

a household paying more than a threshold level of housing costs will face financial stress. The English Housing Survey asks three relevant questions related to stress[37] : (i) how easy is it to pay your rent after benefits? (ii) are you up to date with rent payments? (iii) have you fallen behind with rent payments over the last 12 months? If the household answers either "fairly difficult" or "very difficult" to (i); or "No" to (ii); or "Yes" to (iii), we take this to be an indicator that the household faces stress. Similar questions are asked for owners but, at least in 2015/16, high levels of outright ownership and low interest rates for those with mortgages meant that few owners reported stress, although this was not necessarily the case in earlier years[38]. But 29% of the sample of renters under the age of 60 experienced stress in 2015/16. These cover renters in both the social and private rented sectors, since increasingly low-income renters are housed in the private sector.

The key variable used to explain financial stress is whether the household is spending more than a threshold percentage of income on housing after the subtraction of housing benefits. Since the appropriate threshold is unknown, we experimented with different values and, in fact, found that a value of 25% provided a slightly better explanation than 30%[39]. However, the expectation is that those in the lowest income quintiles are more likely to experience stress than those on higher incomes, who are more likely to *choose* to spend a high percentage of their incomes on housing; this is tested directly. Furthermore, in the construction of the affordability ratios, current income is used rather than equivalised income; the latter is sometimes used since it takes into account the size of the household but, here, demographic controls[40] are explicitly incorporated rather than through an income adjustment. The failure to allow for such factors may distort the relationship between stress and affordability.

The important results concern the relationship between financial stress and affordability and the details appear in Appendix 1. The results from the appendix are translated in Table 1 to

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[37] These are only available in the Special Licence version of the EHS.
[38] See Bramley and Karley (2005) and Bramley (2012). These studies also carry out similar logistic analysis to ours.
[39] Bramley (2012) came to a similar conclusion.
[40] The demographic variables considered are ethnicity, household size, the number of dependent children, age, length of residence at the current address, whether the household was homeless before entering into renting, whether there is a disabled or long-term sick member of the household, and the number of unemployed members of the household. In addition stress might differ between tenures (local authority, housing association and private tenants) and location. Each household's location is captured by the Government Office Region in which it resides and the 2015 Index of Multiple Deprivation decile ranking of the Lower Layer Super Output area.

show the relative sizes of the effects of affordability for the different income quintiles. The value of one for the top quintile implies that affordability has no significant influence, but the effect of affordability on stress declines sharply with income. Nevertheless, the results are more subtle than the simple 30:40 rule suggests; those facing high housing costs in the bottom quintile are more likely to undergo stress than those in the second quintile and even those in the third quintile on moderate incomes with high housing costs have a significant probability of stress. Therefore, in fact, in the English case, expenditure ratios provide a better predictor of financial stress than might have been expected given their theoretical shortcomings. But the indicator needs to be more nuanced than the basic 30:40 rule.

Income Quintile	Relative Effect
Quintile 1	1.97
Quintile 2	1.69
Quintile 3	1.58
Quintile 4	1.27
Quintile 5	1.00

Table 1: The Effect of Affordability on Renter Financial Stress at each Household Income Quintile

There is an important related question; households with high net housing costs are more likely to face stress if they are in the lower income deciles, but the values in Table 1 do not imply that, on average within each quintile, those in the bottom quintile have a higher probability of stress than those in the top quintile. This is because housing benefit reduces housing costs particularly for those on low incomes and Figure 1 hinted at this, showing that net of benefits, housing costs as a percentage of income do not differ dramatically across the income classes. Table 2 demonstrates the point; the second column shows the estimated probability that households in each quintile will be in stress (based on their answers to the three questions above), averaged over the households in that quintile, if households each receive the appropriate 2015/16 level of benefits; in fact these probabilities differ little over the quintiles since housing benefit flattens the cost distribution. But the third column simulates the effect of removing benefits which, unsurprisingly, have a disproportionate effect on the lower income groups; for those in the lowest quintile the probability of being in stress rises by almost twenty percentage points. Those at the top end of the income distribution are unaffected. The differences reflect the distribution of housing benefits since those on higher incomes typically do not receive benefits.

In summary our results imply that an expenditure measure, weighted by the income quintile, is appropriate. From Table 1, the expenditure of those in the bottom income quintile would have double the weight of those in the top quintile.

Income Quintile	Probability of Stress (2015/16 Benefits)	Probability of Stress (No Benefits)
Quintile 1	0.29	0.48
Quintile 2	0.31	0.39
Quintile 3	0.31	0.34
Quintile 4	0.28	0.28
Quintile 5	0.24	0.24

Table 2: Housing Benefit and Financial Stress

2. Potential first-time buyer affordability

The analysis of housing expenditure ratios in the last section suggests that a more nuanced indicator could provide a useful representation of the stress faced by low-income renters in England. But a different approach is required for our second focus group – potential first-time buyers because their problems are rather different; whereas, in the case of renters, the differences are between high and low-income groups, for potential owners the problems are intergenerational and also spatial. Once first-time buyers are able to achieve ownership, there is little evidence from the English Housing Survey that owners face significant stress since, at low interest rates, their housing costs are typically low and they accumulate capital gains if house prices are rising. For potential first-time buyers, two elements of affordability need to be distinguished: *purchase affordability* (whether the household is able to borrow sufficiently to buy a house) and *repayment affordability* (which considers the proportion of income spent on servicing the mortgage)[41]. Both differ around the country. Therefore, affordability indicators

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[41] Gan and Hill (2009) operationalise the concepts for Australia and the US. Bramley and Karley (2005) also introduce a related approach for England, concentrating on access to home ownership based on maximum loan to income ratios and a residual income requirement.

have to take into account the required deposit and location. In addition, indicators need to capture quality differences.

Consider relationship (1) again, which holds for both renters and owners, For the same quality of accommodation, normally we would expect households to choose the cheaper, which allows higher levels of non-housing consumption. But the direct cost of ownership hides the fact that potential first-time buyers may face credit market constraints through an inability to raise the required deposit; deposits are necessary to meet both the requirements of lenders arising from adverse selection under asymmetric information and the regulations imposed by the central bank designed to limit high loan-to-income lending. It is possible to show that actual housing demand will deviate from the unconstrained desired level and the length of time spent in disequilibrium will be positively related to the required deposit percentage[42]. Furthermore, less constrained – typically richer households – are likely to have smoother housing time profiles than constrained households.

The principles are now applied to currently renting households, under the age of 60 living in the South East of England outside of London and also to those living in the North East, sampled in the 2015/16 English Housing Survey (data from the Family Resources Survey could alternatively be used). Arguably, age should have a lower cut off point than 60, but further exclusion reduces the sample size and, in any case, the key results are unaffected. Similarly the use of regions is, perhaps, not optimal since they do not correspond to housing market areas but only limited information on incomes is available at finer spatial scales.[43] Current renters are potential first-time buyers, but the sample excludes non-dependent children living with their parents who are also potential first-time buyers[44]. With the exception of London, the South East is generally the most expensive region of the country and so the affordability problems are the most severe, whereas the North East is the cheapest. Using a sample from the Land Registry, in 2015/16 the median house price in the South East was £245,000 and £120,500 in the North East. Relative to *renter* incomes, the difference between the two locations was less extreme – the median price to earnings ratio was 9.9 in the South

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[42] Meen (2001). See also Bourassa (1996) for an application to affordability measures.
[43] See Jones et al (2011). This study circumvents the absence of income data at fine spatial scales by concentrating on one group – young teachers whose salaries exhibit little spatial variation. By contrast, Bramley and Karley (2005) construct their own local income distributions. It might be noted that highly localised analysis is not necessarily appropriate since it implies that households can only buy in those small areas.
[44] The sample could also include some renters, who had been owners in previous periods and, therefore, not potential first-time buyers.

East and 7.6 in the North East; we stress the fact that the ratio is measured relative to the incomes of renters in the sample. Published price to income ratios typically look at all incomes, including home owners. Since the incomes of renters are, on average, lower than owners, our measure raises the ratio in each region. This is illustrative and we have, of course, already criticised the use of the average price to earnings ratio since it ignores the distribution, a problem that becomes evident shortly. Note also that restriction of the samples to renters under the age of 60 in only two regions limits the sample sizes, to 590 households in the South East and 233 in the North East. Renters cover private, local authority and housing association tenants.

Household incomes and house prices are divided into deciles; the latter provides information on the supply of and demand for homes of different types. Consequently it is possible to calculate the proportion of the house price distribution a potential first-time buyer in each income decile could purchase under differing assumptions concerning deposits and mortgage interest rates, if mortgage repayments as a percentage of income are not to exceed 30% (or any other percentage)[45]. This gives rise to a form of Lorenz Curve (a graphical distribution of the equality of affordability) and Gini Coefficient, shown in Figure 3. A restriction should be noted; we are interested in properties that are realistically achievable by first-time buyers whereas, in fact, in the South East, the highest-priced property sold in 2015/16 was £18 million. Therefore, in the South East the price distribution has been curtailed at £425,000 and £300,000 in the North East. These are the highest valued dwellings that a renting household at the 10th income decile could afford under the assumptions concerning deposits and mortgage interest rates[46]. It should also be noted that this approach does not attempt to match the *numbers* of households and properties, because of the concentration on first-time buyers; matching is concerned with the stock of owners and properties, whereas first-time buyers are only one segment.

Figure 3a shows the Lorenz Curve for the **South East**. The straight blue line illustrates a 'perfectly equal' distribution of affordability; households in the lowest income decile could

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[45] Wilcox and Bramley (2010) use a related methodology. See also Wilcox (2006).

[46] A further caveat is that the highest income category in the EHS is recorded as "£100,000 or more" rather than precise values; income for these observations has been set to £100,000 and, so, for some in the highest decile, affordability is likely to be understated. This affects the South East, but not the North East, where no tenants recorded incomes over £100,000.

afford to buy a house in the lowest house price decile without spending more than 30% of their incomes on mortgage costs; and households in the second income decile could afford to buy a house in the lowest two house price deciles etc. What we actually see is that - assuming a 5% mortgage interest rate, a 25 year repayment mortgage and a required 5% deposit - a household with an income at the sixth decile could not afford to purchase a property at *any* point in the truncated property distribution without paying more than the 30% of its income in housing costs. The Gini Coefficient is 0.74, reinforcing the high degree of inequality obvious from the figure. The parameter assumptions are arbitrary, but the method allows easy simulations under alternative values; for example, the household may be able to afford repayments at a 5% interest rate, but not be able to obtain a loan at the higher rates used in stress tests. Also the market is gradually shifting towards longer term loans. If the required deposit is 20%, the Gini Coefficient falls to the still high value of 0.62, but, of course, most first-time buyers would struggle to raise 20% without help. The results are, however, sensitive to the 30% threshold; increasing the maximum proportion to 50% reduces the Gini Coefficient to 0.36. By contrast, the position is fundamentally different for existing home owners who wish to move, because of the accumulated equity in their current homes. The EHS provides owner-based assessments of equity and, using these estimates, with the exception of the most expensive properties in the (untruncated) price distributions, most owners, even in the lower income ranges (for owners which are higher than for renters) could afford higher value properties without paying more than 30% of their incomes in housing costs. The results, therefore, reinforce the nature of the intergenerational problem. Existing owners can use accumulated equity both to meet the deposit on a new (or additional) home and can achieve low mortgage payments at the same time. Accumulated equity matters more than income for existing owners, a benefit not available to renters.

Figure 3b shows the equivalent Lorenz Curve for the **North East** under the 5% deposit, 5% mortgage interest rate and 30% repayment rules. At 0.58, the Gini Coefficient is lower than in the South East, but there are still significant proportions who cannot afford to buy even properties at the lowest priced decile. The proportion is 60% in the South East, but still 30% in the North East. Therefore, affordability for first-time buyers is not just a southern problem, once the full distribution of outcomes is taken into account, rather than just averages.
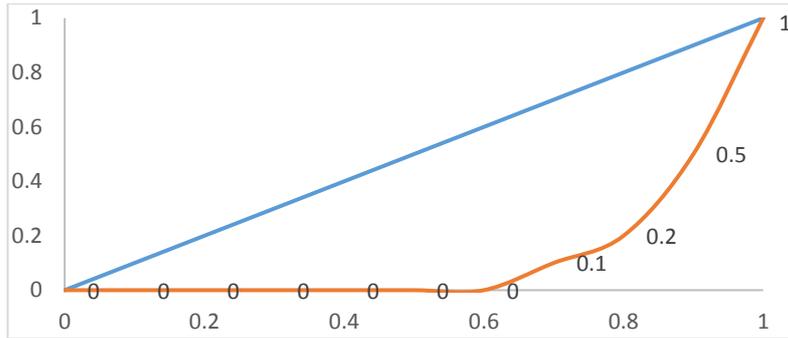
*Figure 33a: Lorenz Curve: Affordability for Potential First-Time Buyers in **South East England.** Horizontal axis: cumulative percentage of households going from poorest income decile (left) to richest income decile (right) . Vertical axis: cumulative percentage of house prices from lowest (bottom) to highest (top)*
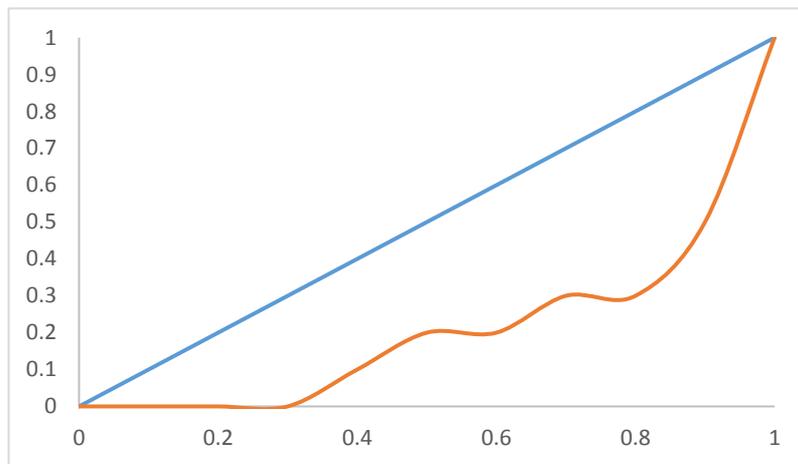
*Figure 3b: Lorenz Curve: Affordability for Potential First-Time Buyers in **North East England** Horizontal axis: cumulative percentage of households going from poorest income decile (left) to richest income decile (right) . Vertical axis: cumulative percentage of house prices from lowest (bottom) to highest (top)*

Conclusion

In this paper we have examined indicators of affordability relevant to the two groups and suggest that different indicators are required for low-income renters and potential first-time buyers; the indicators can be constructed using regularly published data and well-known concepts. Importantly, the measures are based on the distribution of outcomes rather than relying on measures of central tendency. This is necessary because different groups face different housing conditions; the majority of households do not face affordability problems and, indeed, increasing house prices represent a capital gain for those already on the owner-occupation housing ladder. The unambiguous losers are renters; affordability problems are tied to three types of inequality: inter-generational, spatial and across the income distribution. Any measure has to incorporate all three elements. Although measures applicable to low-income groups and across different locations have been widely discussed in the literature, arguably, measures applicable across the generations have received less attention; by their nature, measures need to be dynamic rather than considering the position at one point in time. For example, affordability in owner-occupied housing has two components – the ability to access the sector and the ability to maintain mortgage repayments. The former requires information on the ability to borrow in mortgage markets.

The paper discusses a number of classes of affordability indicators. We are highly critical of the simplest – the house price to earnings ratio; the ratio provides no information on the distribution of outcomes across household types and income levels, it can be misleading as an indicator of changes in affordability over time even at the aggregate level and it is worrying that it is to be used as a central indicator in local authority housing needs planning. The second class – measures of housing expenditure relative to incomes (both rents and mortgage payments) - has been heavily criticised in the literature on conceptual grounds; for example, ratios cannot distinguish adequately between households with different income levels, but still continues to be widely employed. We consider, therefore, whether expenditure measures provide useful information in practice and, perhaps surprisingly, in the English case they are strongly related to direct measures of financial stress. Nevertheless, the results have to be carefully interpreted and the widely-used 30:40 rule is over-simplistic. The third approach – the residual income method – has conceptual advantages, but still has practical, measurement problems, notably in the definitions of income and non-housing budget standards. Furthermore, the budget constraint on which it is based takes no account of borrowing possibilities. The fourth approach has the advantage of recognising that affordability needs to

take into account the supply of properties as well as demand, but some of the problems of the other approaches remain. In practice, this approach has been used less widely internationally.

Two new measures are proposed; the first is a variant on the 30:40 rule for renters, but recognises that even those well up the income distribution can still face stress. The second recognises the importance of variations in the availability of different types of property and mortgage market conditions that particularly affect potential first-time buyers, but not existing owners because of accumulated equity; the paper provides estimates of affordability for potential first-time buyers based on variations of the Lorenz Curve and the Gini Coefficient. These incorporate both measures of access to mortgage markets through the required deposit and mortgage repayments. The indicator suggests that in the South East of England, a household would need an income at the seventh decile before it could afford a property in the first decile of prices; incomes would need to be in the fourth decile in the North East. By contrast, existing owners have no such problems, emphasising the inter-generational and inter-tenure inequalities.

Appendix 1

Modelling the Effects of Affordability on Stress

The effects of affordability on stress are modelled through a probit equation[47]. The dependent variable refers to renters under the age of 60 and includes 5,715 observations, taken from the 2015/16 English Housing Survey. The dependent variable takes a value of one if the household is in stress (as defined in the main text) and zero otherwise. 29% are defined to be in stress.

The key independent variable takes a value of one if the household is paying for housing more than 25% of its household gross income, net of benefits, and zero otherwise. No allowance is made for property taxes or fuel costs. The variable is multiplied by a dummy for the income quintile in which the household lies, which allows different effects for affordability in each quintile. The lowest quintile is omitted as the comparator, but its implied coefficient is given by row (5) in Table 1a; for the second quintile, the total effect is row (1) + row (5) and similarly for the other quintiles. Since the coefficients are taken from a probit equation, in this form they do not have a ready interpretation; for example, they are not marginal effects. Therefore in the main text (Table 1), they are shown in terms of their relative sizes.

A range of demographic, tenure and location control variables, described in the text, are also added, but not shown in Table 1a.

	Coefficient	z-value
(1) Affordability*Quintile 2	-0.266	3.6
(2) Affordability*Quintile 3	-0.376	3.9
(3) Affordability*Quintile 4	-0.666	4.4
(4) Affordability*Quintile 5	-0.920	3.9
(5) Affordability	0.867	15.2

Table 1a: The Probability of Financial Stress

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[47] Perhaps the closest study in the literature is Yates (2007) for Australia, who, in multi-variate logit estimation, found little relationship between financial stress and housing stress, although the measures of financial stress were rather different from that employed here.

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