



Spatial Disparity in Household Indebtedness across the UK

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Abstract

Design/methodology/approach:

Using GIS-based Exploratory Data Analysis and mapping, the paper identifies local concentrations of household borrowing, both secured and unsecured, which is referenced against regional Gross Added Value.

Purpose:

This paper assesses the lending risks associated with the level of total household indebtedness at local authority level across the UK.

Findings:

Significant local differences are revealed which are tracked over the period 2013 to 2019. Total debt relative to the size of economy is larger in London and local authorities around London. A positive correlation was revealed between areas of multiple deprivation in England and those local authorities with proportionally high unsecured lending, confirming that the less well-off require access to debt facilities and in the absence of availability of secured loans, resort to unsecured borrowing.

Originality/value

Understanding where the additional lending risks are located across the UK is relevant when evaluating the robustness of the economy to recession, with its uneven effects on different sectors and households and the impact of monetary policy changes, particularly sharp rises in interest rates. The mapping of these risks is illuminating and aids understanding.

Key words: Household, indebtedness, lending, risk, GIS.

1.0 Introduction

Prior to the Covid-19 pandemic, the level of total household debt across the UK, secured and unsecured, was rising¹. Total household debt by the end of March 2018 was £1.28 trillion, of which £119 billion (9%) was financial debt (credit card loans and other non-mortgage debt) and £1.16 trillion (91%) was property debt (mortgages and equity release). In this period, total property debt increased by 0.03 trillion (3%), while total household financial debt rose by £12 billion (11%) with most of the change being accounted for by an increase in the amount of goods purchased through higher purchase agreements (up by £6 billion) and student loans from the Student Loans Company (up by £7 billion). The increases in total household property debt and total household unsecured debt were driven by a combination of both an increase in the number of households with debt and increasing levels of debt (ONS, 2019a).

The pricing of lending risk is affected by the size and purpose of the loan, the nature of the security, the tenure, the fixed or variable nature of the interest rate, household demographics and the financial strength of the borrower. ONS (2019a) ranks households by their total wealth and split the number of households into 10 equal deciles. From this, it is observed that the bottom wealth deciles are most likely to have financial (unsecured) debt, while the middle wealth deciles are the most likely to have property debt – a not surprising result given that households in those bands are sufficiently wealthy to be able to secure mortgages and meet the first-time buyer deposit requirements but who are unable to purchase the property outright. Overall, more debt is held by the higher wealth deciles - the wealthiest 50% of households held 64% of total household debt in the two years to March 2018 - since they are more likely to have mortgage debt, which has higher average values than financial debt. When debt is considered as a proportion of wealth, for the lowest wealth decile, the value of debt was three times the value of total wealth in this reporting period, although for the rest of the total wealth deciles, the value of total debt is lower than the value of total wealth (ibid).

Behind these national figures hide significant local differences in demographic profile, housing supply, overall economic activity and level of economic sector diversification, house price and wage growth and fluctuations in the composition of the debt between secure and unsecured lending, all of which requires proper investigation. Debt is obtained at household level in specific urban and rural locations where levels of economic output and prosperity differ. This introduces the likelihood of differential

¹ While the pandemic and consequent lockdown saw a reduction in levels of personal debt among the wealthy, as opportunities to spend and travel were restricted, this is viewed as an anomaly and not a reversal in trend. Over £12 billion of consumer credit was repaid mainly by higher income households in the second quarter of 2020 (Gray, 2020)

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3 levels of lending risk when comparing both secured and unsecured borrowing levels, against economic
4 activity in a specific area. Understanding where across the UK these additional risks are located is
5 relevant when evaluating the robustness of the economy to a recession, with its uneven effects on
6 different sectors and the impact of monetary policy changes.
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11 To fully understand the loan book risk, the overall aim of this paper is to assess the lending risks
12 associated with the level of total household indebtedness at the local level. Our interest is in
13 understanding where the economic risk lies, where the risk is concentrated and if there is a downturn
14 in the economy which areas are likely to suffer more. To achieve this, we aim to investigate at a
15 household level which cities and regions have higher levels of borrowing in absolute terms and to
16 understand the composition of the borrowing between secured and unsecured debt, all with
17 reference to Gross Value Added (GVA). Reference and comparison will also be made to the English
18 indices of deprivation (Ministry of Housing, Communities & Local Government, 2019). The results will
19 be of interest to central and local government in shaping national and regional economic policy and
20 to the lending industry, highlighting areas with potentially higher lending risk. The research is
21 innovative in that it will use Geographical Information System (GIS) mapping techniques to assist in
22 the analysis of the results and to help illustrate the striking spatial differences in household
23 indebtedness. To date, the incorporation of GIS into housing and mortgage market research has been
24 limited.
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37 This research is particularly timely given the cost of living crisis in the UK, driven by supply-side
38 inflation, witnessed most notably by the substantial increase in energy costs. A continuing period of
39 high inflation, coupled with suppressed wage growth, may well force financially weaker households
40 to take on more debt, both property and financial, to meet day-to-day expenses, albeit at a higher
41 cost of borrowing given that the interest rates have also risen.
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47 The results show that the pattern of household debt has not been the same across local authorities
48 and that there are local variations in risk. Total debt relative to the size of economy is larger in London
49 and local authorities around London. The unsecured household debt pattern shows that mid-England,
50 North England and part of Wales show a predominantly high share of unsecured debt relative to GVA,
51 while Scotland has low unsecured debt per GVA. When comparisons were made with the Index of
52 Multiple Deprivation in England, a positive correlation is revealed between the ranking of the 20 local
53 authorities with the highest proportion of income and employment deprivation and our ranking of the
54 ratio of total unsecured debt to Gross Disposable Household Income(GDHI).
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3 The remainder of this paper is structured as follows. Section 2 contains a critical review of the
4 literature. Section 3 outlines the research design, followed by spatial data preparation, the GIS analysis
5 and interpretation, and a commentary in Section 4. Section 5 presents a summary and conclusions
6 from the research.
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10 11 **2.0 Literature Review**

12 *Secured and unsecured lending*

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14 Household debt offers opportunities and risks for both the borrower and the lender. For most
15 households, the aspiration of owning your own home is made possible only by borrowing money in
16 the form of a mortgage secured against the property, with repayments spread over most of the
17 borrower's working life, often over 25 years or more. For the borrower, the risk centres around the
18 continuing ability to make the monthly repayments, which is a function of the stability and level of
19 their employment income, and the risk of upward movements in interest rates (Zabai, 2017). For the
20 lender, the focus is on both the financial strength of the borrower, the age of the borrower and the
21 loan-to-value ratio to ensure the return of their debt capital should the borrower default and a forced
22 sale occur. Interest rate movements, duration of a loan and the relative margin on the loan deal are a
23 risk to the lender, while both parties in the transaction are concerned with house price movements,
24 interest rate volatility and liquidity.
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35 The easing of credit restrictions in the UK in the 1970s and the introduction of credit cards and short-
36 term loans, gave rise to an era of rising unsecured lending, not seen previously (Nat West, 2021).
37 Credit cards offered the opportunity to 'buy now, pay later' and removed the requirement to carry
38 large sums of cash. For the wealthy, this has enabled large items of discretionary expenditure such as
39 overseas holidays, household improvements and consumer goods to be charged to a credit card or
40 short-term loan agreement to help smooth the repayment period. However, alarmingly, easier access
41 to credit has also allowed low-income households to use credit to fund day to day essentials such as
42 food and rent with repayment of capital often difficult to achieve, if ever (Linares-Zegarra and Wilson,
43 2017). Such has been the increase in the level of borrowing the term 'creditocracy' has been coined
44 to describe numerous advanced societies, including the UK, where debts are often never paid off but
45 continue in some form of revolving credit (Ross, 2017). With the growth in equity release mortgages,
46 it is now not uncommon for even the mortgage debt to be rolled over until the mortgagee dies or the
47 house is sold (Mayhew, 2019).
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57 *The sustainability of household debt*

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3 Lower interest rates, changes in lending conditions and a rise in house prices have all led to a
4 substantial increase in household debt over the past decade, both in absolute terms and relative to
5 household incomes². The greater indebtedness has made the household sector more sensitive to
6 changes in interest rates, income levels, asset prices, and credit affordability (Debelle, 2004a). This
7 has raised concerns about the sustainability of household debt, and the implications for the stability
8 of the financial system, if it is not viable.
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15 Regardless of whether the increase in household debt is sustainable or not, the greater indebtedness
16 has important macro-economic implications, arising from unexpected economic shocks (such as Covid
17 and the wars in Ukraine and Israel/Gaza), rising unemployment and changes in housing equity
18 positions (Dumitrescu *et al.*, 2022). Scaling the amount of household borrowing to household income
19 enables comparison across time and spatial locations, providing a suitable comparable measure for
20 determining whether the amount of borrowing is excessive or not (Miles, 2004; 2015). The important
21 point to consider is that local variations in incomes, house prices and employment rates may have
22 created different levels in the uptake of secured and unsecured loans, reflecting local economic
23 conditions and variations in the affordability of credit and level of debt (Koblyakova *et al.*, 2014). To
24 date, local area analysis has mainly been related to the differentials in unemployment trade-offs and
25 incomes but has not examined differentials in household debt (Hearne, 2021). However, this current
26 research makes significant progress in filling the data gaps, by using both ONS and CACI Ltd data,
27 helping to reveal the spatial differences in household debt, highlighted by using GIS mapping.
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39 From a theoretical perspective, it is important to understand that the scale of financial flows within
40 the credit market mainly depends upon the nature and level of the demand for secured/residential
41 and unsecured debt. The central idea of the demand for credit comes from the literature based on the
42 life cycle perspective (Ando and Modigliani, 1963). In periods during which income is low relative to
43 the average lifetime income of the household, the household will borrow to fund current consumption
44 and repay the loan in periods during which income is high. As most households' experience a rising
45 income through their (working) life, debt will tend to be high relative to income early in life, and then
46 gradually decline with age. The presence of liquidity constraints refers to the efficiency of credit
47 supply, complicating borrowing choices. Early in a household's working life, when income is relatively
48 low, householders may not be able to borrow as much as they need (Leece, 2000). This applies
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57 ² In the period from January 2009 to December 2018, the average annual (nominal) growth in UK house prices was 2.74%,
58 while over the same period the average annual growth in total pay was 1.93% (ONS, 2021a & b). As secured lending is based
59 on a multiplier of salaries, this represented a widening gap in house price affordability of 8.2%, allowing for compounding
60 over this period.

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3 particularly to a decision to purchase a house, which is the largest single expenditure a household
4 undertakes. Across all locations, financial institutions will very rarely lend up to the full value of the
5 dwelling being purchased (a 100% mortgage), requiring the household to satisfy first-time deposit
6 requirements (Campbell, 2013; Campbell *et al.*, 2021), a requirement that is consistent across the UK.
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11 As household incomes and savings differ across locations, liquidity constraints also differ, so that
12 household borrowing varies within different areas of residence (Leece, 2008). This contributes to the
13 humped-shape pattern of household debt across locations. Liquidity constraints and affordability
14 issues explain why changes in the structure of the lending market seem to have had such a significant
15 effect on the extent of household borrowing. A significant part of the growth in household borrowing
16 may reflect a change in lending conditions and the introduction of government-supported mortgage
17 borrowing schemes (e.g. Help to Buy Scheme in the UK). The aim of these was to allow households to
18 better structure their path of consumption spending over the life cycle (Benetton *et al.*, 2022).
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27 Despite the easing in lending conditions that has occurred over the last two decades in the UK, the
28 necessary affordability checks require that the monthly mortgage payment should not exceed a third
29 of the household's disposable income, resulting in a limitation on the amount of disposable income
30 that a household can use to service its mortgage loan, thereby restricting the maximum amount of
31 secured debt it can borrow (FCA, 2018; Benetton, 2021). At the same time, when inflation rates are
32 falling, the associated decline in nominal borrowing rates allows households to borrow larger amounts
33 for a given limit on servicing debt (Miles, 2004; 2012a). When referring to the debt-to-income ratio,
34 lower inflation has two effects. First, it boosts the numerator because of increased borrowing by
35 households in response to the decline in nominal interest rates. Second, it may result in lower growth
36 of nominal household income, thereby boosting the aggregate household debt/income ratio (Coletta
37 *et al.*, 2019). However, when inflation spikes, as experienced in the UK over the period 2022/23, the
38 reverse is true. Over this period the cost of borrowing has risen sharply and wages have not kept pace
39 with inflation, causing a squeeze on household budgets. Whether or not this inflationary period will
40 persist depends on the success of the Bank of England's interest rate policy to maintain higher rates
41 of interest to dampen down demand. For those who had increased borrowing during periods of low
42 interest rates, this has caused a financial shock, crystallised when they have come to renew their fixed
43 rate deals.
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57 With respect to the affordability concept, it was found that the highest debt-to-income ratios are at
58 the low and middle sections of the income distribution (Barba and Pivetti, 2010). It was also revealed
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3 that credit cards and other forms of unsecured debt are highly prevalent amongst low-income
4 households, reflecting liquidity constraints and resulting in higher credit costs (Sullivan, 2008).
5 Questions have been asked as to the appropriateness of this lending policy (FCA, 2014).
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10 May *et al.*,(2004) noted that while the majority of debt is owed by homeowners with mortgages, debt
11 problems are concentrated among renters, particularly those on low incomes or unemployed, who
12 are unable to benefit from house price inflation and remortgage to consolidate their debts.
13 Moreover, they suggested that the results of household surveys often understate the level of
14 unsecured debt as respondents may not appreciate the difference between secured and unsecured
15 lending. In addition, they found less transparency in the amount that is borrowed interest-free,
16 whether it be for purchases or on credit card deals. Del-Rio and Young (2005) also found that income
17 is the main variable explaining cross-sectional differences in indebtedness but that the age of the
18 borrower was also key, with 20 to 30-year-olds most likely to borrow unsecured. However, their
19 results concluded, that the rise of unsecured borrowing did not appear to have been concentrated
20 among the poorest groups.
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30 The rise in household indebtedness has also reflected a growing tendency of households to extract
31 equity from the value of their houses to finance consumption, which is especially relevant for the
32 macro-economic implications of rising household indebtedness (Miles, 2012b; Reinold, 2011). Growth
33 in household debt has been defined as a rational response of forward-looking agents to hump-shaped
34 time-earning profiles or to temporary deviations of income from its long-run trend (Debelle, 2004b).
35 Contrary to these views, Campbell and Hercowitz (2009) and Leece (2008) suggest that the rising
36 household indebtedness should be seen principally as a response to worsening real wages and a
37 reduction in the welfare state (i.e. as the counterpart of enduring changes in income distribution and
38 house price dynamics). In their view, the key issue concerns the sustainability of the process and
39 affordability of secured and unsecured debt. That is, household debt can exert a significant negative
40 impact on the aggregate savings rate, stability of the financial system and impose the long-run
41 shortcomings of a growing stock of household debt.
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51 Unsustainable levels of indebtedness can lead to financial stress at the household level as well as to
52 the banking system and general economy. Bullock (2018) defines household financial stress as ranging
53 from mild to extreme; mild, when households worry about money and cut down on discretionary
54 expenditure; and extreme financial stress when households are insolvent. Insolvency results in
55 foreclosure and bankruptcy. Rising household mortgage debt (as measured through debt to income
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ratio) and increase in interest-only loans, present potential sources of financial stress (ibid). A relevant variable to measure financial stress, as highlighted by Bullock (2018), is the proportion of indebted owner-occupied households for whom mortgage repayment is more than 30% of their income. An increase in other debt is also an indicator of rising financial stress for households. With respect to the financial stress to the wider economy, the subprime mortgage crisis in the US in 2007/08, is perhaps the best, if rather an extreme example, of the very damaging effect inappropriate mortgage lending practices can have on the banking system and the global economy (Demyanyk & Van Hemert, 2011).

Spatial differences in household indebtedness

Referring to the limited body of literature exploring spatial disparities in the effects of the variations in household indebtedness and income levels, and reflecting on the resilience to financial shocks, Taylor and Bradley (1994) reveal that the recession in 1990-92, unexpectedly demonstrated its spatial impact, depicted by significant unemployment differentials with rising unemployment rates in the Southeast of England. These rates were far above Scotland's unemployment rate, and not vice versa, as was expected. The key finding suggests that analysis of sensitivity to income shocks should be at the local level, rather than regional level, aiming to provide a useful framework for evaluating spatial disparities in the responses to the impact of economic shocks.

Developing these arguments further, Waldron and Zampoli (2010) suggest the possibility of adverse spatial effects due to the interactions between debt, income, and house prices on consumption levels. Findings suggest the distributional effects of wealth differ across locations according to the homeownership rate and level of house prices, as house buyers usually face a greater debt burden in areas where house prices rise faster and at a greater scale, resulting in increasing levels of indebtedness among households with a mortgage.

It has been found that homeownership is associated with better access to secured and unsecured debt, revealing that higher income families can acquire debt at cheaper costs, while renters and low-income families can only access alternative source of borrowing, typically at much higher costs given their elevated risk borrowing profile (Montgomerie and Büdenbender 2015). That is, disproportional distribution of wealth and variations in the percentage of mortgagors and renters across various locations result in asymmetric impact of interaction effects between wealth, housing costs and the cost (and level) of debt upon consumption levels. Fasianos and Lydon (2022) found that consumption levels in the more indebted households is more sensitive to income shocks suggesting that understanding of distribution (and concentration) of levels of household debt at the local level would

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3 help to quantify the effects of changes in monetary and fiscal policy upon a household's ability to
4 absorb income and interest rate shocks.
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8 Dumetrescu *et al.*, (2022) suggest that a rise in house prices increases household debt, with the impact
9 being amplified when the level of debt is higher. This results in an increase in borrowing levels and
10 associated risks in areas with higher house prices due to the enhanced ability to acquire debt because
11 of wealth effects and the increase in the capital value of collateral. Hearne (2021) raises questions
12 concerning locational disparities and spatial imbalances in incomes and interregional wealth
13 distribution, resulting in households' consumption levels and income shocks resilience, suggesting
14 that a greater concentration of indebtedness has important macro-economic implications, arising
15 from unexpected economic shocks, rising unemployment and changes in housing equity positions.
16 Thus, for a number of reasons, it is important to understand the spatial differences in household
17 indebtedness.
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26 **3.0 Research design**

27 *Geographical Information Systems*

28 The research will use GIS mapping techniques to help analyse and illustrate the results. GIS software,
29 comprising a suite of analytical and geo-visualisation tools, provides the potential to assist in the
30 processing, analysis and modelling of housing and mortgage datasets (e.g. to investigate
31 neighbourhood effects) and to visually explore spatial relationships in the form of maps. GIS tools
32 facilitate the exploration, aggregation, and integration of datasets. In addition, spatial querying and
33 interpolation enable the generation of variables and indexes which is particularly valuable in the data
34 preparation stage when constructing variables at selected levels of spatial aggregation. Spatial
35 querying with the aid of visualisation, error identification, and the incorporation of locational effects
36 also improves the precision of coefficient estimates and increases the predictive power of models.
37 This is especially important for policy formulation because it enables researchers and policy analysts
38 to evaluate the effectiveness of alternative policy tools for controlling undesirable spatial outcomes.
39 Furthermore, GIS are a framework that provides spatial intelligence for effective decision-making.
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51 According to Haining (1990), there are two stages in spatial analysis. The first is called Exploratory
52 Spatial Data Analysis (ESDA) and focuses on the measurement and quantification of spatial structure
53 in the data, important for hypothesis formulation. This involves careful investigation of the spatial
54 structure in geographic datasets in addition to their standard distributional properties. Formal
55 measurement of trends in spatial patterns can be undertaken using what is known as spatial
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3 association (or autocorrelation) statistics. These quantify the extent and direction of spatial clustering
4 in attribute values (e.g., positive and strong, negative and weak) as well as the statistical significance.
5 Spatial association statistics measure the extent of similarity in the values of the same variable across
6 space and can be used either to measure spatial clustering in the whole system or to determine
7 whether a given observation value is significantly different from its neighbours in space. Such
8 observations are called spatial outliers. Identification of spatial outliers is very useful for data cleaning
9 and error checking as well as for the interpolation of missing values in spatial data sets.
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16 As Openshaw (1991) observes, however, although a map is a wonderful communication device, it can
17 also mislead. To that end, it is therefore essential to place geographical explorations within
18 appropriate theoretical and conceptual frameworks (e.g. from urban housing economics) and to
19 address the modifiable areal unit problem (MAUP) to justify the spatial units we use for mapping
20 where aggregation of spatial units may not necessarily correspond to the 'true' scale at which spatial
21 variations exist.
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28 The second stage of spatial analysis, Confirmatory Data Analysis (CDA), involves modelling the impact
29 of spatial structure on behaviour and outcomes in addition to economic considerations. Spatial
30 process exploration uses CDA methods to systematically explore the structural relationships among
31 geographic distributions of selected attributes. This will be the subject of a subsequent paper.
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37 *Data sources and Datasets*

38 Quarterly data is published by UK Finance on the total values of outstanding mortgage debt and
39 unsecured debt in each postcode sector (UK Finance, n.d.(a), n.d.(b)). This dataset offers a view of
40 lending trends broken down to a semi-granular geographic level, striking a balance between
41 transparency and the need to protect customer confidentiality.
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47 To protect customer confidentiality and to comply with data privacy rules, UK Finance has declared
48 that some of the debt data have been redacted; for example, if there are too few borrowers in a
49 postcode sector (UK Finance, n.d.(c)). Despite these imprecisions, the dataset still allows for a more
50 granular analysis of geographic trends in debt levels compared to most other data available on
51 household debt which are aggregated at much larger geographic scales. This can help to augment the
52 understanding of local trends in wealth, financial risk, and lending policies.
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3 Using public GIS data, published by various government agencies (ONS, 2020; Ordnance Survey (GB),
4 2019, Reis *et al.*, 2017), the debt data, aggregated by postcode sector, was re-aggregated into local
5 authority districts to allow for analysis relevant to local government (NHS, 2022). While there are other
6 resolutions possible for re-aggregating the data, the choice of local authority districts as a mapping
7 unit is based on guidance from the practice of UK government statistics which are often aggregated
8 at the local authority level. This facilitates analysis of the debt data together with other socioeconomic
9 data published by the government.
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16 Data on regional Gross Value Added (GVA), Gross Disposable Household Income (GDHI), and average
17 house prices were used in this study, together with the debt data to measure financial risk in each
18 local authority at the macroeconomic and household levels. This is detailed in the sub-section, *Ratios*
19 *and Indices*, below.
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25 *Pre-processing of debt and geographic data.*

26 All geographic data processing in this study was performed using ArcMap 10.8 by ESRI (ESRI, n.d.). To
27 re-aggregate the debt datasets at the local authority level, a 1km² gridded dataset was first computed
28 for each of the mortgage and unsecured debt datasets. The debt data at the postcode sector level was
29 processed together with postcode sector boundaries published by the Ordnance Survey (2019) and
30 the UK Gridded Population 2011 dataset published by CEH (Reis *et al.*, 2017) to produce the gridded
31 dataset. The UK Gridded Population 2011 dataset, published at a 1km² cell resolution, allowed for the
32 debt values to be mapped onto each 1km² grid cell, to scale the debt values according to the
33 population at each cell, and to discard non-populated regions. The gridded dataset provides a more
34 accurate geographic distribution of the debt data when compared to a polygon dataset, which does
35 not account for the different concentrations of populations across areas, as well as rural areas that
36 are not populated.
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46 The gridded datasets for both mortgage and unsecured debt were subsequently used together with
47 GB local authority boundaries published by ONS (2020) to compute the total mortgage and unsecured
48 debt values in each local authority, using zonal statistics in the GIS.
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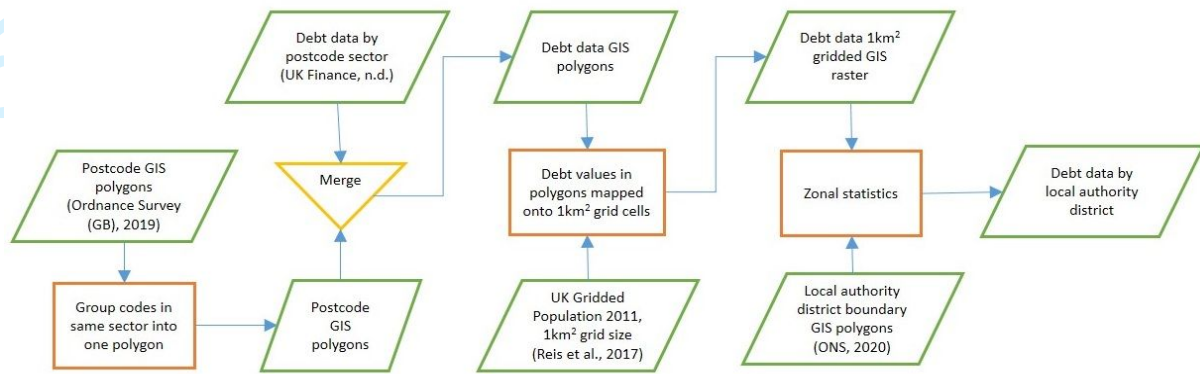


Figure 1. Data pre-processing workflow diagram

Ratios and Indices

We defined the total household debt value in a local authority (D) as the sum of the total mortgage debt value in a local authority (M), and the total unsecured debt value in a local authority (U). Quarterly mortgage and unsecured debt values were averaged over a year to get yearly debt values.

$$D = M + U \quad (1)$$

Data on the number of households in a local authority (HH), as well as the number of households that have taken out mortgages (HH_M), were obtained from CACI Ltd³. These values were used to calculate average household mortgage debt (m), average household unsecured debt (u), and average household debt (d), defined as:

$$m = \frac{M}{HH_M} \quad (2)$$

$$u = \frac{U}{HH} \quad (3)$$

$$d = \frac{D}{HH} \quad (4)$$

The Office for National Statistics (ONS) releases data on regional Gross Value Added (GVA) by local authorities (ONS, 2019b) measured annually. The total GVA across all industries (GVA) was used as a measure of macroeconomic activity within a local authority. Together with the total debt values in a local authority, the following ratios have been used in this study as measures of macroeconomic risk.

Total household debt to GVA ratio:

³ <https://www.caci.co.uk/>

$$R_{D,GVA} = \frac{D}{GVA} * 100 \quad (5)$$

Total mortgage debt to GVA ratio:

$$R_{M,GVA} = \frac{M}{GVA} * 100 \quad (6)$$

Total unsecured debt to GVA ratio:

$$R_{U,GVA} = \frac{M}{GVA} * 100 \quad (7)$$

The above ratios were multiplied by 100 to express them as percentages.

The Gross Disposable Household Income (GDHI) data released by the Office for National Statistics (ONS) measures the “amount of money that all of the individuals in the household sector have available for spending or saving after they have paid direct and indirect taxes and received any direct benefits” (ONS, 2022). The GDHI is a suitable measure to compare against debt at the household level as it reflects the income directly accessible by households after accounting for taxes and benefits.

The ONS data gives the yearly total GDHI (*GDHI*) value in each local authority in millions of pounds. This was divided by the number of households in each local authority to get the average household disposable income (\bar{i}):

$$i = \frac{GDHI}{HH} \quad (8)$$

Using \bar{i} , the following ratios were defined for this study as measures of household financial risk:

Household debt to income ratio:

$$r_{d,i} = \frac{d}{i} \quad (9)$$

Household mortgage debt to income ratio:

$$r_{m,i} = \frac{m}{i} \quad (10)$$

Household unsecured debt to income ratio:

$$r_{u,i} = \frac{u}{i} \quad (11)$$

To obtain measures of household housing wealth and affordability, data on average house prices in a local authority collated by HM Land Registry (2020) were used. The monthly average prices were averaged over a year to get yearly average prices for our calculations.

We defined the housing wealth (w) as the difference between the average housing price (p) and the average household mortgage debt (m):

$$w = p - m \quad (12)$$

Finally, the level of housing affordability (a) in each local authority is defined as the ratio of average house price (p) to the average household disposable income (i):

$$a = \frac{p}{i} \quad (13)$$

4.0 Analysis and Maps

The mortgage debt is an essential instrument to secure financial stability, accounting for around 70.7% and 67.7% of UK's GDP in 2013 and 2019 respectively (Hypostat Report, 2021). Therefore, as the country sets out financial stability in a post-2008 crisis economy, mortgages continue to provide substantial economic leverage. Though the lending conditions are established at the national scale, mortgage markets are more leveraged in certain localities, which exposes these localities to financial shocks. The missing point in the existing research is consideration of the different impacts in more, or less, leveraged regions/locations resulting from changes in interest rates, mortgage costs, and lending practices. The current research addresses the question of locational deviations from the economy-level mortgage indebtedness levels. This is achieved by taking a locational perspective and analysing heterogeneity among localities. In aggregate terms, over the period 2013-2019, the proportion of mortgage indebtedness relative to the size of the national economy has slightly decreased, nevertheless, local economies' indicators demonstrate that numerous localities have expanded their mortgage debt. Declining average mortgage interest rates during the period under consideration compared to pre-2013 years may have resulted in a decrease in mortgage debt in general but at the same time, certain areas witnessed growing leverage levels. In 2012, financial regulators introduced affordability checks requiring that monthly mortgage payments should not exceed a third of the

household's income, to dampen adverse effects of mortgage repayment risks. In this context, it is imperative to take a closer look at locational deviations in mortgage risks.

4.1 Household Debt to GVA Ratio by local authority 2013 to 2019

Figure 2 presents the deviation of household debt to GVA ratio from the average across GB, for each local authority. These are presented in seven categories. Different shades of blue represent local authorities for which the household debt to GVA ratio is less than the GB average. Shades of brown represent local authorities where this ratio is higher. There are two dimensions: (i) the regional variation and (ii) the change over time.

This map shows that the debt is concentrated in the South of England. 41 local authorities out of 363 had a household debt to GVA ratio more than 50% higher than the GB average in 2019. Amongst them, 11 local authorities had household debt to GVA ratios more than 100% higher than the GB average, and include in order of magnitude: Lewisham, Wandsworth, Castle Point, Rochford, East Renfrewshire, Redbridge, Waltham Forest, Haringey, Epsom & Ewell, Tandridge, and Sutton. The local authorities that about London have high debt concentration largely due to a contagion effect. What is interesting though, is that there are stand-alone local authorities in mid-England that also have a high debt-to-GVA ratio, including Gedling and Rutland (East Midlands, 47% and 40% higher than GB average respectively) and Chorley and Rossendale (North West, 27% and 26% higher than GB average, respectively). In Scotland, the debt concentrates around Edinburgh and Glasgow and is particularly prevalent in East Renfrewshire, East Dunbartonshire, East Lothian and Midlothian (136%, 84%, 36%, and 33% higher than the GB average respectively).

The comparison between 2013 and 2019 is interesting. The local authorities, where the deviation of debt to GVA ratio from the average of GB was above 50% in 2013, have continued to be the same in 2019. There are also regions in England and Scotland where the ratio of debt to GVA has come much closer to the GB average. In that respect, overall inequality between regions has reduced during this period.

Figure 5 presents the change in the deviation of the ratio of total debt to GVA from the average of GB at a local authority level between 2013 and 2019. What is interesting about this map is it shows that, for a large part of the UK, the deviation has declined. However, London and local authorities around London have seen a deviation increase by 25%. In Scotland, Aberdeen has also seen a substantial increase in deviation (due to house price decline) and to a limited extent in Orkney and Shetland.

4.2 Mortgage debt to GVA ratio by local authority 2013 to 2019

Since mortgage debt is the largest component of debt that households owe, Figure 3, which presents the deviation of the ratio of mortgage debt to GVA from the GB average shows a similar pattern as Figure 2. Southern England has a higher concentration of mortgage debt than the rest of the country, a consequence of high house prices. The pattern over time has also remained the same as in Figure 2. Figure 5 shows the change in deviation of mortgage debt to GVA from the GB average for local authorities between 2013 to 2019. As the mortgage is the biggest share of total debt, the pattern of change is similar to total debt to GVA. The mortgage risk has increased in local authorities around London and Aberdeen.

4.3 Unsecured debt to GVA ratio by local authority 2013 to 2019

The pattern of deviation of unsecured debt to GVA from the GB average by local authorities presents an interesting time trend. For a single period, the pattern suggests that the North has lower unsecured debt than the South (Figure 4). Over time the ratio of unsecured debt to GVA in North England and Scotland has reduced relative to GB, but the ratio has worsened in Southern England for many local authorities (Figure 5).

Unsecured debt is the riskiest component of debt that a household holds. This is normally short-term in nature and carries high-interest rates. Figure 5 indicates that unsecured debt is potentially a problem in the North-East and North-West of England. In four local authorities – Barking and Dagenham, Broxbourne, Havant, Reigate and Banstead – the unsecured debt to GVA ratio has increased by more than 25% relative to the change in the respective GB average ratio, from 2013 to 2019. Local authorities in Wales have also seen a rise in unsecured debt. Scotland is better positioned relative to other countries as the prevalence of unsecured debt is low relative to England and Wales.

4.4 Change in risk level due to debt in GB by local authority from 2013 to 2019

Figure 6 presents a summary of how debt risk has changed between 2013 and 2019. The local authorities highlighted in red witnessed an increase in mortgage and unsecured debt relative to GVA. There were 20 such local authorities, distributed over various regions in England, with none occurring in Wales or Scotland. The purple and dark blue coloured local authorities saw an increase in unsecured debt while the mortgage debt remained the same (purple) or declined (dark blue). The local authorities where the unsecured debt has increased while mortgage debt remained either the same or declined show that the risky borrowing has increased. A total of 51 local authorities fell into these categories, located in England and Wales, with five of them seeing an increased unsecured debt risk

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3 and decreased mortgage debt risk – Isle of Wight, Dover, Richmondshire, Newark and Sherwood, and
4 Powys. Local authorities highlighted in yellow are those where mortgage debt relative to GVA
5 increased while the unsecured debt relative to GVA decreased. There were only three local authorities
6 that saw this combination of changes: Medway, and the London boroughs of Hillingdon and Lambeth.
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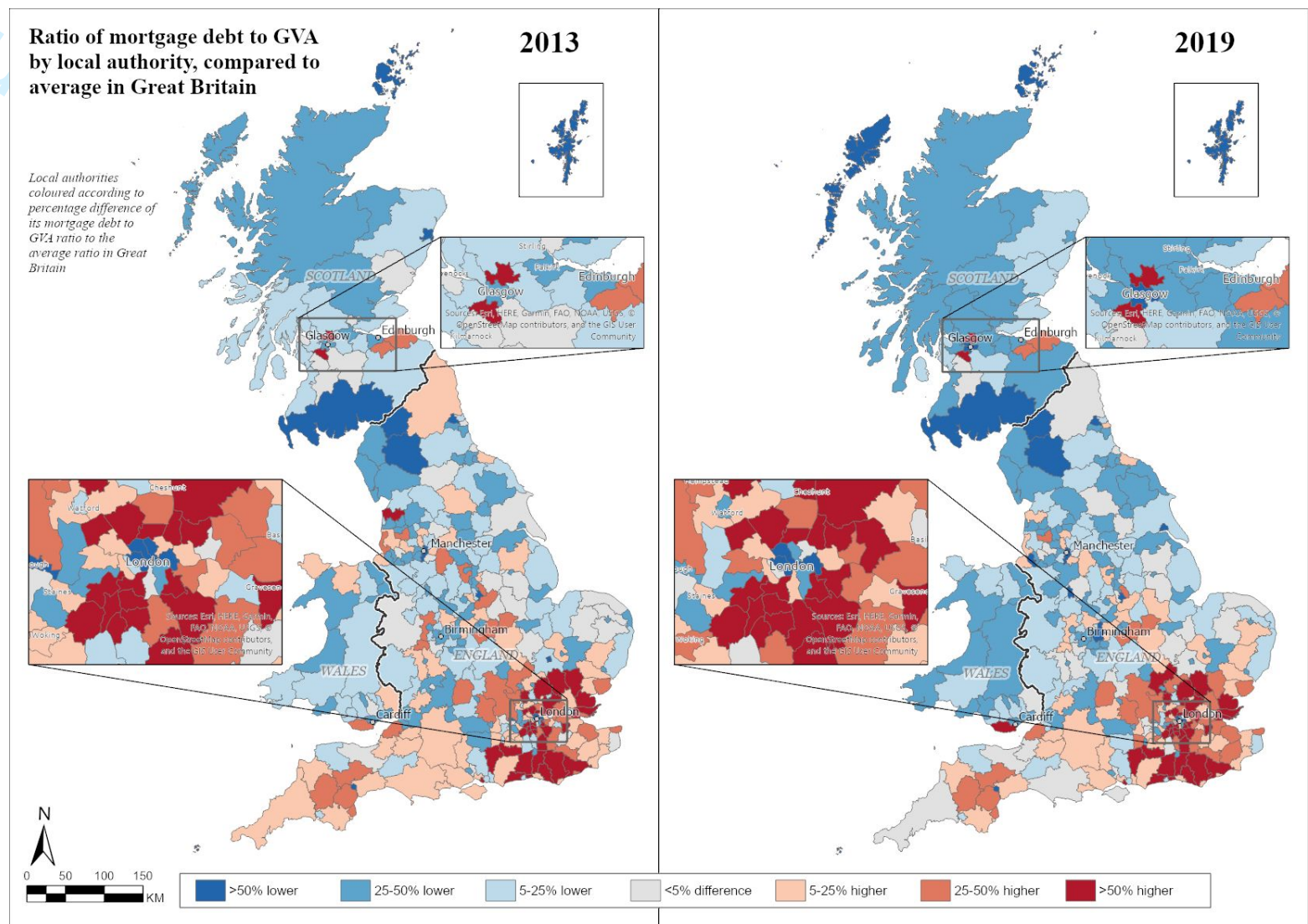


Figure 3. Ratio of mortgage debt to GVA for each local authority compared to the average ratio in Great Britain.

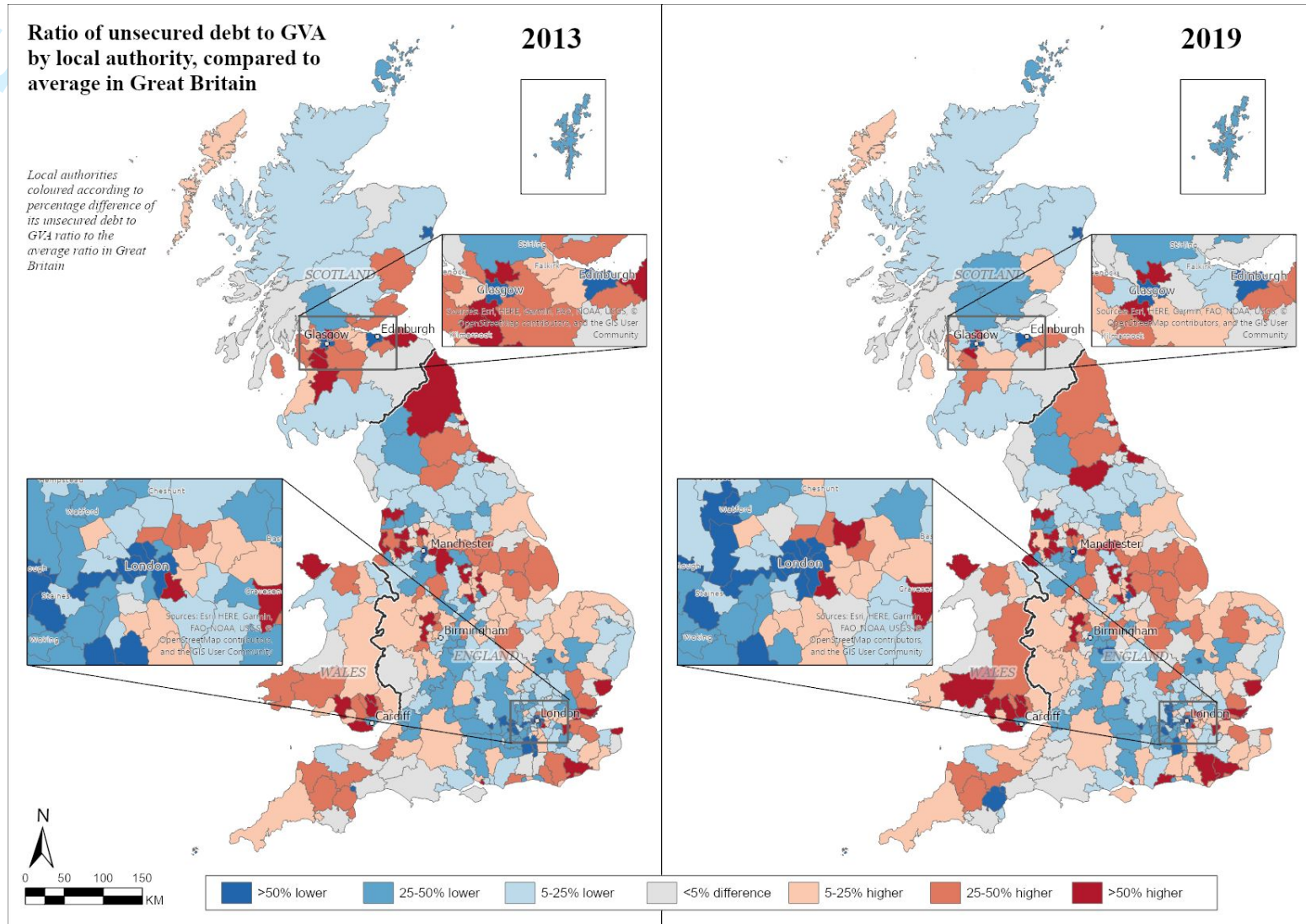


Figure 4. Ratio of unsecured debt to GVA for each local authority compared to the average ratio in Great Britain.

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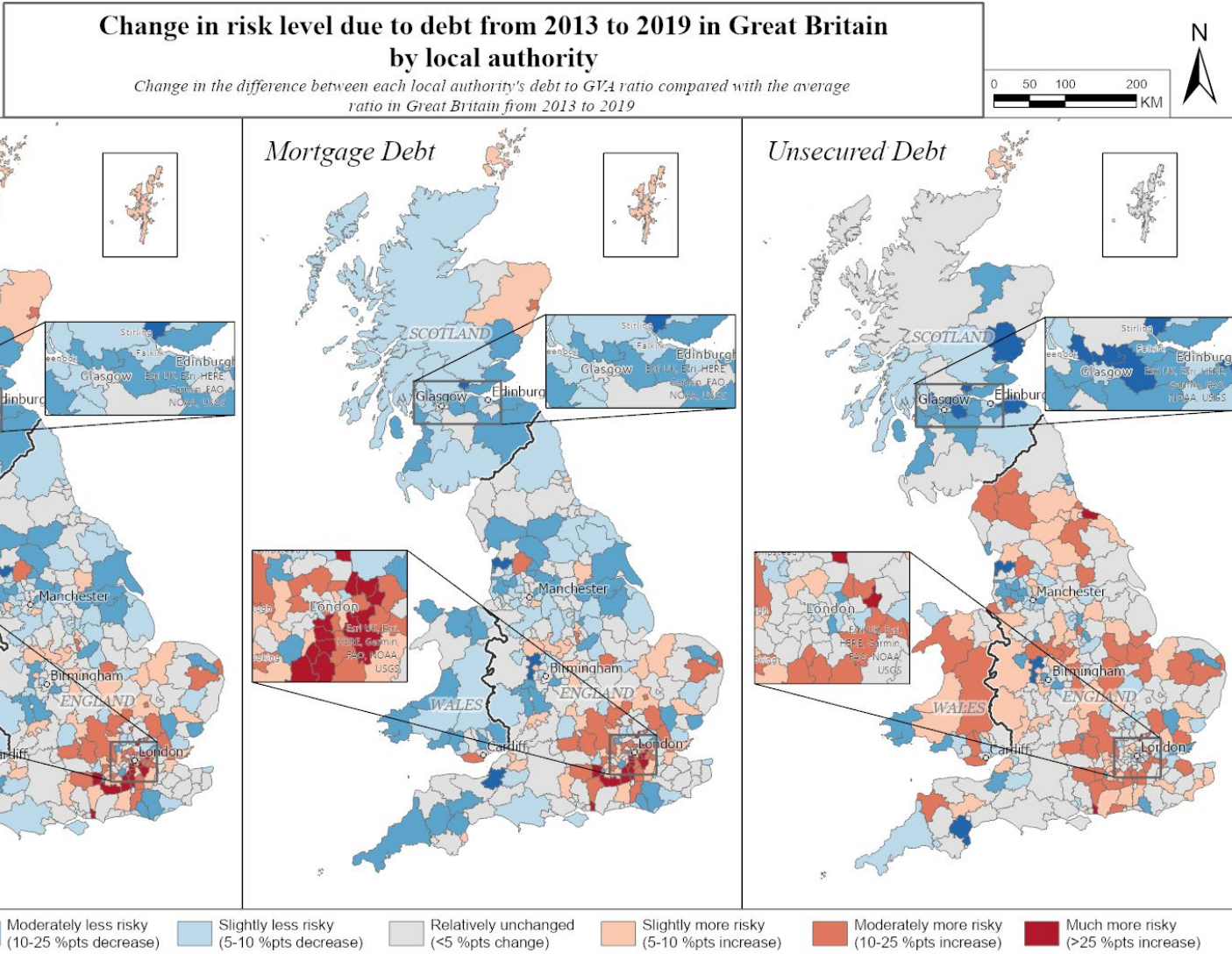


Figure 5. Change in risk level due to each of the three debt types in each local authority, from 2013 to 2019. Risk level is defined as the difference between a local authority's debt to GVA ratio and the average ratio in Great Britain. If the difference increased from 2013 to 2019, the local authority is at a higher risk; if the difference decreased, the local authority is at a lower risk.

4.5 Correlation of indebtedness with deprived neighbourhoods in England

To further understand why there is local variation in indebtedness, comparisons were made between the rankings produced in our analysis with the rankings from the index of multiple deprivation (IMD)⁴ at neighbourhood level in England in 2019 (Ministry of Housing Communities and Local Government, 2019). (A similar analysis will also be done for Scotland and Wales as part of future research). Given that previous authors (e.g. May *et al.*, 2004; Del-Rio and Young, 2005) had indicated that income was a key variable in explaining indebtedness, attention was focused on the 20 local authorities in England with the highest proportion of income deprivation. These are listed in Table 1 along with the average level of indebtedness in these localities.

Table 1: Local Authorities in England with highest proportion of income deprivation: 2019

Rank	Local Authority	Average household mortgage debt £	Average household unsecured debt £	Average total household debt £	Average house price £
1	Middlesbrough	71,606	1,217	22,066	112,675
2	Knowsley	77,444	1,566	25,046	130,569
3	Blackpool	64,228	1,083	20,732	106,116
4	Liverpool	68,159	961	18,939	133,507
5	Hartlepool	66,333	1,250	21,344	108,644
6	Kingston Upon Hull	65,750	1,166	17,505	112,977
7	Birmingham	88,077	1,066	26,792	188,318
8	Manchester	84,813	944	24,518	181,266
9	Sandwell	80,628	1,202	21,317	151,840
10	Blackburn with Darwen	64,895	1,228	21,210	115,190
11	Wolverhampton	74,264	1,225	21,211	153,846
12	South Tyneside	68,698	1,110	19,044	133,248
13	Burnley	63,478	1,201	20,138	84,376
14	Hastings	108,160	1,123	29,440	214,222
15	Rochdale	71,277	1,246	23,468	141,231
16	Walsall	84,053	1,284	24,143	166,648
17	Nottingham	87,447	924	19,357	144,287
18	Leicester	101,555	1,086	23,810	174,491
19	Hackney	251,704	796	46,815	555,269
20	Barking & Dagenham	157,415	1,629	43,427	298,659
	Average	89,999	1,165	24,516	170,369
	Std Dev	43,822	196	7,625	102,204

⁴ The index is based on seven domains of deprivation, each with different weightings which when combined produce the index; namely income (22.5%), employment (22.5%), health deprivation and disability (13.5%), education, skills training (13.5%), crime (9.3%), barriers to housing services (9.3%) and living environment (9.3%). The IMD measures deprivation on a relative and not an absolute scale.

Table 2 below, shows the correlations between the IMD rankings of the 20 local authority districts with the highest proportion of income and employment deprivation, and our rankings of local authorities by the ratio of total mortgage debt to gross disposable household income (GDHI), and this analysis is repeated for unsecured and total household debt.

Table 2. Correlation of Indebtedness with Index of Multiple Deprivation, England 2019.

Deprivation	Ranking of ratio of total mortgage debt to GDHI	Ranking of ratio of total unsecured debt to GDHI	Ranking of ratio of total household debt to GDHI
Ranking of the 20 local authority districts with the highest proportion of income deprivation	-0.5060	0.3120	-0.4867
Ranking of the 20 local authority districts with the highest proportion of employment deprivation	-0.3176	0.3507	-0.3039

The results are revealing in that they show that there is a difference in the sign of the coefficient between secured and unsecured lending across both aspects of deprivation, income and employment. There is a negative correlation between income and employment deprivation and mortgage lending of -0.50 and -0.31, but a positive correlation with unsecured lending of 0.31 and 0.35 respectively. This would suggest that those living in deprived areas are unable to obtain high ratios of secured mortgage lending relative to GDHI but are instead, relying on relatively high levels of unsecured debt as a proportion of their disposable income, confirming that those on lower incomes require access to debt facilities. This confirms the earlier work by ONS (2019a) mentioned in Section 1, that the lower wealth deciles are more likely to have unsecured financial debt than housing debt. The role of unsecured debt is to help smooth consumption, but if the amount is high relative to income, it poses a risk to households and the economy, particularly due to the high-interest rates charged and the risk of immediate recall of the loan.

The 20 local authorities in England with the highest proportion of income deprivation are shown in Fig. 7. The mapping reveals that the risk is concentrated in North and mid-England. To understand why these 20 areas are the most deprived is a complicated matrix of factors beyond the scope of this paper. However, it is likely that the deprivation is the result of deindustrialisation which is evidenced by the decline of the traditional manufacturing industries and extraction industries over the last 50

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3 years, which has had a huge impact on employment levels. Specific examples include the closure of a
4 steel plant in Middlesbrough, a car plant in Sunderland and coal fields in Nottingham. Further analysis
5 included in the IMD England, 2019 (Ministry of Housing, Communities & Local Government, 2019),
6 showed that 25.1% of the population of Middlesbrough and Knowsley live in income-deprived
7 households with an average score of 21.5% for this metric among the 20 most deprived
8 neighbourhoods. The renaissance of these areas has been the focus of much political attention with
9 the current Conservative government promoting a 'levelling up' agenda, aimed at addressing the
10 longstanding problem of the UK's regional economic disparities (Berry, 2018).
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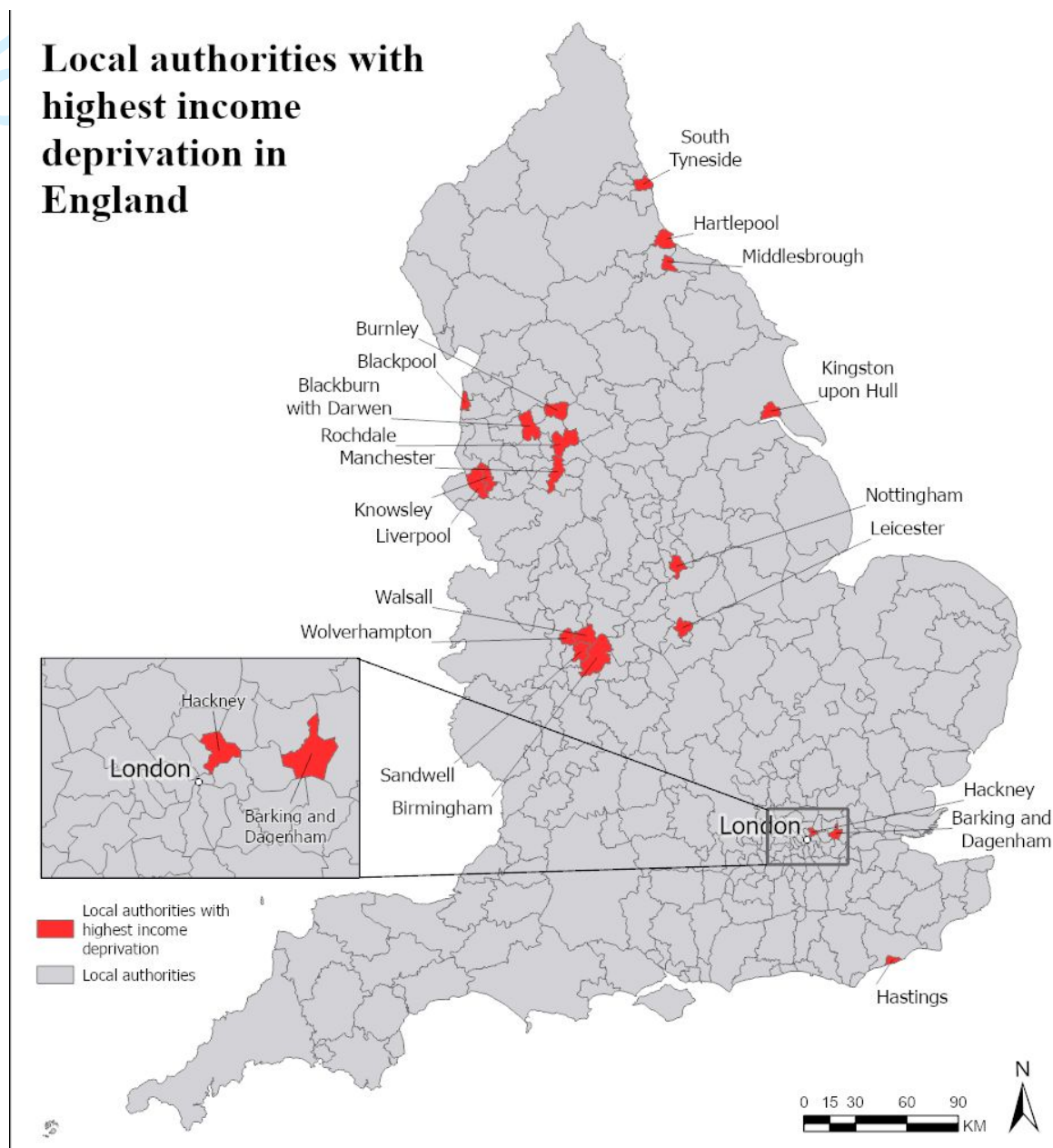


Figure 7. Mapping of the 20 local authorities in England with the highest proportion of income deprivation.

5.0 Conclusion

The pattern of debt has not been the same across local authorities or over time. The increase in debt relative to the size of the economy exposes the system to higher risk if shocks occur. The period under consideration in this paper, 2013 to 2019, is relatively short to understand economy-level changes but even over this period, the research reveals that there are significant shifts in the risk. Using data at the local authority level, the paper demonstrates local variations in risk. While mortgage debt forms a major component of total household debt, the role of unsecured debt to smooth consumption and

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3 as a source of short-term debt is well evidenced. However, excess unsecured debt poses a risk to
4 households and the economy.
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8 The results indicate that the total debt relative to the size of economy is larger in London and local
9 authorities around London. What is also interesting is that Castle Point and Rochford in the East of
10 England and East Renfrewshire in Scotland also demonstrate similar patterns. The mortgage debt
11 relative to the size of economy shows a similar pattern as total debt given the high share of mortgage
12 debt in the total debt of households. The unsecured debt pattern is illuminating, and it shows that
13 mid- England, North England and part of Wales show a predominantly high share of unsecured debt
14 relative to GVA. Scotland has low unsecured debt per GVA. When investigating further the reasons
15 for higher levels of unsecured lending comparisons were made with the IMD in England. This revealed
16 a positive correlation between the ranking of the 20 local authorities with the highest proportion of
17 income and employment deprivation and our ranking of the ratio of total unsecured debt to GDHI.
18 Those in deprived areas are taking on relatively high levels of unsecured debt as proportion of their
19 disposable income. This should be of concern to both lenders and policy makers.
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30 Understanding the pattern of debt relative to the size of the economy is important for policymakers
31 as it shows geographical fissures which are likely to be impacted negatively should interest rates rise
32 or liquidity tightens. An increase in interest rates will affect mortgage repayments and have a negative
33 impact on housing in vulnerable locations. As credit cards and other forms of unsecured debt are
34 highly prevalent amongst low-income households, rising interest rates have a proportionally bigger
35 impact on their finances. Since March 2020, when the Bank of England base rate was 0.10%, the
36 Monetary Policy Committee has raised interest rates 12 times to the current level of 5.25% in August
37 2023, with the markets uncertain whether a further rise may still be required later in the year to
38 control inflation. This has a direct and immediate impact on fixed rate and variable rate mortgage
39 rates, 4.75% & 7.75% respectively⁵, second-hand car loans (12%+)⁶, as well as on the very high-interest
40 rates charged on outstanding credit card balances (c23%+)⁷.
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50 When these increases are combined with high CPI inflation (11.1% to the year ending October 2022
51 and 8.7% to the year ending April 2023), lower-income household budgets are being severely
52 impacted by a cost-of-living squeeze (BBC, 2022). In such a scenario, default rates on both secured
53 and unsecured lending are likely to rise which will have wide social consequences for society. This
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58 ⁵ Halifax, May 2023.

59 ⁶ Car Finance 247, April 2023

60 ⁷ Barclaycard credit card, April 2023

research, using GIS-based Exploratory Data Analysis and mapping, has illustrated the spatial disparity of lending risks across the country, which should be a useful indicator for lenders and government of the localities most vulnerable to economic shocks, and as a result, help to shape policy responses, such as the current 'levelling up' agenda.

Disclosure Statement

The authors report there are no competing interests to declare.

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