Working Paper: Regional Prices and Incomes

Abstract

This paper argues that regional disparities in Britain are exaggerated. We show that official figures overstate differences in regional output, productivity and income. This effect comes about because official regional statistics in Britain are compiled on a nominal basis – i.e. they do not take into account differences in regional price levels. We develop measures of relative regional prices to show that the impact is substantial: regional differences in household income are almost halved after taking into account inter-regional price differences.

As a result, academics need to critically reappraise our approach to regional disparities. The paper argues that future research needs to take into account price variations across regions in Britain and internationally. Since data on regional prices are scarce in many countries, policymakers need to consider these methodological issues when designing regional assistance and redistribution measures,

Introduction

Recent decades have seen a growing awareness of intra-country regional disparities and spatial imbalances. That Britain has a "regional problem" is widely acknowledged by policymakers and in the literature. Some have suggested that regional imbalances in Britain are amongst the worst in the OECD and are more akin to those found in developing nations than its OECD counterparts (McCann, 2016).

As a result, Britain has long been an important focal point for academic inquiry in the literature. Moreover, recent political events have given the debate over what to do about regional differences an even greater salience. Both the election of Donald Trump in the USA and the vote to leave the European Union in Britain have a strong regional dimension. Indeed, these populist movements have been widely ascribed to the idea that those living in regions that have been "left behind" have felt increasingly disenfranchised in recent years (Goodwin and Heath, 2016).

This paper contends that whilst there are very real differences across regions in Britain, these are neither as stark nor as simple as official statistics suggest. A further implication is that relating welfare spending to price levels may be justified. In Britain, welfare spending has a distinct geographic structure (Hamnett, 2009), even though policy is not formed on this basis, leading to claims of wealthier regions subsidising poorer ones. The conclusions of the paper are widely applicable, as data on regional prices are scarce in many countries. It is therefore of the utmost importance to have a sound understanding of the methodology of data analysis around these disparities if regional policy is to adequately identify and address areas with real needs.

Cognisant of the above, the original contribution of this paper is therefore twofold. Firstly, relative regional consumer prices are calculated in line with modern international best-practice. Treatment of housing costs is consistent with economic theory and non-housing costs vary across regions (with the latter being based upon work by the ONS). This treatment updates previous estimates of regional prices to 2010. The second contribution is

to use this data to estimate real regional incomes and establish a lower bound for the impact upon productivity. The results are consistent with international findings that wealthier regions typically also have higher price levels and suggest that official data overstate the disparities across regions. Further, this analysis is likely to impact Britain Government's agenda with regard to its "industrial strategy" and "northern powerhouse" and presents a clear research agenda moving forward.

Previous Work

The literature investigating spatial inequalities, both in Britain and internationally, is now voluminous. In their widely-cited work, Barro and Sala-i-Martin (1996) document regional convergence in a variety of European regions (including Britain). Interestingly, their work shows σ-divergence in British regions from 1975 to 1990, which they attribute to the effect of oil shocks. Given that the divergence in the British case has continued since 1990, it seems likely that this is at least partly driven by the behaviour of prices (particularly given evidence on diverging regional house prices and, more recently, rents) and this may be a more important explanation than the oil shocks.

Evidence suggests that convergence in Western European regions may have slowed, or even stopped, from the late 1980s onwards (Tondl, 1999). This is in spite of structural funding to bolster the performance of poorer regions, although Gripaios and Bishop (2006) amongst others raise conceptual issues over the use of GVA per capita as a measure of regional performance. Evidence from Canada suggests a similar pattern, whereby regional convergence stopped during the 1980s (Breau and Saillant, 2016). Interestingly, Fingleton, Garretsen, & Martin (2012), investigating the short-run impact of economic shocks show that regions in Britain experience significant hysteresis effects on their employment levels. Recent work further implies that deindustrialisation in the 1980s and 1990s continues to have an effect on regional public finances today (Beatty and Fothergill, 2017).

This suggests a strong stochastic element to regional economic performance (which may also explain more recent divergence). With respect to the northern and southern regions of Britain, this has been widely studied and a variety of explanations have been posited for it (Gardiner, Martin, Sunley, & Tyler, 2013). Indeed, it has been argued that uneven patterns of development have been reinforced in Britain since the recession of 2008 (Omstedt, 2016).

The so-called "north-south divide" in Britain has long been a source of angst for policymakers and social commenters. Indeed, in the 1980s, the Regional Studies Association undertook an "Inquiry into Britain Regional Problem" and both before and since, countless academic and popular articles have documented various aspects thereof. Moreover, "[t]he geographical pattern of lagging regions in Britain has been remarkably stable" (Gudgin, 1995, p. 18) and it has not changed in the intervening decades. As recently as 2017, the Government noted that, "[o]ur country has significant disparities in economic performance […] and it is these differences that ultimately impact on how much people earn" (Department for Business, Energy & Industrial Strategy, 2017, p. 13).

A plethora of work has sought to understand the reasons behind these disparities and the spatially unbalanced nature of Britain economy. One strand of though links these differences in broader economic performance (and specifically TFP growth) to education

levels (Harris and Moffat, 2015). Monastiriotis (2002) finds some earlier evidence that human capital may have a substantial effect on regional wages. The geographic-economic rationale for such explanations largely centres around geographical knowledge spillovers (Döring and Schnellenbach (2006) survey earlier empirical work on their impact on regional growth).

In contrast to arguments around relative skill levels, explanations based upon "the New Economic Geography" tend to argue that high productivity in large urban areas as being due to agglomeration effects (see Ottaviano and Puga (1998) for an excellent survey). Indeed, amongst many policy commentators and some economists, the benefits of agglomeration are taken as axiomatic – e.g. Swinney (2016).

The empirical evidence supporting this argument is mixed. Rice, Venables, & Patacchini (2006) find some support for the idea that agglomeration supports productivity growth in UK regions, although the recent work of Beugelsdijk, Klasing, & Milionis (2017) also suggest that across Europe historical development paths are also important. In contrast, Frick and Rodriguez-Pose (2017) find that small cities (up to 3 million inhabitants) are most conducive to rapid economic growth. This accords with evidence that suggests that denser regions may grow slower than less dense ones (Bosker, 2007). Indeed, as Frick and Rodriguez-Pose point out, the existing empirical literature is predominantly based on evidence from the US and UK, which appear atypical. P. Martin, Mayer, & Mayneris (2011) offer further evidence from France that agglomeration effects are likely to be modest.

Even within Britain, the empirical evidence on agglomeration is far from clear cut and Greater London and its environs appear to be particularly important drivers of it. This has led think-tanks such as the Centre for Cities to hypothesise as to why a majority of cities in England have below-average productivity (Swinney and Breach, 2017). There are several potential factors at work here, but one noteworthy contributor is likely to be systematically higher price levels in wealthier areas (and particularly London). High prices in dense regions (particularly around London) skew nominal measures of productivity.

This work challenges the dominant narrative in the literature, arguing that whilst regional disparities are real and serious, differences in living standards across regions in Britain are much smaller than hitherto believed. Moreover, this is particularly true for the bottom 80% of wage earners who, by definition, constitute the majority of Britain's workforce. Taking account of differences in the cost of living across Britain halves the disparity in household incomes between the wealthiest and poorest regions (London and the North East respectively).

In order to do so, this analysis builds on and extends previous work on regional prices. Nevertheless, in spite of some notable contributions, the literature is thinner than that on international differences, probably due to a paucity of high quality data. As Blien et al. (2009) note, "[T]hough the value of information on regional prices is obvious, there is a lack of empirical data in many countries". Use of purchasing power parities reduces the disparity between French and Spanish wages from 52% to 30%, for example (Eurostat, 2017). One notable exception is the USA, where the Bureau of Economic Analysis (BEA) publishes estimates of regional price parities and hence real personal income. Indeed, the BEA finds that prices in New York State are 34% higher than those in Mississippi, which has a material impact on regional wages.

In common with similar "regional divides" across Europe (most notably in Germany and Italy), prices appear higher in the wealthier region. For evidence on the East-West divide in Germany see Dreger and Kosfeld (2010). As in the British case, there is some evidence that already wealthy German regions may have "pulled further ahead" of the rest of the country (Geppert, Gornig, & Werwatz, 2008).

In Britain there is substantial anecdotal evidence that prices of many goods and services are significantly higher in southern England than elsewhere. Given this, it is surprising that there are no official regional consumer price indices, in spite of clear interest in the subject as far back as the 1960s (RPI Advisory Committee, 1971). Nevertheless, official attention notwithstanding there have, in fact, been several attempts to calculate differences in consumer price levels across Britain. In most cases these have been used to estimate real regional wages.

Borooah et al. (1996) and R. Martin and Tyler (1994) suggest that as early as the 1980s, significant differences in living costs were emerging and that housing costs were a particular driver of this. Similar work by Johnston, McKinney, & Stark (1996) also find that price levels diverged during the 1980s with London's price level increasing from 5% above Britain average in 1980 to around 7.5% above Britain average a decade later. Like later work by Hayes (2005), all of these authors drew on regional price data published in the Croner-Reward Cost of Living Surveys.

Whilst these were an extremely useful source of data (being the only source of regional price data that we have for the period from the 1970s to the 1990s), they were understandably less detailed than official statistics with a much smaller basket of goods and fewer price samplings. This led to extremely large standard errors on certain items of expenditure, as noted by Borooah et al (1996). Moreover, the Croner-Reward surveys were discontinued some years ago and all of these articles relate to relative prices in the mid-1990s or earlier. There is substantial evidence to suggest that disparities in some relative costs (particularly housing) have widened considerably since then.

This article is thus naturally situated in the context of the above literature and considers relative regional prices 15 to 20 years on, before drawing out some of the startling consequences for official data. Improved data availability and Britain's participation in Eurostat's purchasing power parity programme mean that we are now able to calculate theoretically consistent relative regional consumer price levels in a way that was impossible for practitioners 20 years ago.

Where R. Martin and Tyler (1994) use the Croner Reward data directly to establish estimates of relative regional prices for manual and non-manual workers, Borooah et al. (1996) draw on the methodology used by the RPI. Since the 1990s, Britain's national statistical agency (the Office for National Statistics or ONS) has moved away from the RPI as a price index and instead the CPIH, which did not exist at the time, is now the preferred measure of inflation. Reasons for this include the fact that the former includes only a subset of households and uses an arithmetic mean and Laspeyres index (in the case of the RPI, this is over time, although the same decision appears to have been made with respect to the cross-sectional dimension of the data).

Most important, however, is its treatment of housing (given that this is the major category of spending where costs differ most across regions). One major weakness of the

Reward Survey data is that it treats owner-occupied housing costs as being "based on the cost of a typical mortgage for a family seeking to acquire a house in the area" (R. Martin and Tyler, 1994, p. 834). This inevitably conflates the acquisition of an asset with the consumption cost of housing (the latter being the rental equivalent). Borooah et al. (1996) investigated a variety of potential methods to account for housing costs, although these were based upon two main concepts.

The first used mortgage interest payments reflecting the construction of the RPI. This is a conceptually poor measure of housing costs as it embodies expectations of future rents (and thus, implicitly, inflation) and is linked to both the present interest rate and past house prices meaning that it is a flawed embodiment even of these. Moreover, it fails to capture the costs associated with maintaining a dwelling. Finally, a large and growing share of homeowners own their dwellings outright (or are approaching the end of their mortgage term implying very low interest payments). A mortgage-interest based approach assumes their cost of housing to be zero.

The second main concept used is that of "user cost". This measures the opportunity cost of home ownership and is thus a vastly superior measure relative to mortgage interest costs. However, it is best suited to modelling the purchase of housing as an asset rather than measuring an income stream, particularly given the importance of capital gains in the measure. Modern inflation measures instead use the "rental equivalence" cost of housing, namely: what would it cost to rent a house of the type owned on the open market?

Unlike the aforementioned approaches, this measures the market value of house services consumed by owner-occupiers. This was adopted by Johnston, et al. (1996) based on estimates of gross rent from the Family Expenditure Survey. As with the work of Borooah, et al. (1996) and R. Martin and Tyler (1994), the non-housing portion of their data on regional prices is derives from the Croner-Reward surveys. In any event, it appears that prices in 1990 ranged from approximately 7% below Britain average in the North East and 5% below average in the North West to around 7.7% above average in London and 4% above average in the South East. The remaining English regions are close to Britain average, although Wales, Scotland and Northern Ireland are all lower-cost regions. Changes to regional boundaries mean that these data are not directly comparable with later statistics, but give a broad outline of the situation at the end of the 1980s boom.

There have been a small number of more recent attempts to construct indices of relative regional consumer prices. Rienzo (2017) exploits the fact that a large proportion of consumer price variation across regions is related to housing costs. She therefore constructs a "regional RPI" based upon a combination of regional weights (derived from the precursor to the Living Costs and Food survey), national prices of non-housing commodities and regional rents (derived from the Family Resources Survey). However, Rienzo's work may understate or overstate price variations across regions for several reasons.

The following illustrates some of the methodological issues presented. First note that the regional RPI is calculated as follows:

$$Regional\ RPI_{rt} = (1 - w_{rt})NRPI_t + w_{rt}(rent_{rt}) \qquad (1)$$

Where NRPIt is the national RPI excluding housing costs during year t, and wrt is the weight of housing costs for region r in year t. To see the problem, normalise NRPI = 1 for the year T. In order for the resultant series to be meaningful, rents must also be normalised – i.e. we are interested in relative rents. If we let qh be the quantity of housing consumed, ph be actual housing rentals and rent be relative regional rents, then:

$$Regional\ RPI_{rT} = (1 - w_{rT}) + w_{rT}\left(\frac{p_{h_{rT}}}{\sum_r p_{h_{rT}} q_{h_{rT}}}\right) \quad (2)$$

If region r were to double in size overnight, the relative weight of housing wrT would not change, nor would any prices but the quantity of housing consumed qhrT would, naturally, double. This would change the prices in region r relative to region j. This is counterintuitive behaviour in a price index – a well behaved measure of relative regional prices should be invariant to scale.

In addition to academic work, several more recent attempts have been made by the ONS to derive measures of regional price levels. In 2000, an attempt was made to calculate relative regional prices by using prices collected by the ONS in a special survey (Baran and O'Donoghue, 2002), but this work did not include owner-occupiers' housing costs (thus dramatically understating the price differences between regions). Additionally, the use of national expenditure weights was problematic (as it fails to allow for the substitution effect).

A later attempt to update this analysis with a view to using it as a basis for a regional RPI used regional weights (Ball and Fenwick, 2004). In practice the intended RPIs were never produced and the work remained a one-off although it was updated and extended a year later (Wingfield, Fenwick, & Smith, 2005). The "regional RPIs" produced for 2004 show broadly similar results to those produced by researchers in the 1990s. The use of mortgage interest payments as a proxy for housing costs is deeply problematic - they relate to the purchase of an asset and not the cost of consumption. As previously noted, they have largely been superseded by modern "rental equivalence" measures.

Another issue noted is the fact that the ONS procedure in question used the Geary-Khamis (GK) method when calculating regional RPIs. The GK method has fallen out of favour in international comparisons due to the fact that it systematically "rewards" countries with price structures that differ from the norm (the so-called Gerschenkron effect). Evidence also suggests that the GK method is more vulnerable to stochastic errors in the measurement of price and quantities data than the EKS method used in this paper (Dikhanov, 1997).

A further document attempting to estimate regional prices was put together in 2010 based on COICOP and using an approach consistent with the Eurostat-OECD PPP programme. Unlike earlier work, this used a "multilateral" system akin to that typically used in international PPP comparisons (which, unlike the previous "bilateral" approach, uses the full set of information available to us). Unlike earlier work, however, this did not include either rent or owner-occupier's housing costs. This paper therefore extends that work by explicitly adding housing costs calculated via the rental equivalence approach. After doing so, we show that prices vary significantly across Britain, this has a large impact on real household incomes and a more modest, but still notable, impact on productivity.

Defining the region

Workers have some choice as to where to live: therefore setting the regional breakdown too finely runs the risk of overstating price differentials as areas with higher prices are typically more desirable. In essence, people are paying for higher quality amenities. A two-bedroom flat in Kensington is more expensive than the same flat in Newham: in this case the price difference largely reflects the quality of the locale. Equally, using regions that are too large fails to capture variation inside the region.

Added to this is the distinction between the region as an economic unit and the region as a facet of identity (Roberts and Baker, 2006). Regional boundaries in England have been adjusted numerous times over the past century without adequate study as to what the true functional geography looks like. For practical purposes, regions therefore need to be as small as possible whilst maintaining sufficient size to make movement between them significant. Measures of commuter flows might be an effective way to make this distinction and further research may seek to develop the present analysis along the lines of "travel to work areas" (.

In practice, the data needed to construct price indices are available at the Government Office Region (GOR) level, which is a practical constraint. In an ideal world, "Greater London" would include parts of Essex, Hertfordshire, Buckinghamshire, Berkshire, Surrey and Kent as these contain areas where one could realistically live whilst working in London. Nevertheless, one should not allow the perfect to be the enemy of the good and, this caveat notwithstanding, GORs overlap relatively closely with the regions we actually seek to construct deflators for. Moreover, by considering wages by place of residence rather than workplace one can still construct good estimates of real incomes.

Method

The question of method is much thornier. It is clear that whatever method is chosen should fulfil certain basic criteria. It is preferable that any method should be scale invariant – if all quantities in a given region double but prices remain identical then the relative price levels shouldn't change. This rules out indices such as the GK method, which approaches a Laspeyres index with the largest region as a base. In addition, it is desirable that the index chosen should be base invariant (it should not matter which region is chosen as region 1).

A symmetric, base-invariant index achieves this. If one additionally specifies that the index for any regional pair should be an average of the Laspeyres and Paasche indices (representing the extremes of evaluating the price levels against the basket of region 1 and region 2 respectively) then the Fisher ideal index is in some sense an optimum bilateral index. Specifically, the Fisher index is the only homogeneous[1] symmetric[2] average of the Laspeyres and Paasche indices that is base-invariant[3]. It is thus typically used precisely because it deals with the problem of the substitution effect identified whilst using the Laspeyres and Paasche indices as bases.

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[1] Doubling both the Laspeyres & Paasche indices should double the average
[2] Symmetric in the sense of giving both regions equal importance
[3] Meaning that it is irrelevant whether one chooses the West Midlands, North East or Great Britain overall as a "home region"

As quantities are not observed (but expenditure shares are), a straightforward rearrangement produces the following Laspeyres index. This can thus be seen as the arithmetic mean of the relative prices when weighted by region 1's expenditures. Summation is over all expenditure categories and indices on the summation operators have been omitted for clarity.

$$Laspeyres_{2/1} = \frac{\sum(price_{region\,2} \times quantity_{region\,1})}{\sum(price_{region\,1} \times quantity_{region\,1})} = \frac{\sum(\frac{price_{region\,2}}{price_{region\,1}} * weight_{region\,1})}{\sum weight_{region\,1}} \quad (3)$$

Likewise, a rearrangement of the theoretical Paasche index gives a calculable expression. This can be seen as the harmonic mean of the relative prices when weighted by region 2's expenditures. Equivalently, it is seen to be the inverse of the Laspeyres index for evaluating the prices of region 1 at the weights of region 2. Summation is similarly over all goods and subscripts have been omitted for clarity.

$$Paasche_{2/1} = \frac{\sum price_{region\,2} \times quantity_{region\,2}}{\sum price_{region\,1} \times quantity_{region\,2}} = \frac{\sum weight_{region\,2}}{\sum(\frac{price_{region\,1}}{price_{region\,2}} \times weight_{region\,2})} \quad (4)$$

In practical terms, the Fisher index is then calculated as the geometric mean of the two. The downside of a Fisher index when making comparisons when there are more than 2 regions in total is that it is not transitive. Thus, $RRCPL_{A/B} \neq RRCPL_{A/C} \times RRCPL_{C/B}$

One therefore needs a procedure to make the Fisher index transitive. The EKS procedure adopted in this paper provides transitive price levels that are as close as possible to the bilateral Fisher relative price levels. This is the so-called property of characticity (see OECD (2012) for further details) and is an important motivator in using the EKS method over alternatives. In particular, the EKS procedure minimises the sum of squared differences between the resultant EKS index and the original Fisher index (whilst guaranteeing transitive results). As such, it minimises the expression: $\sum_{i=1}^{N}\sum_{j=1}^{N}(\ln EKS_{ij} - \ln Fisher_{ij})^2$

The practical method for calculating the price levels is somewhat more straightforward. It is given by the equation:

$$\left(\prod_{k=1}^{N} \frac{Fisher_{k/j}}{Fisher_{k/i}}\right)^{1/K} \quad (5)$$

The Eurostat-OECD Purchasing Power Parity (PPP) methodology allows results that are conceptually sound (with the proviso that these results only cover that portion of all prices pertaining to goods bought by households). Moreover, as this was the methodology used by the ONS when calculating Relative Regional Consumer Price Levels (RRCPLs) in 2010, using it thus allows one to build on these in a coherent manner.

Data

Two sets of data are necessary to construct relative consumer price levels. Firstly, one needs data on the prices of different goods and services in each region. Secondly, one needs data

on expenditure shares in each region. The most recent data on prices of different goods and services in regions of Britain comes from the RRCPLs produced by the ONS for 2010 (ONS, 2011). Usefully, the prices used by the ONS have already been aggregated to the division level using the same aggregation procedure used in this paper. The results are conceptually coherent as the methodology requires repeated aggregation. As previously noted, the RRCPLs lack any data on housing costs or expenditure.

Less usefully, division level expenditure is given only for London, "Rest of England" and the other UK countries. Two options are therefore available: either to use the division level prices for "rest of England" and assume that the only price difference between regions outside of London pertains to housing or to use the RRCPLs given by the ONS and attempt to add appropriate weights for housing costs and certain other categories. Neither is ideal. The first method almost certainly underestimates price differences across the English regions (non-housing related prices in the South East appear to be about 4% higher than in northern England). Equally, the second method does not aggregate by internationally recognised COICOP category (and small sample sizes suggest that some of the variation in prices may be statistical noise). In practice, the differences between the two methods are modest and so we report both.

Regional expenditure shares for each category are calculated from the 2010 Living Costs and Food Survey (ONS and DEFRA, 2012) with two important modifications. Firstly, UK price indices (most notably the CPI and CPIH) are computed on the basis of domestic expenditure – all expenditure within the territory of Britain. This is conceptually the correct measure when considering inflation for the purposes of setting interest rates. However, if one wishes to consider relative incomes then what matters is purchasing power of those living in an area and thus prices need to be considered on a national (regional) basis. This means accounting for the fact that some spending takes place outside the region of residence (particularly holiday spending and spending on hotels). The RRCPLs appear to exclude these completely (along with education and health spending) so they are added again.

Education and health spending are modest. Prices for goods and services associated with the NHS (e.g. prescriptions, NHS glasses etc.) are set by the state and do not vary by region. Non-NHS medicines and glasses are fully tradable and therefore any inter-region price differences are likely to be minimal. No data exists on the relative costs of private healthcare and education across regions and so it has been assumed that prices are uniform across regions. Due to the low weight associated with these categories (under 3% of total expenditure) this is unlikely to have materially impacted the results.

All Britons (irrespective of region) face the same purchasing power when spending abroad. Similarly, one can choose to holiday in a more or less expensive region of Britain than one's home region. As a result, domestic and foreign holiday spending (together with spending on hotels) is assumed to be equally costly irrespective of one's region of residence. This typically accounts for roughly 10% of all expenditures.

Finally, it is necessary to include owner-occupied housing costs in the expenditure set. Whilst there are several ways in which this might be done, this paper uses the rental equivalence approach. This is economically coherent as it explicitly captures the value the homeowner derives from the ownership of their dwelling. It is also the methodology used by

the ONS in computing the CPIH, which provides a useful "sanity check" against which to compare national expenditure shares.

Any costs associated with the acquisition of a house as an asset are excluded (as capital repayments are already categorised separately, this simply involves subtracting mortgage interest payments from total expenditure). Money transfers and gifts are excluded at the same time as these simply involve the transfer of purchasing power from one individual to another. Then, the proportion of the total dwelling stock that is owner-occupied is ascertained from the Family Resource Survey (Department for Work and Pensions, 2014) and owner-occupied housing expenditure (by rental equivalence) is calculated as follows:

$$Owner\ Occupied\ Housing\ Costs = \frac{Proportion_{OOH} * Gross\ Rents}{1 - Proportion_{OOH}} \qquad (6)$$

This approach assumes that owner-occupied housing is no more or less costly than its rented counterpart. In practice, this is likely to understate total owner occupied housing costs because owner-occupiers tend to live in larger dwellings. Nevertheless, lacking detailed data on the breakdown of the housing stock by tenure this approach provides a realistic estimate of likely housing costs. In addition, the figures produced are realistic when considered on a national level (housing has a weight of 21.7% for Britain, compared to 21.4% in the CPIH of 2010). This method does give slightly higher weight to rents relative to owner occupied housing than the CPIH though. It is unclear whether this is due to differences in timing (CPIH weights are typically generated by data from 2 years prior due to the time taken to produce national accounts), the use of different data sets or our methodology underestimating the value of owner-occupied housing.

Finally, data on regional rents is needed, both to estimate rental prices directly and to estimate imputed owner occupied housing costs. Two options are available at this juncture – one can use the figures produced directly by the Family Resources Survey (FRS) for private sector rentals or attempt to use a variety of other datasets (specifically data from the Valuation Office Agency, Rent Services Scotland and Rent Officers Wales).

In all cases, the overall pattern (of high housing costs in London and the South East) is maintained but some differences are noteworthy. The FRS shows considerably lower relative rents for Scotland and London than the other sources. Two factors ultimately lead the FRS to be the preferred data source. It gives fully comparable figures across Britain nations (including Northern Ireland) and the sample is statistically chosen to be representative of regions and family type.

Valuations Office Agency data in particular are not statistically sampled and relies on information being provided on a goodwill basis. The downside of using the FRS is its sample size: the total sample of private sector rents is around 3300 for the entire UK compared with over 500,000 for the administrative data sources. As a result, we report results generated from both (with Northern Ireland defaulting to the FRS due to the absence of administrative data). We show that both data sources produced qualitatively similar conclusions and that our primary data source gives a conservative estimate of the size of the price effect.

Results

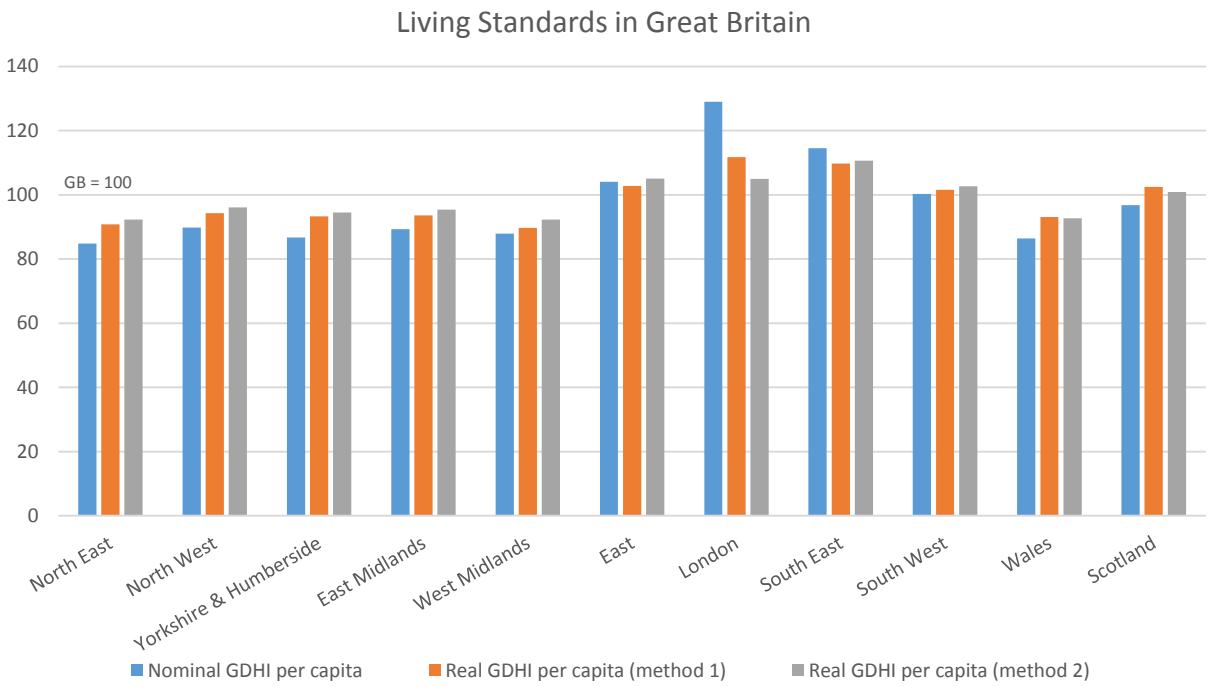
Results for three sets of results are reported. Our primary result involves applying the Eurostat-OECD Èltetö-Köves-Szulc (EKS) procedure to the region-level prices reported in the appendix of the RRCPLs and then adds categories for housing, health, education and other non-varying expenditure. Housing costs are derived from FRS data and the results are weighted by region (as far as possible) using the LCF survey. The second set of results involves the same methodology and weights but uses data from the Valuation Office Agency, Rent Services Scotland and Rent Officers Wales to estimate housing costs.

The final set of results actually measures a slightly different (but equally interesting) concept. Rather than a consumer price level consistent with a PPP, this measures the cost of buying the same basket of goods as the average UK household (using CPIH weights and the prices from method 1). Perhaps unsurprisingly, there is modest variation across different methods, with the CPIH giving a slightly wider spread across regions. This is to be expected as consumers substitute away from goods which are relatively more expensive in their regions (thus, although Londoners consume more housing by value than other regions the volume of housing per person is lower as witnessed by smaller dwelling sizes per person).

Region	***Method 1***	***Method 2***	***Method 3***
North East	93.4	91.8	95.2
North West	95.2	93.5	97.0
Yorkshire & Humberside	92.9	91.8	94.7
East Midlands	95.4	93.6	97.2
West Midlands	98.0	95.3	99.8
East	101.2	99.0	103.2
London	115.4	122.9	118.8
South East	104.4	103.5	106.6
South West	98.8	97.7	100.5
Wales	92.8	93.2	94.8
Scotland	94.5	95.9	96.2

The broad picture, irrespective of the precise method used, is of substantial regional variation in prices. London appears to be particularly expensive (at least 25% more costly than the cheapest region), although the gap between the northern regions and the South East is also substantial at around 10%. As can be imagined, this has a very real impact on real incomes and hence inter-regional disparities.

Real incomes are measured by Gross Disposable Household Income per capita, which is the best measure of overall regional incomes that we have available to us and should be used in preference to GVA per capita when talking about living standards (Dunnell, 2009). Although widely used, Gross Value Added per capita is greatly distorted by commuting and demographics (it divides the output of those working in a region by the number of people living in said region).



As can be seen, deflating by regional prices has a profound impact upon relative incomes. The average London resident may be 52% better off than her counterpart in the North East, but in real terms the difference is only 23% using our preferred method. In other words, the gap between the richest and poorest regions more than halves. Administrative data on rental costs suggest that the disparity may be even smaller.

This is not just a London phenomenon either (although it is, admittedly, the most egregious example): residents in the South East are 32% better off than those in Yorkshire in nominal terms but the gap shrinks to less than 18% in real terms. In fact, even these deflators fail to fully capture several aspects of welfare. From the perspective of the employee, commuting represents foregone leisure time just as much as traditional work. Given that commutes in higher wage regions – especially in the so-called "Greater South East" tend to be longer than those elsewhere, the welfare of such workers will be commensurately reduced (Harvie, Slater, Philp, & Wheatley, 2009).

Likewise, wage inequality is higher in London than elsewhere (due to the presence of a small number of extremely high income earners). This suggests that for the majority of the population (the bottom 80%) the gap in living standards is even smaller than this analysis suggests. As a result, spatial imbalances in this dimension appear much more in line with other developed nations. The impact on Gross Value Added and hence regional productivity is more complex and is likely to fuel a broader research agenda. Nevertheless, the fact that household final consumption expenditure accounts for around two-thirds of GDP and that the costs of investment and government services are likely to be higher in regions where the cost of living is elevated suggests that it will be substantial.

Discussion and Conclusion

These findings demonstrate that real incomes differ much less across British regions than official data suggest, bringing Britain into line with other developed nations. Whilst agglomeration remains an important factor in explaining regional specialisation, this is undoubtedly a much more subtle and specific process than in the past, with traditional measures of specialisation declining since the mid-20th century (Krugman, 2011).

As such, it should not come as a surprise that proper deflation substantially reduces the difference in macro-level measures of income across regions relative to that believed heretofore. Estimates of regional GVA and convergence thereof need to be reconsidered to take into account differences in regional prices. This may be an explanatory factor in the 'winners circle' identified by Patacchini and Rice (2007).

An additional puzzle is to understand what factors are driving these substantial differences in regional prices. Restrictive planning legislation is an obvious culprit, but the extreme spatial concentration of power in Britain (where the executive, legislative, administrative, legal and financial centres of the country are all located within a small area in central London) identified by McCann (2016) is also likely to be an important factor. In any event, the challenge is to understand those factors that permit higher nominal wages in certain regions.

This is analogous to the so-called "Penn effect" noted in the international economics literature (Tan, 2016). In that literature, however, such differences are often explained via the Balassa-Samuelson hypothesis, which relies on the relative immobility of labour across countries (Asea and Corden, 1994). Clearly such an explanation is not tenable in the regional context, where labour is (at least in theory) relatively mobile. One potential explanation is that higher productivity in the so-called tradables sector (or equivalently more favourable terms of trade for the wealthier region, possibly due to different regional specialisations), combined with a constraint on the quantity of housing leads to higher regional prices.

Nevertheless, narrower real income differences render the disparities across a wide range of indicators more puzzling rather than less. Labour market outcomes in Britain show notable inter-regional differences (Jones and Skilton, 2014), even after allowing for demographic factors. As has been noted in the literature, changes in employment opportunities in city-regions often have a long-lasting impact upon economic activity rates, particularly for certain socio-economic groups (Bailey and Turok, 2000).

Thus, far from reducing the scope for further regional research, these results suggest that an accelerated research agenda is needed. Firstly, we urgently need robust information on the evolution of regional prices in the 21st century – are real regional incomes converging or diverging? In addition, there is a strong research agenda in understanding the international context. We know that the British experience of higher prices in wealthier regions is typical – research has shown that this effect can be demonstrated in Italy (Nenna, 2001), China (Jiang and Li, 2006) and the same is visible in US statistics on personal incomes (Aten, Figueroa, Mbu, & Vengelen, 2017).

Nevertheless, internationally comparable data across a wide range of countries is lacking – is the effect unusually intense within Britain or is it typical and how do disparities in real household incomes compare to other spatially concentrated states (such as France or

Japan)? Extending the concepts elucidated here to calculate real regional GDP in Britain and across Europe should be high on the agenda of the academic community, Eurostat and National Statistical Institutes. This poses very real questions for a wide gamut of questions on regional development and convergence in developed and developing countries alike.

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