Regional unemployment and house price determination

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Abstract

This paper investigates the effect of unemployment on house prices in the UK property market to give an indication of the nature of their relationship. By evaluating housing research, including unemployment variables, this paper gives an overview of the uses of the unemployment variable and show the lack of a specific focus on unemployment in house price research. Theories of unemployment are presented as being a component of housing demand. A composite model of house prices against supply and demand variables used in other research is constructed. Using regional UK panel data of a fixed effects panel regression at the national level, the resulting coefficient for unemployment is compared with similar findings from other studies, resulting in unemployment being shown to be statistically significantly negatively related to house prices. Then, using OLS, no real relationship was found in regional house price sensitivity to unemployment, and how relatively rich or poor a region is. This result was possibly caused by problems with the regression as previous research had indicated that relatively richer regions do have a greater sensitivity of house prices to unemployment.

JEL codes: R31, C13

Keywords: unemployment; house prices; regional

1. INTRODUCTION

1.1 Motivation

The relationship between house prices and the rate of unemployment provides an interesting topic for research as the two variables are important macroeconomic indicators for the overall economy and as such, are of interest to policy makers. This research is particularly relevant as the great recession caused by the credit crunch in 2007 followed a long housing boom, and resulted in the highest unemployment in a generation across the developed world. The negative relationship between the two variables is accepted as given, by both economists and policy makers, and as such surprisingly little research has been undertaken into this specific relationship. The unemployment rate has been used in housing models along with other variables, but unemployment has never been the main focus of the research, leaving this important variable almost as an afterthought in the extensive research into housing.

This paper intends firstly to examine the important relationship between house prices and the unemployment rate, and secondly to examine the anecdotal assumption that house prices in relatively richer regions have a higher sensitivity to unemployment than in relatively poorer regions. This anecdotal relationship is stated by Clapp and Giacotto (1993), and both their research, along with that of Meen (2001) and Giussani and Hadjimatheou (1991b), provide support for this argument. As with all other research on house prices and unemployment, all three papers had another focus to their research. The Clapp and Giacotto (1993) research examined how economic variables influence local house price dynamics using both Repeated Sales and Assessed Values measures of house prices, and found that 'Rising unemployment reduces house price changes, and this reduction is substantially greater in the relatively *affluent* West Harlford region.' Meen's (2001) research concerned UK spatial coefficient heterogeneity and ripple effects, and discovered that 'for a given level of unemployment, there is a bigger effect on the south.' This corresponds to the finding in Giussani and Hadjimatheou (1991b), in a paper on modelling the UK north south divide in house prices, that the south has a higher sensitivity to unemployment than the north. These three findings, along with the coefficients of regional unemployment in house price models from other papers such as Reilly and Witt (1993), Gilmartin and Korobilis (2010a) and Wilcox and Peer (1992), will be examined and discussed.

1.2 Do High Wage Regions Have A Greater Sensitivity In House Prices To Unemployment?

The question of whether richer regions have house prices which are more sensitive to the regional unemployment rate is a highly relevant economic question. As noted by Clapp and Giacotto (1993) there is anecdotal evidence that relatively richer regions have a higher sensitivity than relatively poorer regions. The question is, why? What is the economic theory supporting this? And could the converse, that relatively poorer regions have house prices more sensitive to regional unemployment, be true?

A theory explaining why relatively richer regions have a higher sensitivity of house prices to unemployment is related to fact that properties in the relatively richer regions have higher average prices. If the definition of 'richer' is having higher average incomes and/or higher average wealth, then house prices are directly correlated to incomes, as is argued by King (1990 cited in Meen, 2001, p.90) evidenced by the UK boom in house prices in the second half of 1980s which was due in part at least to reassessments of permanent income.

Also, as housing is the main form of wealth for most citizens in the UK, wealthier regions by definition have higher house prices. Therefore as higher priced houses are more volatile over the business cycle, enjoying higher percentage increases than lower priced houses during a boom and a convergence of both house prices during a recession, then higher priced houses will be more sensitive to unemployment. Another factor is the greater levels of leverage associated with purchasing housing in regions with relatively higher house prices than in relatively lower house price regions. Benito (2005), examining house price dynamics across UK regions, argues that high loan-to-value ratios raise the sensitivity of house prices to economic shocks. Similarly Meen (2001) finds that house prices in the south of England are more sensitive to national stimuli, particularly the interest rate.

The reasons for the relationship between house prices and unemployment could include that both changes in unemployment and house prices are caused by the deviations of the economy from its long term potential output, thus the relationship between them is from an 'indirect' effect, and simply an indication of economic conditions. A more 'direct' affect for the relationship would be higher unemployment causing more bank repossessions which would increase the market supply of housing, consequently reducing the average price of housing. The actual relationship between house prices and unemployment is likely to be a mixture between the direct and indirect relationships, as housing is an asset with a complicated relationship with the macro economy. For instance if house prices fell caused by unemployment, then building new domestic housing becomes less profitable, reducing supplier activity, which would then feedback via the construction industry creating more unemployment. There has been some debate on whether the 1980s consumption boom was causing or caused by the house price boom, with inconstancy evident between the micro data of Attanasion and Web (1994) and Miles (1997) and the macro data of Muellbauer and Murphy (1990) as cited by Meen (2001).

The converse of the theory in this paper would be that relatively poorer regions have a greater sensitivity of house prices to unemployment. This theory postulates that as relatively poorer households have less valuable non-housing assets, such as saving and shares, they are unable to pay their mortgage if members of the household become unemployed, and are therefore likely to be repossessed. This would both increase the supply of housing in these regions, and decrease demand, as households cannot access mortgages in the period after facing repossession. Becoming renters, households increase demand for renting but this does not increase the total demand for housing, or, therefore, the price of home ownership. Therefore the house price would fall by more in relatively poorer regions for the same given level of unemployment.

Anecdotal evidence and coefficients from the few other studies involving house prices and unemployment supports the theory of house prices being more sensitive to unemployment in relatively richer regions. This paper will use panel data for UK regions to find the coefficient for unemployment, in order to test the theory and to compare it with other research. Firstly, in section 2, the relationship between house prices and unemployment in other research will be discussed, with a particular emphasis on UK regions, giving the reasons why other papers have used house prices and unemployment. Then, in section 3, specific papers and findings will be reviewed, with an emphasis on providing an answer to the aforementioned question, before section 4 and 5 explain the data and empirical findings of the panel regression respectively. Finally the conclusion in section 6 will comment on the findings of this research and compare them with existing findings.

2. HOUSE PRICE AND UNEMPLOYMENT RESEARCH

2.1 Relationships Between Unemployment And House Prices

Housing is of vital importance to the macro economy and as such is an area of much research. Therefore it is surprising that research investigating the relationship between housing and unemployment, another area of great importance to the economy, is so deficient. In this section the use of unemployment in house price models is examined with a review of the relevant research and issues.

Some house price models, such as Meen (2001), use the rate of unemployment as a simple indicator of labour market risk, with the risk of unemployment reducing the willingness of employed households to get mortgages thus reducing house prices (Reilly and Witt, 1993). This particularly affects households with volatile incomes, who will not purchase houses due to potential losses in the future and it also reduces the availability of mortgages (Yao and Zhang, 2005 cited in Gathergood, 2011). Similarly Dias-Serro (2005) and Turnbull et. al. (1982) found a negative relationship between income uncertainty and homeownership.
Therefore as homeownership rates have a positive relationship with house prices, the risk of becoming unemployed increases income uncertainty and thus decreases house prices. Gathergood (2011) also investigates the impact of income uncertainty, in the form of unemployment risk, in the decisions of renters to become homeowners. The endogeneity of employment to home ownership status is avoided by using an exogenous variation in unemployment risk. This paper is about unemployment and homeownership rather than house prices, but it highlights both the use of employment, as opposed to unemployment, as is the focus much of the research, and also states of accepted correlation between unemployment and house prices: 'It is likely that regional house price movements are correlated with regional employment fluctuations.' This correlation is taken as given in many papers however it has received some investigation in online financial blogs. The most significant of these is probably Blitzer, chairman of the Index Committee S&P Indices, who reports the correlation of the unemployment rate and house prices of the 20 American S&P/Case-Shiller cities, as presented in diagram (1) below (HousingViews, 2012).
The diagram simply shows the correlation between the change in house prices over 12 months to October 2011 on the horizontal axis and the local unemployment rate in November 2011 on the vertical axis, for these cities. As the time periods are different for both variables, this diagram only gives a basic indication of the correlation. Blitzer does not speculate over any causation between the two variables or whether a third variable may cause the relationship.
Another reason for using the unemployment rate to capture the effect of regional labour markets on house prices is that unemployment may constrict interregional labour mobility (Reilly and Witt, 1993). This constriction of interregional labour mobility is discussed by Rabe and Taylor (2010) who find that the unemployed are less likely to migrate to high employment areas than to high wage areas, as the unemployed are less likely to make a speculative move. Related to this issue is the argument that, generally, both homeowners and social housing tenants are less likely to move than private renters, due to the relatively large transaction costs involved (Oswald, 1999, cited by Quigley, 2003). This positive correlation between ownership rates and unemployment received some support from

Haavio and Kauppi (2001), however Green and Hendershott (2001) found no simple correlation and thus argued that housing transaction costs do not affect unemployment. This discussion on home ownership is important as higher levels of home ownership generally relate to higher house prices.
Reilly and Witt (1993) state the theory that high levels of unemployment may also serve to dampen down real wage growth, with obvious consequences for house prices, and this theory is a reason for including unemployment as a variable. This may not be the case, however, as Cameron and Muellbauer (2001) theorise that high wages might compensate for high unemployment or high house prices in a developed economy. This implies that high unemployment may not dampen real wage growth, therefore the link of unemployment to the house prices would be broken.

2.2 Long Run v Short Run

When modelling the housing market, it is important to distinguish between the long-run, in which both supply and demand affect prices, and the short run in which supply is fixed and only changes in demand will affect the house price. The short-run and long-run effects on unanticipated and anticipated inflation, housing construction and other variables of regional US house prices is the focus of research by Baffoe-Bonnie (1998). Using time-series data and a VAR approach, the paper analyses only new construction and is therefore focused on housing stock investment rather than the flow of housing services. As housing has both a durable consumption element, in the flow of services it provides, such as shelter, storage for possessions, access to neighbourhood amenities and an indicator of social distinction (Meen, 1989), and also an investment component, houses are the main, or even sole, asset for many households. Baffoe-Bonnie finds that regional house prices for new construction reflect regional employment growth, regional inflation, and the national interest rate and money supply. It would be expected that the relationship between unemployment and employment would be negative but not perfectly correlated due to the some of the jobs going to economically inactive and migration from other regions or countries. Interestingly the employment variable uniquely influences demand in most regions, and, also, the economic variables alone cannot explain the fluctuations in prices. This research‘s result for employment disagrees with the findings of Sari et. al.(2007).

2.3 Transaction Costs

Transition costs in housing markets are significant and it is these transaction costs which prevent short-term adjustments to income, such as being made unemployed, from resulting in a new neoclassical equilibrium for house prices (Quigley, 2003). These transaction costs involve non-financial costs such as searching and the effort of moving home, and financial costs such as legal costs, taxes (e.g. stamp duty) and moving possessions. The existence of these transaction costs means short-term regional income elasticises are unrealistic, as households do not move house (Goodman, 2001). For this reason random shocks to income streams, such as being made unemployed, have negligible effects on demand in the short run and that is another reason why the model used in this paper will be a long-run model.
The neo-classical equilibrium is also complicated by the spatial fixity of housing, and this characteristic also makes defining a neoclassical exchange market difficult as there are overlapping sub markets differentiated by tenure (MacLennan,1982). Therefore as housing markets reflect local economic conditions, regions will have differing responsiveness to economic variables (Huang and Quigley, 2006; Meen, 2001). This factor caused the failure

of house price models in (not) predicting house prices in the 1990s (Meen, 2001). As house prices within regions are in long-run relationships over time (Ashworth and Parker, 1997), modelling long-run regional house prices with regional unemployment is a close estimation of economic reality. In fact, for a national analysis to be valid, all households must behave identically in response to unemployment in order to have coefficient homogeneity (Meen, 2001). Using UK regions is therefore a good estimation of geographical housing markets as the regions are large enough to encapsulate the smaller over-lapping urban housing markets.

2.4 House Prices

Defining house prices is difficult due to the heterogeneity of housing. Houses are physically unique, something which causes different house prices within a set location. To get a standardised index for house prices, a hedonic index is used. Housing is decomposed into different attributes and then an average house price house is created (Goodman, 2001). Hedonic pricing is accepted by economists but it has limitations, as argued by Wallace and Meese (2003). Using two-stages, first getting an index of hedonic house prices and then using the hedonic index for price in a supply and demand model, gives a different and less satisfactory result compared with conducting the whole model in one stage. However as Wallace and Meese concede that the difference between the two methods would not be worth the extra time and resources of the one stage model, and also as the vast majority of papers use the two stage model, the two stage model will be used in this paper.

2.5 Permanent Income

Housing models use measures of permanent income as demand variables rather than current income. In long run supply and demand models, the demand variables chosen need to reflect the long-run lumpy nature of housing. Due to the large transaction costs of moving home mentioned above, households in general move home very infrequently. This means that when they are deciding how much to spend on a house they take into account their likely future income and households will remain in their property over a given time period rather than moving whenever they have an income change (Muth, 1989). This life-cycle analysis model is related to the utility function and will be discussed in section 4. Muth argues that whole life-cycle analysis is inappropriate due to uncertainty of future income and housing needs. An example of this being students not immediately purchasing the same types of houses as their parents at a young age. Another problem with permanent income is that it is relatively difficulty to value compared to current income. Meen (2001) uses current consumption as a proxy for income as economic theory relates current consumption to expected future income as well as current income. Consumption is therefore a satisfactory and easily measurable variable to use in the model. Breedon and Joyce (1993) following Meen (1990) include both wealth variables, combined with unemployment, as a measure of permanent income (Reilly and Witt, 1993). Therefore, using unemployment as a component of permanent income is the main reason for past research including unemployment in a house price model.

2.6 Lags

Lags between changes in house price and component variables of demand and supply are a common feature of the property market. The house price is generally a leading indicator compared with economic output whereas unemployment and income are lagging indicators. The existence of these lags means that current unemployment or income will not affect

current house prices but, rather, future house prices. If unemployment increases repossessions, which increase supply and lower house prices, then unemployment will operate with a lag on repossession and therefore a lag on current house prices. A well specified model will therefore need to account for lags between the variables.
Lags are particularly important because the housing market is cyclical, with movements related to the business cycle. Tsang and Edelstein's (2007) research indicated that local variables, employment growth and unexpected unemployment growth, had the most impact on housing markets. However, the interest rate was positively related to housing supply, contrary to economic theory, possibly due to the short time period used. This justifies the use of data over a longer time period if possible.

2.7 Ripple Effect

A large part of UK regional housing economic analysis is concerned with the 'Ripple Effect', in which changes in regional house prices are caused by house price changes in the South East spreading in waves to other regions, with time lags (Giussani and Hadjimatheou, 1991a). This effect is created by demand factors or migration pressures and many housing models included spatial autocorrelation, where regions are correlated to their neighbouring regions (Ashworth and Parker, 1997).
Similarly, multicollinearity between the variables means models are somewhat limited in reliability because they cannot deal with all the interactions with the rest of the economy (Baffoe-Bonnie, 1998). As Leung (2004) argues that, at best, models of house prices include some exogenous macroeconomic variables but a more comprehensive modelling of the interplay between the housing market and the rest of the economy would an improvement. A microeconomic example of this interplay is as follows: a factory in a town closes, creating unemployment, then repossessions increase and house prices fall, which decreases consumption due to wealth effects and in turn creates more unemployment (Murphy and Muellbauer, 1993). However Baffoe-Bonnie (1998) argues that including feedback effects such as this, increasing the complexity of the model, also increases the possibility of serious misspecification. Reilly and Witt (1993) noted that lagged house prices can have an effect on personal disposable income and set the issue to one side when examining the effect of disposable income on house prices. It is therefore reasonable not to account for all the complex interplays between the variables in the model to keep it focused.

2.8 Econometric Methods

Most house price models use time-series data, with the older research using OLS regressions to test models and the more recent papers using the preferred cointegration analysis, to confirm house prices and their fundamentals are integrated of the first order. The existence of cointegration between house prices and their economic fundamentals implies causation and a long-run equilibrium relationship between them, rather than just a random relationship between trending variables. The Reilly and Witt paper (1993) is criticised by Ashworth and Parker (1997) for having a 'spurious regression' problem, as the OLS method was used. The reason Reilly and Witt did not use the cointegration analysis was the short time period of their data. Ashworth and Parker use the same variables as Drake (1993), i.e. less variables than earlier studies, with a long-run emphasis, and use the Johnson technique for multivariate analysis. Also Kenny (1999) also uses the Johansen cointegration technique to assess the extent to which the Irish housing market possesses well behaved long-run housing demand and supply relationships. Recently

however, Zhou (2010) argues that housing economics has focused only on linear cointegration rather than non-linear cointegration, and this may lead to the misconception that no cointegration exists between house prices and economic fundamentals. House price models also often use the VAR method pioneered by Sims (1980, 1982 cited by Goodman, 2011) to account for the lags of the variables between themselves and that of the other variables. All the issues in this section are evidence of the way housing behaves differently from other goods and as such, care needs to be taken in modeling and regression analysis. However, if the model is correctly specified then it is reasonable to set aside these factors to focus on house prices and unemployment to investigate the pure relationship between them.

3. UNEMPLOYMENT COEFFICENTS FROM PERIOUS RESEARCH

3.1 Research Using Unemployment

The last section highlighted the relevant research linking housing economics and unemployment. This section's focus is on research that specifically models house prices with the unemployment rate along with other macroeconomic variables. To review coefficients of unemployment in house price models, analysis is carried out on the research methods for a comparison between the papers' methods and results.

'Baby Boom, "Pent-Up" Demand and Future House Prices' by Peek and Wilcox (1992) focuses on household demographic variables in the USA from 1950-1989. They model real median hedonic house prices, from Freddie Mac, as a function of demographics, costs of financing home purchases, incomes, construction costs, and the cyclical component of the unemployment rate, using logs. The reason for including the cyclical component of unemployment rate is that it may affect demand for housing due to borrowing constraints and income uncertainty (Haurin, 1991). They also note the correlation between the cyclical unemployment rate and the business cycle's peaks and troughs. The results for unemployment show that house prices decline with unemployment rate increases; specifically, a 1% rise in cyclical unemployment will reduce house prices by 0.74%. The result is statically significant, however this regression uses the OLS method and therefore has the 'spurious' regression problem. Also as it uses national data it will face the problem of regions having different responses to economic variables (Meen, 2001).

Another paper using OLS is 'Regional House Price and Possessions in England and Wales: An Empirical Analysis' by Reilly and Witt (1993). Here the main focus is on repossessions, motivated by real and nominal house price falls in the South East for four years around this period. This paper notes that the reason Breedon and Joyce (1993) include the unemployment variable is as a measure of permanent income along with a wealth variable. Reilly and Witt on the other hand include unemployment to capture the effect of regional labour markets on house prices and give the following economic explanations for this: high unemployment may constrict inter-regional labour mobility; dampen real wage growth; and increase labour market risk, with consequences in mortgage borrowing. Reilly and Witt run a regression of log regional unemployment, income, and repossessions on house prices and do consider the potential endogenuity of the variables. They argue, however, that as unemployment and income lag current repossessions, they are independent. They use planning regions equivalent to NUT 1 regions with data from 1987-1991 and the resulting coefficient for unemployment implying a 1% rise in the regional unemployment rate decreasing regional house prices by 0.17%. The result is statistically significant and

the lower coefficient compared to Peek and Wilcox (1992) could be attributed to using the unemployment rate rather than the cyclical unemployment rate, as house prices would be expected to be more responsive to the cyclical rate. Problems come from the use of OLS and of few variables, as there is no measure of opportunity cost, such as the interest rate, nor any supply variables. The reasons given are that there is no spatial difference in interest rates, the short time period of the data, and the lack of availability of regional date. The lack of these variables does possibly imply a mis-specified model, however the time period is quite short.

The paper 'Modelling Regional House Prices in the UK' by Ashworth and Parker (1997) uses maximum likelihood cointegration methods to analyse determinants of house prices in the NUT 1 UK regions. This paper does not use unemployment as a variable but does however explain why, i.e. that: 'unemployment was found to be integrated of a different order to the other variables, and so could not be a candidate for a cointegration relationship'. Similar findings to this may be the reason unemployment was more commonly used as a variable in the earlier OLS papers and has been generally omitted in more recent cointegration papers.

3.2 Research Papers Of Richer Region House Price Sensitivity

Three pieces of research are presented here which indicate an answer to the question: do relatively richer regions have greater sensitivity in house prices to unemployment than poorer regions? The first is by Meen (2001), investigating 'Spatial Coefficient Heterogeneity and the Ripple Effect' on UK regions using annual panel data from 1973 to 1994. A simple regional house price model is used, partly reflecting less regional data. Using logs of nominal house prices, income, lagged income, unemployment and the nominal interest rate. Meen states that although such models are usually expressed in real terms, there is relatively little variation in UK regional consumer prices and no data about the variation, therefore it acceptable to use nominal variables. The unemployment rate is included is as a simple indicator of labour market risk. The regions are grouped into four blocks and equations are estimated as Seemingly Unrelated Regressions (SUR), to capture the spatial correlation in the error terms. The research investigates how regional house prices respond to national variables, and the difference between national and regional variables. The south is found to be more responsive to a given level of unemployment than the north. Meen highlights however that this does not imply that unemployment is more *important* in the south, possibly as the unemployment rate is higher in northern regions and therefore unemployment depresses house prices by more in absolute terms.

The second study for discussion here, Clapp and Giacotto's (1993) 'The Influence of Economic Variables on Local House Price Dynamics' explores the relationship between the methods used to *measure* house prices. The research uses house price indices, Assessed Value and Repeat Sales, and local-level economic variables, quarterly changes in employment and unemployment as suggested by Fama and French (1988), and also national economic variables, expected inflation, unexpected inflation and the risk-premiums of a long term bond, as suggested by Case and Shiller (1990). The data was for three US towns; East Hartford, Manchester and West Hartford, from 1981 to 1988. The results did not find any significant difference between the two house price indexes. However, modelling the test in this way gave the result that rising unemployment reduces house prices, and also the reduction was substantially greater in the relatively richer West

Hartford region compared to the other two towns. Clapp and Giacotto state that 'this supports the notion held by real estate professionals: relatively high prices are more sensitive to cyclical changes in the economy.' The results for unemployment were highly statistically significant in both the contemporaneous relationship and in using lagged values for the explanatory variables. Clapp and Giacotto conclude that local unemployment as well as expected inflation is able to predict house prices and that this is contrary to the efficient markets hypotheses.

The final paper discussed here is 'Modelling the North/South Divide in House Prices' by Giussani and Hadjimatheou (1992b) which uses UK planning regions' quarterly data from 1972 to 1988 and OLS to find evidence for the north / south divide in property prices. The model explains the fluctuations in relative house prices between the North West and South East regions using the relative values of: per capita disposable income; a ratio of households to housing stock; a ratio of housing wealth per household; the rate of interest, and the rate of unemployment. Unemployment is included in this model to allow for expectations/degrees of optimism about future incomes not captured by present income. Therefore unemployment is used as a constituent of permanent income. All values are in logs except for the unemployment rate and the interest rate. Ratios of variables are used where possible due to multicollinearity between them. As elements of supply are included the model could be reasonably well specified. However a problem stated is that housing wealth is directly affected by house prices. This is a serious problem which means that the model is probably not well specified. Therefore the choice of variables and the use of OLS mean that there are problems with this paper; however the results, like that of Clapp and Giacotto (1993) suggest that relatively richer regions have house prices with more sensitivity to unemployment than relatively poorer regions. Giussani and Hadjimatheou (1992b) state that 'coefficients for changes in unemployment suggest a greater sensitivity of the housing market in the South East to changes in general economic conditions'. A separate cross-correlation test using unemployment as a proxy for the prevailing economic climate shows that annual house price changes in the South East move contemporaneously with annual changes in unemployment, whereas they move with a lag of one quarter in the North West. The reason suggested for this is that a higher average level of unemployment in the North West means changes in prevailing economic conditions take longer to affect the housing market. The North West also has a higher correlation coefficient, between changes in house price and changes in unemployment, which suggests that unemployment itself, rather than as a proxy for prevailing economic conditions, is a more important determinant of house prices here. This finding has implications for the present research as it implies that although house prices are more sensitive to unemployment in relatively richer regions, this is not caused directly by unemployment but rather by general economic conditions. Conversely in the relatively poorer regions where house prices are less sensitive to unemployment, it is unemployment itself which is affecting the house price, instead of prevailing economic conditions.

4. MODELS

4.1 Supply and Demand

In this section the theoretical house price models are examined and a composite model suitable for this research will be created. Housing markets, as with all markets, have an equilibrium price determined in the long run by supply and demand. A well specified housing model must distinguish between the long run and the short run information

contained in the data (Kenny, 1999). Short-run deviations can only cause changes in prices due to inelastic supply. Long-run housing demand is a function of income, prices and possibly demographics and housing supply is a function of profitability which depends on house and construction prices (Huang and Quigley, 2006).

4.2 Two Alternative Models

There are two distinct kinds of models for housing prices and economic variables, the first being the 'supply and demand' approach, an example of which is given by Ashworth and Parker (1997). This involves equating long-run demand for housing services, $ln\ H_t^D$,to price and a set of demand variables, X_t, which do not vary substantially across studies - usually some form of income measures, employment ,demographics, mortgage rates and changes in financing mechanisms (1). With the supply of housing services, $ln\ H_t^S$, consisting of house prices, and a set of supply variables, W_t, containing construction costs, housing starts, regulations and also interest rates (2). Note that the supply variables, W_t, need to be different from the demand variables, X_t , with some papers using the opportunity cost variable, the interest or mortgage rate, as a demand variable and others as a supply variable (Zhou, 2010).

(1) $$ln\ H_t^D = \phi_1 \ln p_t^h + ln\ f(X_t)\ \ \phi_1<0$$

(2) $$ln\ H_t^S = \phi_2 \ln p_t^h + ln\ g(W_t)\ \phi_2<0$$

In long-run equilibrium (1) and (2) are equated to give a 'reduce form' equation, (3), of house prices positively related to demand variables and negatively related to supply variables, thus:

(3) $$ln\ p_t^h = \frac{ln\ f(X_t) - ln\ g(W_t)}{\phi_2 - \phi_1}$$

The second model is the 'life cycle model' and involves households maximizing lifetime utility, subject to budget constraints and an asset depreciation condition which gives the 'user cost' equation. In equation (4) the time subscripts are not included for clarity and i , is the nominal interest rate, τ is tax rate, π is the inflation rate, δ is the depreciation rate of capital, $(\dot{p}^h/p^h)$ is the capital return on housing and (u'_H/u'_c) is the marginal rate of substitution between housing and consumption.

(4) $$p^h = (u'_H/u'_c) \cdot [(1-\tau)i - \pi + \delta - (\dot{p}^h/p^h)]^{-1}$$

As the (u'_H/u'_c) term is unobservable, proxies must therefore be used for empirical analysis. This is usually done by setting (u'_H/u'_c) as equal to logs of supply and demand,

(W_t) and (X_t) terms of equations (1) and (2). The $[(1-\tau)i - \pi + \delta - (\dot{p}^h/p^h)]$ term is equal to the rental cost of housing services and markets in which the rental sector is not of sufficient size, such as in the UK; the rental cost of housing is also approximated by the housing stock, the number of households, income and wealth. This has the effect of giving the separate two models equivalence. This is why many papers fail to mention the explicit theoretical underpinnings of their models (Ashworth and Parker, 1997). However it is important to note that the 'life-cycle model' is the starting point for most modern house price models (Meen, 2001).

4.3 The Composite Model

The model in this paper will include important supply and demand variables to give a well specified model at the regional level. Many economic variables can influence house prices and the choice of variables does not differ significantly across empirical studies (Zhou, 2010). The demand (X_t) terms include incomes, employment, demographics, changes in financing mechanisms and mortgage rates, whereas the supply (W_t) terms include construction costs, interest rates, and construction regulation. Recent empirical studies use fewer variables than older studies. An example are the variables of Drake (1993) used by Ashworth and Parker (1997), which only use household income and an opportunity cost variable, the interest rate, for demand and personal sector housing starts for supply. This paper will also use similar variables, with the addition of the unemployment rate and lagged income. Therefore, the following equation (5) is consistent with the two models (3) and (4):

$$\textbf{(5)} \quad ln\, p_t^h = \beta_0 + \beta_1\, ln\, Y_t + \beta_2\, ln\, Y_{t-1} - \beta_3\, ln\, U_t - \beta_4\, ln\, R_t - \beta_5\, ln\, PSHS_t$$

where Y is average of regional household nominal income and lagged income, U is the LFS regional unemployment rate, R is the nominal national real rate and PSHS is regional personal housing starts. Using regions this becomes (6):

$$\textbf{(6)} \quad \ln p_{t,i}^h = \beta_{0,i} + \beta_{1,i} \ln Y_t + \beta_{2,i} \ln Y_{t-1} - \beta_{3,i} \ln U_t - \beta_{4,i} \ln R_t - \beta_{5,i} \ln PSHS_t$$

Similarly to the Meen (2001) model, nominal variables are used to give a panel estimation which controls for the fixed effects of the different regions. Note that a lagged unemployment should possibly have been included to make the model as well specified as possible. It was not included however due to technical/time constraints.

5. EMPIRICAL METHODOLOGY AND RESULTS

5.1 Data Introduction

The data used in the model is quarterly UK panel data of house prices, unemployment, income, interest rate and housing starts, from quarter 1 1997 to quarter 3 2011. The house price data is compiled by Halifax and shows seasonally adjusted quarter-on-quarter changes in property prices across the 12 UK NUT 1 regions (Halifax, 2011). The regional LFS unemployment data was also seasonally adjusted, however the housing starts data and

average weekly earnings data was not seasonally adjusted (ONS, 2011). Quarter 1 2001 of the income data is missing, for unknown reasons, and the last few quarter of housing start data is missing for Scotland and Wales. This means the panel is unbalanced. This fact, combined with the lack of seasonally adjusted data for housing starts and average weekly wages, are the main limitations of the data used (ONS, 2012). The 12 regional UK NUT 1 regions as defined by Eurostat are: North East, North West, Yorkshire and Humber, East Midlands, West Midlands, East Anglia, Greater London, South East England, South West England, Wales, Scotland and Northern Ireland (Eurostat, 2012). The LFS unemployment data and the Halifax house price data labelled some of the regions differently from each other and from the Eurostat definitions, e.g. the Halifax data labels East of England as East Anglia; this however did not present a problem as both data sets describe the same UK NUT 1 regions. A longer time period or more regions would be advantageous, but due to the availability of regional data in the UK and the possible problems in using other regions outside of the UK, such as complicating explanations of results or different data compiling methods, the data set is limited to that described above.

5.2 House Price Data

The Halifax house price index is compiled by Halifax, which is part of the HBOS group and is the largest UK mortgage provider (Home, 2012). The regional average house prices are provided in a quarterly index. The Halifax data is compiled from a sample of its own mortgage approvals, with the Halifax covering 15,000 housing purchases each month, which is approximately a quarter of UK mortgages (Home, 2012). This means that the sample is very large and as it only covers mortgages and approvals and does not include properties which are not for private occupation, cash buyers, or properties sold at a less than market price e.g. 'right to buy' for council tenants, it gives a good estimation of house prices for the purpose of this regression (Lloyds Banking Group, 2012). The index is seasonally adjusted to account for the higher prices usually encountered during spring and summer. A problem with this data is that as it is compiled from mortgage approvals rather than actual transactions, this means it cannot be entirely accurate (Home, 2012). This could be a particular problem with the data taken from during the credit crunch in late 2007 to 2008, in which many mortgage approvals were withdrawn from customers by the banks which issued them. Another problem with this data is the possible sampling error of its being limited to Halifax customers. Though these customers represent a large cross-section of mortgage approvals, they could be skewed towards the North of England as that is where Halifax had its base. The index is compiled using a hedonic regression model which breaks down house prices into various characteristics, using a multivariate regression analysis, in order to estimate the price of a typical house rather than an average house (Lloyds Banking Group, 2012). The constituent characteristics, which contain either quantitative or qualitative attributes, are: purchase price, location *(region)*, type of property, age, tenure, number/function of rooms, number of toilets, central heating, garages, garden, land area and road charge liability. Having an index compiled against a standardised average property in 1983 and ignoring the filtering, as defined by Gibb (2003), which may have occurred, should not present a significant problem for the panel regression.

5.3 Unemployment Data

The unemployment data used in this study was available from the Office of National Statistics (ONS) website and the Labour Force Survey (LFS), as defined by the International Labour Organisation (ILO). The data comes from a survey of households'

residents at private addresses in the UK and is seasonally adjusted to take into account the seasonality of some types of employment. The Social Surveys division manage the survey for the ONS in Great Britain and the Central Survey Unit in the Department of Finance and Personnel in Northern Ireland manage the survey for the Department of Enterprise, Trade and Investment. The LFS defines the unemployed population as persons above a specified age who are available to work but not engaged in the production of goods and services over a short reference period, either a day or a week (ILO, 2012). Therefore these unemployed persons would have accepted suitable employment or started enterprise over the reference period if the opportunity had arisen. The ILO defines the employed population as being made up of persons above a specified age who work during the reference period, with the definition of work being working for pay, profit or family gain, and includes people with a job but were temporarily absent for the reference week, for example being on holiday or maternity leave. Together the sum of the unemployed population and the employed population during the reference period is equivalent to the labour force. The data used is the unemployment rate, so it is given as the percentage of the unemployed population compared to the labour force. The labour force, or economically active population, as defined, contains the two subgroups: the unemployed and the employed. There is a third population, which is made up of economically inactive people such as the providers of services for household consumption and discouraged workers, who are not included in the data used. Using a regional unemployment rate as a percentage of the population containing economically inactive would not be more desirable as the aim of this paper is to compare house price sensitivity to unemployment across regions with different incomes. However, this could be a problem as the economically inactive rate has a cyclical element due to the business cycle and could therefore also be correlated to house prices. Also, other unemployment data for the UK such as the claimant count would have been acceptable in providing an unemployment rate. The claimant count has the advantage of being compiled by the government which would be preferable to the survey data of the LFS as it does not have the sampling errors and some of the non-sampling errors of the LFS. However, as the claimant count includes some people who are either economically inactive or employed it is not a preferred measure. Furthermore the claimant count can easily be affected by government policy, such as putting people on or taking people off incapacity or other sickness benefits and transferring them on to job-seekers allowance. As previously noted, including a lagged unemployment rate variable would be preferable to just having the unemployment rate, as in this paper.

5.4 Other Data

The other data sets used in the panel regression are the nominal interest rate, housing starts and average earnings. The interest rate is the Bank of England's quarterly average of four UK banks' base rates (Bank of England, 2012). Using an average of banks' base rates gives a representative measure of the interest rates charged to consumers as these are closely related to average mortgage interest rates. Therefore they would be expected to negatively affect house prices. The nominal rate was used rather than the real rate as all the variables are nominal values and there would be no significant inflation difference across UK regions (Meen, 2001).

The quarterly (not seasonally adjusted) housing starts data also comes from the ONS (2012) and represents the building of permanent dwellings started for all three tenure - private rental, social housing and owner-occupier, measured in thousands. Data for housing

completions is available, however due to the possible lags between house prices and housing construction, housing starts was chosen as the preferred variable.
The average earnings data is a measurement of nominal gross weekly earnings by employees by region and is not seasonally adjusted. Other measures of income have been used across different studies, such as disposable income or consumer expenditure. Possible problems with the data, include, that if using average earnings from LFS, an underestimation of income is known to occur and it does not include incomes over £100,000. However using the nominal average wage will give a good estimation of income at the regional level. This variable also operates with a lag on house prices, therefore a lagged term has also been included as well as the contemporaneous term (Meen, 2001).

5.5 National Results

A panel regression which removed the unobservable cross-section specific fixed effects of the UK regions was used to answer the question of whether house prices are correlated to unemployment. The resulting coefficients for this regression and a pooled panel regression from equation (5) are given in Table (1) on the next page. The resulting coefficients show that unemployment is negatively related to house prices and that the other variables are positively related.
The result for unemployment means that a 1% rise in the unemployment rate is equal to a 0.27% decrease in house prices. This corresponds closely with Reilly and Witt, at 0.17 and is slightly less than the higher Peek and Wilcox cyclical unemployment result, 0.72. All results for the sensitivity of house price to unemployment have a negative relationship of less than 1.These results are also statistically significant; the R^2 value is very high and F-statics were also high. Lagged income affects house prices the most, and this finding corresponds with other research. However the other results obtained for housing starts and the interest rate do not respond as would be expected in economic theory. The interest rate result is in fact similar to that of Tsang and Edelstein (2007) so could be also be caused by the period investigated containing a long housing boom with higher interest rates followed by a recession with historically low rates. The supply variable could be the result of regulation stopping a positive increase in supply from occurring, and as the period in question contained a housing boom in the UK, this means that supply did not keep up with demand. The pooled panel regression not accounting for fixed effects gave the expected negative coefficients, and housing starts and interest rates had the correct sign. This would imply that the economic relationships hold at the national level, not accounting for regional effects. The interest rate however was not statistically significant.

TABLE 1

METHOD	CONSTANT	UNEMPLOYMENT	WAGE	WAGE LAG	HOUSE STARTS	INTEREST RATE	R^2
PANEL FIXED EFFECTS	-4.83 (-30.65)***	-0.27 (-9.60)***	1.41 (10.90)***	1.37 (10.62)***	0.08 (4.90)***	0.20 (9.83)***	0.92 (0.92)
POOLED PANEL	-0.94 (-4.24)***	-0.16 (-3.61)***	0.75 (2.85)***	0.86 (3.27)***	-0.16 (-7.1)***	-0.01 (-0.31)	0.66 (0.66)

In the table the t-statistics are the estimated coefficients in brackets and *** denote statistical significance at 1%. Adjusted R^2 is below R^2 brackets.

5.6 Regional Results

The relationships between house prices and variables at the regional level are examined using equation (5), to answer the second question of this paper i.e. whether relatively richer regions' house prices are more sensitive to unemployment than relatively poorer regions'. Due to technical constraints, these relationships will be examined using OLS rather than a panel regression. Though this will result in the 'spurious' regression problem, giving high R^2 showing only high correlation, the result can still be used to compare to other OLS regional studies. The 'spurious' regression explicitly rules out any conclusion of causation in the answer to the second question of this paper. This means if it could be shown that richer regions have house prices more sensitive to unemployment, any causation cannot be included, as another factor such as economic growth could actually be causing changes in both house prices and unemployment. The resulting relationship between house prices, unemployment and the other variables are shown in table (2), below.

TABLE 2

REGION	CONSTANT	UNEMPLOYMENT	WAGE	WAGE LAG	HOUSE STARTS	INTEREST RATE	R^2
NORTH EAST	-5.17 (-8.13)***	-0.45 (-4.14)***	1.59 (3.52)***	1.37 (2.97)***	0.14 (2.97)***	0.15 (1.90)*	0.92
NORTH WEST	-6.28 (-12.25)***	-0.14 (-1.64)*	1.62 (3.44)***	1.62 (3.41)***	0.11 (2.50)**	0.31 (5.56)***	0.95
YORKSHIRE AND HUMBER	-6.90 (-13.49)***	-0.11 (-1.20)	2.17 (4.41)***	1.29 (2.69)***	0.14 (2.71)***	0.30 (5.25)***	0.95
EAST MIDLANDS	-5.52 (-14.26)***	-0.53 (-5.37)***	1.52 (4.55)***	1.55 (4.68)***	0.12 (2.63)***	0.13 (2.65)***	0.96
WEST MIDLANDS	-4.61 (-10.41)***	-0.30 (-3.40)***	1.08 (2.26)**	1.57 (3.29)***	0.16 (3.12)***	0.04 (0.43)	0.95
EAST ANGLIA	-6.15 (-15.79)***	-0.23 (-3.13)***	1.37 (2.72)***	1.63 (3.29)***	0.23 (4.41)***	0.15 (2.79)***	
GREATER LONDON	-3.21 (-9.79)***	-0.47 (-7.40)***	1.33 (3.89)***	0.85 (2.51)**	0.05 (1.22)	0.06 (1.20)	0.96
SOUTH EAST ENGLAND	-5.12 (-16.10)***	-0.42 (-5.94)**	1.44 (4.45)***	1.21 (3.80)***	0.28 (4.64)***	0.04 (0.78)	0.96
SOUTH WEST ENGLAND	-3.62 (-7.13)***	-0.85 (-5.87)***	1.00 (1.78)*	1.33 (2.36)**	0.26 (3.95)***	-0.07 (-1.07)	0.93
WALES	-5.45 (-8.39)***	-0.26 (-2.77)***	1.74 (4.09)***	1.30 (3.10)***	0.08 (1.20)	0.25 (3.46)***	0.93
SCOTLAND	-5.61 (-7.75)***	0.23 (1.82)*	1.38 (2.86)***	1.56 (3.21)***	0.01 (0.26)	0.46 (6.16)***	0.94
NORTHERN IRELAND	-4.82 (-4.70)***	-0.20 (-1.29)	1.32 (4.30)***	1.53 (5.20)***	0.04 (0.52)	0.43 (4.35)	0.92

In the table the t-statistics are the estimated coefficients in brackets and *, **, *** denote statistical significance at 1%, 5% and 10% respectively.

5.7 Interpretation Of Results

From the results of the regression, no direct comparison can be made between the relativity richer regions and the relatively poorer regions, to confirm or deny the house price and unemployment correlation.

6. CONCLUSIONS

This paper had two aims: firstly, to investigate the theory and use of unemployment as a determinant factor of house prices and secondly, to test the assertion that relatively richer regions have house prices which are more sensitive to unemployment than relatively poorer regions. By researching the use of unemployment in house price models this paper highlighted what will be referred to as 'indirect' effects. Firstly it is used as a measure of labour market risk, a partial proxy for permanent income, because permanent income is unobservable, and because the 'lumpiness' of housing means that households make purchasing decisions based on permanent rather than current income. Unemployment risk reduces the willingness of employed households to get mortgages, thus reducing prices. Secondly, unemployment may reduce interregional labour mobility, with the unemployed less willing or able to migrate to other areas and thus more unemployment occurs in some regions, reducing homeownership, which in turn reduces prices in the region. A final 'indirect' effect is that much of the previous research uses unemployment as a proxy for prevailing economic conditions. More 'direct' effects given are that unemployment dampens real wage growth, lowering wages translating into lower house prices, and similarly, unemployment increases repossessions, which decreases house prices.

When unemployment is included in models it is usually largely due to these 'indirect' effects rather than the 'direct' effect of unemployment. These 'indirect' effects are if the reason that previous research papers never have unemployment as the focus when modelling house prices. Unemployment is usually a proxy, for one of the above mentioned reasons. As house prices and unemployment are only possibly both influenced by other economic factors, there would be correlation but no direct causation between them. The direct causality could also run the other way, with rising house prices reducing unemployment as opposed to falling unemployment raising house prices. These are the reasons why previous research has largely overlooked the relationship.

This paper brought the relationship between unemployment and house prices into focus to investigate the relationship fully. Using UK regional panel data this paper created a supply and demand model as a composite of the variables used in other papers; namely, the nominal house price index against the unemployment rate, nominal average wages, housing starts and the nominal interest rate. This model gave a coefficient for unemployment which was similar to other models which use unemployment as a house price variable. Therefore it can be confirmed that unemployment could be a component of house prices.

The second aim of this paper was to test the anecdotal assertion that relatively richer regions have house prices which are more sensitive to unemployment than relatively poorer regions. The theory explaining this is that more expensive house prices fluctuate more than lower priced houses, and as richer regions have more expensive house prices, these will be more sensitive to unemployment than house prices in relatively poorer

regions which fluctuate relatively less. Research in this area also highlighted that more expensive house prices, such as in the South East, usually means greater debt for households in these regions, thus the greater debt may make those who become unemployed more likely to have a repossession, and thus reduce house prices in the regions.

The anecdotal assertion that relatively richer regions have house prices which are more sensitive to unemployment than relatively poorer regions, is confirmed by the findings of Clapp and Giacotto (1993) studying three US towns. Similarly Meen (2001) also found that the south of the UK was more responsive to unemployment than the relatively poorer north. Finally Giussani and Hadjimatheou (1992b) had similar results, showing that the coefficients for changes in unemployment suggest a greater sensitivity of the housing market in the South East to changes in unemployment. The pieces of research presented here not only indicate an answer to the question of whether relatively richer regions have greater sensitivity in house prices to unemployment but also suggest that it is the actual unemployment in the relatively poorer regions which affects the house price, rather than the prevailing economic conditions.

However, the regional results of this paper by OLS were ultimately inconclusive. This was most likely due to the problems with the empirical method used and the lack of a lagged unemployment variable. Future analysis of house prices and unemployment in different regions could give a more definitive response to the question of whether relatively richer regions have house prices that are more sensitive to unemployment than relatively poorer regions. This is an important question, firstly to confirm the commonly held assertion with economic analysis and secondly because it could have policy implications. Even if there is no significant causal relationship between the two variables, it is still important to understand the interactions between house prices and unemployment across the UK's regions.

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