LUND UNIVERSITY
School of Economics and Management

Labour Mobility, Housing Prices and Unemployment: a Swedish perspective

Forslund, Sandra

Lund University

Master's Programme in Economics

Supervisor: Fredrik N.G Andersson

Abstract

The importance of the housing market and labour market has long been recognized and explored in macroeconomics. In this thesis the linkages between these two markets are highlighted and examined. In this paper the particular relationship that will be explored is that of rising housing costs and unemployment, thereby adding to the small number of papers observing rising costs as opposed to falling prices. The results generally perform as expected with significant results. Most of the variables of interest indicated a positive relationship between rising housing costs and unemployment, however one of the variables produced a surprising result and indicated that there was a negative relationship. Despite this result, there is sufficient evidence through theoretical framework and estimation to infer that rising housing costs act as a deterrent for relocation leading to labour mobility problems which can exacerbate or prolong unemployment.

Keywords*: Housing; Mobility; Unemployment; Panel Data; Random Effects*

Acknowledgement

I would like to thank and acknowledge all those that have been instrumental at making this thesis possible. Their guidance, be it technical, structural or simply advice on how to make improvements, have been very helpful and much appreciated.

Thank you to;

My supervisor Fredrik N.G Andersson

Julienne Stewart- Sandgren

My friends who have heard me complain, stress and generally freak out over this thesis. Your presence have been invaluable.

Those at the National Institute of Economic Research and Statistics Sweden, who have helped guide me on confusing websites in search of data and provided me with the data needed if not publically available.

List of Tables

List of Abbreviations

DIV: Abbreviation for those variables related to distance. These variables are; distgbg, diststhlm and distmalmö.

GRP: Gross Regional Product

KIX: Konjunktursinstitutets effective växelkurs (NIER's effective exchange rate)

NIER: National Institute for Economic Research (Konjunktursverket)

REV: Abbreviation for those variables related to rents. These variables are: rentgbg, rentsthlm and rentmalmö

SCB: Statistiska Centralbyrån (Translated: Statistics Sweden)

Table of Contents

1. Introduction

A majority of the greater cities in Sweden are currently experiencing an imbalance on the housing market, that is, there is a deficit of available accommodation relative to demand. Consequently, the housing situation in Sweden is becoming increasingly difficult with long housing queues, estimated to about 7.7 years in average for a Stockholm rental residence, as well as slow responsiveness to new demand and increasing prices. This has led to increased concerns regarding the potential exclusion of certain groups due to a lack of smaller, more affordable housing. With a current unemployment rate of around 8 %; a sluggish job market combined with difficulties with finding good, affordable homes makes it increasingly harder to relocate within Sweden in order to work and/or study.

The relationship between the housing market and labour mobility has been explored since the late 1960's but following the recession in 2008-2009 it has been reignited. A lot of the research performed into the area have centred on the effect of home-ownership and unemployment and how falling prices lead to labour frictions as owners cannot afford to sell their homes in order to accept offered employment elsewhere. This means that the loss from selling the home or loss in asset may be greater than the cost of unemployment causing the individual to rather remain unemployed. Most of the previous research has found that there is a positive relationship between falling housing prices and unemployment, meaning that changes in the housing market does effect the labour market, causing rigidities. However the strength and explanations as to why this relationship exist differs.

This thesis aims to investigate this relationship and unemployment from the perspective of housing costs and labour mobility using Swedish data. Its purpose is to observe whether there is a positive relationship between the housing market and unemployment and how this may relate to rigidities in the labour market and labour mobility. Though, this thesis aims to leave the strong focus on ownership and falling prices and instead focus on the effects of rising housing costs on regional mobility and unemployment. Contrary to that of the relationship between ownership and falling housing prices, very little research has been found on the specific situation of rising housing costs, and how it may act as a hindrance to labour mobility leading to increased unemployment and/or duration. The thesis attempts to highlight this opposing view and relationship as this will contribute to the research in this field.

The expectation is for the relationship between unemployment and rising housing costs to be the same as that of unemployment and falling housing prices. Both observe a non-stable environment leading to imbalances in the markets and labour immobility. Therefore the expectation is based on the hypothesis that as housing costs increase the more difficult it will become to relocate or remain in a high-cost environment, which will have adverse effects on labour mobility.

The data used in this thesis is collected from reliable government agencies, such as the Statistics Sweden and the Swedish central bank but also from online sources. However, some of the data is not strictly comparable as a consequence of changes in those agencies' data collection methods. As a consequence alternative data was found and used as *proxies* to account for the missing data.

The results found in this thesis mostly corroborates the theory and expectations in that they generally indicate that there is a positive relationship between the housing cost variables and unemployment. There are some unexpected results which this thesis cannot fully explain. Despite the fact that the results generally follows theory and expectation these results are not fully reliable as they may be biased due to flaws in the methodology.

The disposition of this thesis can be divided into sections. The first section is the introduction of the subject, purpose and aim of this thesis. Section two presents the theoretical foundations and previous research. The third section outlines the data and methodology of this thesis. Section four presents the empirical part of this thesis with the results of the estimations. Section five concludes this study by examining the results found in the estimations, analysing their significance and discuss potential linkages, causes and effects.

2. Literature and Theoretical Review

2.1 Overview

Smith, Rosen and Fallis (1988) points out that a large amount of the literature concerning real estate and the housing market at large came to fruition during the mid-1960's and late 70's with the realization that housing is a commodity which not only responds to classical market forces but which also possess a range of characteristics which are needed to be taken into account in order to be sufficiently analysed (Smith et al, 1988). This became especially clear following the housing collapse in the US in 2008-2009, where many countries saw large downward adjustments in their housing prices which caused reductions in the wealth and consumption in many households as well as in the investment of new construction. The OECD (2011) did an analysis into the causes and effects of the housing collapse and found that it was not only due to macroeconomic factors but also because of flawed structural and policy features in the housing market. These in turn could be traced back to flawed financial institutions and markets thereby corroborating the early literature on the subject (OECD, 2011).

Newer research into the field has shown that there is a positive correlation between the mobility rate of labour and unemployment, and that during weaker markets, such as during contractionary periods or recessions, those that become unemployed are more inclined to relocate in search of new job possibilities (Farber, 2012). Their willingness to move however, is not purely dependent on employment status, but also on other factors such as rental prices, market value of the house one currently occupies, as well as the cost of housing and potential offered wage. If one is a homeowner, or looking to become one, the liquidity of housing is therefore of importance as its effects are not restrained to a single market or city, but are widespread and may lead to consequences on the regional and aggregate level (Head & Lloyd-Ellis, 2012). Furthermore, research has found that high homeownership rates, negative equity and regional differences in such areas as rents, appreciation rates and housing prices can be cause for increased rigidity in the labour market, which may in part explain unemployment (Lux & Sunega, 2011). Thus, there is some evidence for imperfect and inefficient mobility due to the relationship that exists between home-ownership and mobility. It has even been speculated that home-ownership rates may be a factor of great significance when observing unemployment differences. Some research into this relationship have estimated that the effect of a 10 % decrease in ownership have a reducing effect on unemployment of between 1.7 and 2 percentage points (Oswald, 1998).

However, one cannot simply look at the results without taking different characteristics into account. If one observes the effects between two groups, homeowners and renters, then the results may be interpreted differently. Homeowners are for example more likely to be highly educated, older and married: characteristics which are less likely to be unemployed independent of ownership status. Furthermore, as they are owners instead of renters they may be willing to make sacrifices in order to obtain a new job locally. This may affect the results and consequently the interpretation of those results (Head & Lloyd- Ellis, 2012). In Farber's (2012) study he compared labour mobility between that of homeowners and renters. His hypothesis stated the expectation of higher mobility amongst renters than home-owners yet the results did not corroborate his expectation. The results indicated that overall mobility had declined but that renters had a lower mobility than that of home-owners. Farber (2012) suggested that an alternative explanation for the decline in the mobility rates could be the broad geographical effect the recession had, as it was spread worldwide (Farber, 2012).

Contrarily, a paper on the topic looking at labour migration in the Czech Republic found that the willingness to relocate for work was decidedly lower amongst homeowners when compared to those that used rental housing. The same paper also attempted to qualitatively uncover potential important variables that may influence labour migration and the decision to relocate. The paper found that the main reasons given for moving to Prague for work were; to obtain specialized work experience and promote their career, pursuing a university degree, fear of being unemployed, and because there were a desire to have an independent life without the restrictions imposed by owning a home. This same strategy uncovered the reasons for not moving in search of employment, which were; risk-aversion stressing the importance of family links and a sense of responsibility toward the broader family. Other reasons were; the importance of living in a family home where the standard of living was relatively high which translated into a view of a lifetime investment with high sunk costs, as well as the adherence of a pessimistic perspective where the blame for high local unemployment and economic downturn was placed on external causes (Lux & Sunega, 2011).

2.2 Housing Market, Labour Market and Mobility

From above it is clear that understanding the concept and mechanism of labour mobility and how it is related to the housing market is an important aspect in understanding structural unemployment. Lux and Sunega (2011) explains that in order to have an effective market there is a need for functioning labour mobility; workers must be able and willing to relocate in order to find employment opportunities across both regions and industries. When individuals become unemployed they usually start considering relocating to areas with lower unemployment rates. This results in theory for the equilibrium between supply and demand to quickly be met. If this is not the case and there is a presence of high unemployment for a longer period of time it may be due to structural unemployment problems such as frictions in labour mobility and labour market inflexibility (Lux & Sunega, 2011).

Statens Bostadskreditnämnd (2008) explains that in order to have growth there is a need for mobility and research shows that most of the economic activity associated with growth is becoming increasingly more concentrated, and that the interaction between the actors more important. Moreover, growth occurs in areas where there are large markets or a concentration of innovation/research environments such as universities, consequently, some research focuses on the effect of economic growth in terms of clusters, where some grow and some shrink or stagnate. As a rule, the greater city areas generate more growth however many rapports notes that many of these areas suffer from housing problems which may act as a hindrance to growth (Statens Bostadskreditnämnd, 2008, translated).

In Dohmen's (2005) study the links between housing, mobility and employment are explained using well known stylized facts. He explains that in order to accept an offer in another region the individual face a fixed costs associated with the move itself, and this cost differ between renters and homeowners. Furthermore, unemployment and the mobility of a worker is dependent upon: the potential wage W the individual is offered, relative to the unemployment benefits B the individual may receive by remaining in the original region, as well as the cost of moving k^m. This condition can be illustrated by:

$$W - B > k^m$$

Dohmen (2005) points out that from the condition above it is clear that a rise in either B or k will result in a worker being less willing to relocate. Moreover, if one then assumes that the fixed costs of homeownership are greater than that of renters, one can infer that renters will have a higher tendency to migrate than owners as their costs are lower, ceteris paribus. This means that an increase in homeownership rates will lead to a decreased job offer acceptance rate causing unemployment rates to increase (Dohmen, 2015).

Using the rationale provided by Dohmen (2005) one can extend and adapt this by including housing costs C^H in the moving costs in order to integrate the concept of labour mobility with housing costs.

$$W - B > k^m + \Delta C^H$$

Above condition shows the extended version and simply explains that if the cost of housing is higher in the new region the change in housing ΔC^H is positive. That means that in addition to a rise in either B or k, a rise in the cost of housing will also result in a worker being less willing to relocate. One may simply use the logic that if housing costs are greater in the region where the employment offer comes from then one can infer, as with moving costs, that the likelihood to relocate will decrease with a rise in housing costs.

Thus, the determinants of mobility are plenty and varied and the failure of supply and demand of labour to match the demands of economic growth can be attributed to a number of structural causes. Workers may become discouraged to search for employment in the face of too generous unemployment benefits or too high moving costs and homeownership and rising housing costs may act as a barrier to mobility. Consequently, the relationship and subsequent effects of the housing and labour markets is often the most clear during crises, such as the housing collapse in the US in 2007 where the adjustment of the labour market have been slow and caused persistent unemployment (Lux & Sunega, 2011: Katz, 2010). There are many different ways to explain the mechanisms behind how labour mobility might be effected by the housing market. One possible explanation is as follows; workers are incapable of efficiently reallocate due to a failing housing market, job offers become less attractive or even impossible to accept due to the difficulty of relocating or because of transaction costs and/or opportunity costs; commuting for example. This causes more job offers to be declined leading to higher unemployment rates as well as longer durations of unemployment. These factors and more are complementary because the effects of one factor can be enhanced if another factor is present or strengthened (Rupert & Wasmer, 2012). This complementary effect would be present in the extended condition illustrated earlier, where k is complemented by the additional factor of ΔC^H. These combined would probably be stronger than when observing them separately; synergy.

A large study performed by the OECD (2011) focusing on housing and the economy in the member states found that the labour markets, job matches and mobility can be facilitated through housing policies. It found that if the Netherlands could increase their supply responsiveness it could increase mobility by as much as 50 % and that Nordic and continental European countries could benefit by increasing the supply of rental housing and be relaxing the strict, relatively speaking, rental regulations that exist. The same study explains that residential and labour mobility is of importance in order to continue the progress after the recent global crisis and that on average 6 % of households move every year in the OECD and that this is almost doubled for Nordic countries and in English-speaking nations. The study further explains that home owners are less mobile than renters, with a distinction being made between those homeowners with a mortgage and those without. The study illustrates that there is a 13 % respective 9% less likelihood of relocation with a mortgage than without a mortgage. Subsequently, taxes and policies that encourage home ownership can reduce mobility as well as crowd out other more productive investments negatively affecting productivity and growth (OECD, 2009). Besides, taxes and policies favouring ownership can induce speculative behaviour in financing home investments which in turn may induce price volatility which can adversely affect macroeconomic stability. This was observed during the recession of 2008-2009 where reductions in the down payments demanded allowed for higher dependency on debt financing, which made it possible for lower income and younger individuals to invest in the housing market. This created an environment which exacerbated the volatility of housing prices and increased volatility decreases the stability of an economy. This in turn enhanced the risk banks and financial institutions faced due to their exposure to overleveraged mortgages (OECD, 2011).

Gustafsson, Stockhammar and Österholm (2015) explains that when viewing the Swedish housing market a significant observation is the historically high real housing prices that exists today. The explanation for this increase can be explained by several different factors, one of which is slow supply growth, i.e. slow responsiveness of supply sector to increased demand. Sorensen & Whitta-Jacobsen (2010) explains that the supply of housing is dependent upon several factors and since housing capital is highly durable new supply is only a fraction of the total housing stock. Therefore, any changes, even highly small ones in housing demand may require the supply sector to make relatively large changes. Housing supply can be derived from the profit maximizing condition, where the construction firm will continue to expand its construction of new housing until its marginal costs are equal to that of the market price of a unit of housing. The demand for housing is dependent upon several factors and can be derived by maximizing a consumer’s utility function, which is assumed to be of Cobb-Douglas form. This in turn is then solved by using the first order condition and simply rearranging the function. This gives the demand curve for housing which in many aspects only lead to increased housing costs in the short run due to the fact that the aggregate housing supply is fixed at the pre-existing housing stock level. This is because the new construction of housing as given by the supply curve above does not add to the current housing stock until the next period. The housing market in the medium to long term can be seen as a little more problematic as it tends to be affected by more factors but in its simplest form it can be explained in the following manner (Sorensen & Whitta-Jacobsen, 2010).

Sorensen and Whitta-Jacobsen (2010) argues that there is a pre-existing housing stock and a demand curve which intersects the supply curve providing the equilibrium which gives the housing prices. Assume demand for housing has increased which causes the demand curve to move right. However as explained above the housing stock is fixed in the short run which means that an increase in demand leads to rising housing prices. Since housing prices have increased as a consequence of increased demand the construction (supply) sector sees the possibility of increased and new profit. Consequently investments into new housing begin. Accordingly, stock increases in response to the increase in demand causing housing prices to fall. A simplified graphical illustration of the short run and the long run can be seen in Appendix 1 (Sorensen & Whitta-Jacobsen, 2010). However, disregarding price increases versus reductions, it is the price responsiveness that determines whether the increase in demand result in increased housing prices as opposed to new housing investment. Therefore in order to have smaller increases in real housing prices, the responsiveness of the supply sector is important, partly because it allows for better matching from the supply sector to changing regional demand patterns. On the other hand, a flexible and fast responsiveness in the supply sector does have the disadvantage of increased cyclical activity (OECD, 2011). Continued, the combination of rising housing prices, slow responsiveness, declining real interest rates, lower home-ownership taxation and an increase in household income as well as household debt due to structural factors have created a discussion regarding the possible macroeconomic impact of potential future falling housing prices and the presence of imbalances in the Swedish economy (Gustafsson et al, 2015).

2.3 The Swedish Situation

According to Boverket (2014) Sweden experiences structural problems as well, as observed by the fact that despite low rents the rental market suffers from long rental queues. These structural problems in conjunction with an unwillingness of individuals to relocate, forces those new to the housing market to compete, whether they want to or not, for those residences that are for sale, thereby becoming homeowners. This occurs as a consequence of the long housing queues on the rental market. As a result, there may be some groups that are excluded from the market completely because they do not have the credit worthiness needed in order to purchase a residence or because they are forced to queue for years (Boverket, 2014, translated). However, the long queues are themselves not a sign that there is a lack of supply of rental residences but rather that the rental market itself is inefficient due to, amongst others, rental regulations and unavailability of information causing mismatching. As a result, the inability to relocate combined with long queues and miscommunication has translated into a feeling and view amongst individuals of *there is nowhere else to live.* For that reason, many individuals, families with children as well as single parent households are forced to remain in cramped accommodation as potential housing better suited to their needs are either too expensive or unavailable. Moreover, Boverket (2014) also stress that there are also those that are forced to travel far distances for work rather than relocate closer (Boverket, 2014, translated).

All of the above seems to be a sign that the market is not functioning as it should, which has led to those wishing to accept employment in, for example, Stockholm cannot and those wishing to move closer to their work cannot. Consequently, the rental market's inability or non-allowance to adjust to the preferences of the households causes an in reality deficit in rental housing (Boverket, 2014, translated). To clarify, there is demand and there is supply but one does not satisfy the other as a consequence of regulation, market rigidities and consumer preferences. Therefore, there is a deficit in the rental market since the housing demanded is not met by the available supply. Moreover, in the greater areas such as Stockholm, there is a decrease in the new supply of rentals despite high demand. Low rents makes it less profitable to build new rental supply and current rental stock is being converted to purchase-residences. In light of this, the fact that greater Stockholm and Göteborg have one fifth of its residents waiting for a rental residence, and greater Malmö has every twentieth waiting, this conversion in conjunction with a decrease in new rental supply is a further sign that there is an imbalance in the housing market which might have an effect on unemployment. (Boverket, 2014, translated). Regional, and therefore national, growth is dependent upon labour mobility, as it allows for more productive workers to relocate which may increase growth.

If one were to attempt to build away the demand captured in the queues there is an approximate need for 350 000 new rental apartments in these greater city areas. Yet with only about 10 000 new rentals being built a year it would take many more years until the demand in the queues where met. This is assuming a non-realistic static environment where there is no increase in the queues, population, costs nor are there any decreases in current supply.

Studies have shown that so much as 30 % of Swedish businesses may have difficulties in finding employees with the right skills and competencies (Statens Bostadskreditnämnd, 2008, translated). This problem can be both exacerbated and explained by poor geographical/labour mobility. If the workers needed cannot be accessed as a consequence of relocation issues such as high housing costs for example the economy cannot function optimally. Statens Bostadskreditnämnd, (2008) point out that those unemployed in Sweden, may in fact loose by relocating for work due to the high living costs in the greater cities. Thus it is important to improve the housing markets, especially in those regions with a higher growth rate, so that households will be willing to relocate or remain in these regions, without feeling like they cannot, are forced to or that the costs associated are too high (Statens Bostadskreditnämnd, 2008, translated).

3. Data and Methodology

3.1 Methodology

This section will be explaining the econometric theories and principles used in this thesis. It will provide a description of longitudinal and panel data and potential appropriate models. Longitudinal analysis is an analysis of several cross sections of subjects over time which allows for observations of a dynamic and cross-sectional aspect, allowing for more realistic and complicated models than those available from single cross-section or time series. A panel data set is collected from observations on the same units repeated over time and the terminology of longitudinal and panel data is often used interchangeably (Verbeek, 2012).

There are plenty of advantages to using panel data analysis; it allows for more complex models, which are able to control for example individual behaviours and omitted variables. It is able to do this as panel data usually have more sample variability leading to increased efficiency and inference of estimates and parameters. Moreover, as panel data has at least two dimensions: cross sectional and time series there is more room to transform, convert and adjust the data to observe different aspects of the model (Hsiao, 2007). However it does have the disadvantage of no longer allowing for the assumption of independence between observations, creating complications of correlation when using certain models. Subsequently, OLS is an inefficient method to use since it is often misleading in standard error computation (Verbeek, 2012). Not only does the problem with standard error computation occur but there is also the problem of spurious regression, where OLS may show a strong relationship between variables despite the fact that there is no relationship. The problem of spurious regression and non-stationarity was originally introduced for time-series models however it can be applied to panel data models as well, yet is less of a problem in a panel setting than in a time series (Hsiao, 2003: Granger & Newbold, 1974).

There are several different models one can apply in a panel model setting, however some of the most used are the fixed- and random-effects models, as well as the first difference model. The fixed effects model includes an individual specific intercept term α_i, which takes the place of the general intercept term β_0 since it is incorporated into the individual specific intercept (Verbeek, 2012). By including an individual specific intercept which captures all observed but unaccounted for time-invariant differences between individuals one allows for consistent estimations since there is no restriction that the intercept α_i and X_{it} are uncorrelated (ibid.). Fixed effects allows for an analysis of the independent variables on the dependent variable by removing the time-invariant "individual-specific" characteristics. These time-invariant characteristics are assumed to be distinct to the individual and therefore the individual error terms and intercepts should not be correlated. The random effects model is in many ways similar to the fixed effects except it is possible to use this model when a variable of interest is constant across the subject, e.g. the model allows for the inclusion of time-invariant variables. This is possible because random effects works under the assumption that the error term is not correlated with the variables, conversely this is a rather strong assumption and can act as a disadvantage (Torres-Reyna, 2007). The first difference model is in many ways a "sub-model" of a fixed effects model and is sometimes called first difference fixed effects model. The model is used when one wishes to remove some unobserved effect (McManus, 2011). The model is at its strongest when there are unmeasured variable bias in the estimates, errors which are auto correlated over time in the variables and/ or when the measurements of the change in the variables are more reliable than the actual value. However this is not the case if above does not occur or if the explanatory variables are highly correlated over time (Liker, Augustyniak & Duncan, 1985). The choice of which model to be used in this thesis will be explained and motivated in Section 3.5.

3.2 Data and Variables

The model specification that is to be tested in this thesis is;

$$
\begin{aligned}
Unemployment_{it} &= \alpha_i + \beta_1 GRP + \beta_2 Interest\ rate + \beta_3 Exchange\ rate \\
&+ \beta_4 Annual\ \ rent_{stockholm_{t-1}} + \beta_5 Annual\ rent_{malm\ddot{o}_{t-1}} \\
&+ \beta_6 Annual\ rent_{g\ddot{o}teborg_{t-1}} + \beta_7 Unemployment_{t-1} + u_{it}
\end{aligned}
$$

The justification and motivation for this model is simple. The aim of this thesis is to investigate the relationship between unemployment and rising housing costs, therefore the model includes REV, which are those variables related to rents. These are the variables of interest and represents the housing costs and the three cities were chosen as they are the largest in Sweden and most sought after in terms of employment and housing. The variable for grp was included as unemployment is heavily influenced by the growth and economic wellbeing in a region. To not include this would definitely cause omitted variable bias. This same logic was applied to the justification of including the dependent variable as an explanatory variable. The dependent variable was added into the specification as a lag of itself as it is reasonable to assume that the unemployment at a prior time would have an impact on the model and because it would illustrate duration of unemployment. Moreover, the inclusion of a lagged dependent variable may have the effect of reducing autocorrelation.

Note though, that the inclusion of a lagged dependent variable changes the model to a dynamic panel model. The variables concerning the interest and exchange rates were included as controls. The variables of interest as well as the unemployment variable are lagged as there is most likely lag time between the housing prices, in this model the REV, and its potential effect on unemployment.

However, as in most projects this specification was adjusted and changed throughout this process as the model and data was tested and explored further. Due to high collinearity in the data many of the variables were omitted in the original specification which required further examination of the data to determine why this may be the case. This examination revealed that one cause for this collinearity may lie in that most variables only moved along the time and not across regions. In fact, upon further observation of the variables it was clear that the only variables that moved across both time and region were the grp variable and the unemployment variable, the remaining variables did not vary across regions, only across time.

The data used for these variables are collected from Statistics Sweden, National Institute of Economic Research, the Swedish central bank or regionfakta.se. Much of the data used is found online, on each source's website in digital format, or provided directly through personal communication. A more in-depth description of each data source will be given below.

Unemployment is measured as the percentage rate of individuals currently unemployed but actively searching for employment. This data was provided by Statistics Sweden (SCB, 2015a) on their website and converted from monthly rates to annual by finding the average of each year.

The data on gross regional product was also provided by Statistics Sweden (SCB, 2015b) except for greater Malmö and Greater Göteborg which were compiled based upon municipal numbers given by regionfakta.se (2015). Not all municipals were used, only those which corresponded to what Statistics Sweden has divided into belonging to greater city-areas (SCB, 2015c). This was done in order to estimate, as accurately as possible, the effects rents in the three greater city areas of Sweden may have on unemployment; as well as to make the data more comparable. These corresponding municipals' numbers were summed and converted to percentages. These will be used as *proxies* in the analysis.

The data for the real interest (Sveriges Riksbank, 2015a) rate was found on the Swedish Central Banks website, in one of their digital rapports and corresponding data file (Sveriges Riksbank, 2015b).

The data on the real exchange rate, the KIX index, was not published in real terms to the public. The only publically available digital data were in nominal terms which presented a problem since it is quite challenging and complex to convert an exchange rate index corresponding to 32 countries into real terms. However, after contacting the National Institute of Economic Research (personal communication, 8 May 2015) the data was provided as this thesis is limited to the years 2005-2012 and did not intend to forecast or make predictions.

The data on rent per square meter were the most difficult to obtain since the SCB did not survey the years 2010 and 2012. Attempts were made to find alternative sources for the data but with little luck, so the decision to use the data provided by the SCB were made. However as there were no data for the missing years, alternative data was found and used as *proxies*. Consequently, the data for 2010 (SCB, 2012a) is the average rent per square meter for rental housing for greater Stockholm and greater Göteborg however the rapport did not have any data on greater Malmö which meant that the data on municipals with more than 75

000 inhabitants were used to represent Malmö in this case (SCB, 2012a). The data for 2012 (SCB, 2012b) is represented by the average rent per square meter for a new rental in greater Stockholm and greater Göteborg however as with the data for 2010 there was no data for greater Malmö. Therefore the average new rent per square meter for Malmö municipal was used to represent greater Malmö (SCB, 2012b). As a consequence of the alternative data sources the data may not be strictly comparable.

Finally, the data for the distance variables, which will be explained further down, were created by dividing each of the rent-variables with the distance between each regions' capital and the greater city-area. For example, the distance variable for Stockholm was created by taking the REV of Stockholm divided by the distance between Stockholm and for example Kalmar. The distances themselves were given by the website se.avstand.org.

3.3 Stationarity

Despite the fact that this thesis does neither have a large cross-section nor a large time dimension and that it is not necessary to check for non-stationarity, a unit root test is performed as a precaution on the variables that will be used in the regressions. The approach used is that of a Fisher-type test, which combines the p-values from an ADF test on each cross section. The test works in such a way that its null hypothesis states that all panels include unit root, i.e. non-stationarity whereas the alternative simply states that at least one panel is stationary (Stata, 2015b).

The results from the unit root tests can be seen below in Table 1. The first test on the original variables clearly proved that there was non-stationarity in the data, illustrating a need to adjust the data or the test. There is a simple way to transform the non-stationary variables to stationary. This approach works in most cases, and that is to simply take the first difference in the non-stationary variables. The second unit root test was performed on the changed variables and as can be seen in the table, by taking the first difference in the non-stationary variables, they were all transformed and were now stationary.

Table 1: Unit Root Tests

Unit Root Test Variable	Fisher- ADF Chi Squared (*original variables)*	Fisher- ADF Chi Squared (*differenced variables)*
Unemployment	0.7297	0.0039***
Gross Regional Product	0.0000***	n/a
Interest Rate	0.9756	0.0102**
KIX	0.8203	0.0210**
Rents in Göteborg	0.9998	0.0000***
Rents in Stockholm	0.8078	0.0000***
Rents in Malmö	0.1334	0.0000***

Source: STATA 13 regression. See full output in Appendix 1

Note: * = 10 % confidence level; ** = 5 % confidence level; *** = 1 % confidence level

A surprising result is that of gross regional product which according to the test is stationary, however the expectation was that it would be non-stationary as it works the same as GDP but on a regional level (Aslandis & Fountas, 2013). The explanation as to why this result occurred is unclear.

3.4 Model Specification and Expectation.

As in most projects the original specification illustrated in Section 3.2 above was adjusted and changed throughout this process as the model and data was tested and explored further. The idea that accounting for a spatial dimension and its potential effect on unemployment lead to the creation of three new distance variables (DIV). These comprise of the REV divided by the distance between each region's capital city and the rent-city in question, for example (rent in Stockholm)/ (distance between Kalmar and Stockholm). These three new variables are then going to be tested against the REV by replacing them in the model specification.

In the end, following testing and adjustments to the data, the variables and the original specification, there were four individual yet highly similar model specifications. The specifications mainly differs in two ways; the specific variable of interest included and whether the variables were simply lagged or differentiated.

Model 1:

$$\begin{aligned} &Unemployment_{it} \\ &\quad = \alpha_i + \beta_1 GRP + \beta_2 Interest\ rate + \beta_3 Exchange\ rate \\ &\quad + \beta_4 Annual\ rent_{stockholm_{t-2}} + \beta_5 Annual\ rent_{malmö_{t-1}} \\ &\quad + \beta_6 Annual\ rent_{göteborg_{t-1}} + \beta_7 Unemployment_{\,t-2} + u_{it} \end{aligned}$$

Model 2:

$$\begin{aligned} &Unemployment_{it} \\ &\quad = \alpha_i + \beta_1 GRP_{it} + \beta_2 Interest\ rate_{it} + \beta_3 Exchange\ rate_{it} \\ &\quad + \beta_4 Dist_{stockholm_{t-2}} + \beta_5 Dist_{malmö_{t-1}} + \beta_6 Dist_{göteborg_{t-1}} \\ &\quad + \beta_7 Unemployment_{\mathrm{i}\,t-2} + u_{it} \end{aligned}$$

Models 1 and 2 can be observed above and they represent the model specifications where no changes or adaptions are made to the variables as they are. The only difference between the two models is that in Model 1 the REV's are used whereas in Model 2 the DIV's are used. The only difference between Models 1 and 2 and that of Models 3 and 4 below is that in the latter each variable has been differentiated and do not have any lags. These latter models were included in order to observe the relationship when accounting for non-stationarity. These changes should potentially improve the model specification and its goodness of fit.

Model 3:

$$
\begin{aligned}
&Unemployment_{it} \\
&\quad = \alpha_i + \Delta\beta_1 GRP_{it} + \Delta\beta_2 Interest\ rate_{it} + \Delta\beta_3 Exchange\ rate_{it} \\
&\quad + \Delta\beta_4 Annual\ rent_{stockholm_t} + \Delta\beta_5 Annual\ rent_{malmö_t} \\
&\quad + \Delta\beta_6 Annual\ rent_{göteborg_t} + \Delta_2\beta_7 Unemployment_{\mathrm{i}\,t} + u_{it}
\end{aligned}
$$

Model 4:

$$
\begin{aligned}
&Unemployment_{it} \\
&\quad = \alpha_i + \Delta\beta_1 GRP_{it} + \Delta\beta_2 Interest\ rate_{it} + \Delta\beta_3 Exchange\ rate_{it} \\
&\quad + \Delta\beta_4 Dist_{stockholm_t} + \Delta\beta_5 Dist_{malmö_t} + \Delta\beta_6 Dist_{it} \\
&\quad + \Delta_2\beta_7 Unemployment_{it} + u_{it}
\end{aligned}
$$

The working hypothesis of this thesis is that there will be a positive relationship between unemployment and the REV and DIV as explained by this thesis. The expectation for each variable and model is the same. A summary and motivation for each variable expectation can be seen below.

Gross regional product is expected to have a negative coefficient illustrating the negative relationship that is expected to exist between unemployment and grp. This expectation is motivated by the fact that grp is a measure of economic growth and economic theory says that as growth increases unemployment decreases.

The expectation for the interest rate is uncertain, it can either be positive or negative. If the interest rate increases it may cause individuals to save more, investments to be put on hold and to less consumption. All of which effect unemployment negatively leading to a positive coefficient. However, it may also lead to increased inflows from abroad causing unemployment to decrease, which would lead to a negative coefficient.

The exchange rate variable, KIX, is expected to have a positive coefficient as an appreciation of the SEK may be damaging to the exporting sector as Swedish exports may become less competitive, whilst imports may increase as they are now cheaper. This may lead to a fall in exports and a rise in imports, which in the longer run will have a dampening effect on growth, which subsequently affects unemployment negatively.

3.5 Hausman Specification Test

The Hausman test is used to determine which model is the most appropriate to use for the data, a fixed effects model or a random effects model. The rejection of the null hypothesis states that the random effects model does not capture the individual effects effectively and one should therefore use the fixed effects model and vice versa (Stata, 2015a).

Table 2: Hausman Tests

Model Specification	probability>chi^2	Conclusion
Lag + REV	0.0000	Reject null => FE
Lag + DIV	0.0000	Reject null => FE
Diff + REV	0.6289	Do not reject null => RE
Diff + DIV	0.7048	Do not reject null => RE

Source: STATA 13 regression. See full output in Appendix 3

As can be observed in Table 2, the Hausman specification test shows that any model specification using lags should use a fixed effects model, whereas if one uses a model specification which takes differences one should use a random effects model.

However, despite that the Hausman test performed above indicates that those models using lagged variables passed all the assumptions for a fixed effects model when running a fixed effects regression all but two variables are omitted from the regression result. The variables that remain are the grp and the lagged dependent variable, the rest are omitted due to multicollinearity, which occurs when there are two or more variables that are highly correlated with one another.

The explanation for this may lie in that if there are little to no variation within the variables, time- or region-wise, the fixed effects model may not adequately function. This is because the within variability will be too small and consequently there will not be anything left to examine. The same problem occurs if either the time period or the subjects are too small and few. These problems do occur in this thesis as the time period is limited to only a short period of time and because most of the variables do not vary across regions. In fact only unemployment, grp and the DIV vary with the regions, which unfortunately is not enough for a successful fixed effects approach. Consequently, contrary to the Hausman test the models will not use a fixed effects approach, but will only use random effects which allows for time-invariant variables.

4. Empirical Results

4.1 Random Effects Approach

In the regressions below it is important to note that results are most likely biased and inconsistent. This is due to the fact that by using the random effects model the dependent variable is included as an explanatory variable and the assumption of exogeneity no longer holds. To clarify, when using the random effects model on a dynamic data panel the results most likely suffer from Nickell's bias. This can take the form of over- and underestimated coefficients and errors, and may in some cases show the opposite relationship between two variables than in actuality exist.

Table 3: 1st model specification using lagged REV and random effects

Unemployment	Coefficient	Robust Std. Errors
Gross Regional Product	.0150303	.0230525
Interest Rate	4.586388***	1.527756
Exchange Rate Index	.6784984***	.1583669
$\text{Ave.Rent}_{\text{Göteborg},t-1}$	.196215***	.0710639
$\text{Ave.Rent}_{\text{Stockholm},t-2}$	.154167***	.0400169
$\text{Ave.Rent}_{\text{Malmö},t-1}$	.2926785***	.0731596
$\text{Unemployment}_{t-2}$	.6015611***	.081105
R^2	0.7464	

Source: STATA 13 regression. See full output in Appendix 4

Note: * = 10 % confidence level; ** = 5 % confidence level; *** = 1 % confidence level

The results from using the first model specification illustrated earlier in Section 3.4 and a random effects approach, as the fixed effects approach would not be viable as explained in Section 3, are demonstrated in Table 3 above. The first observation when using random effects as opposed to fixed effects is that the regression results are significant with no omitted variables. Secondly, all the coefficients illustrate a positive relationship with unemployment that is, an increase in any of the variables would have an increasing effect on unemployment. Another observation is that almost all variables are significant at a 1 % level except for grp which is insignificant. The relationship between GDP and unemployment is well-known and explored and the idea that grp would not have an effect on unemployment is illogical. Therefore, the reason as to why grp is insignificant most likely does not lie in it not having an effect. One reason as to why it is insignificant could be that the model does not accurately capture the potential time from cause to effect. That is the effect is not observed at this level but may in fact be observed when there is a longer scope in terms of time and information. The last observation of note is the R^2 which has an acceptable value of 0.7464, which means that circa 75 % of the variance in the data is explained by the model.

Below, one can observe the results from the second model specification in Table 4. In this regression the REV has been replaced by the DIV and the first thing of note is how all variables except for the lagged dependent variable have become insignificant. This is rather drastic change from the results demonstrated in Table 3, in which the opposite was true. Not only has the significance of the variables changed but so has the coefficients, they have all decreased and three variables have changed signs. The interest rate, KIX and DIV of Göteborg now have negative coefficients as compared to the results in Table 3.

Table 4: 2^{nd} model specification using lagged DIV and random effects

Unemployment	Coefficient	Robust Std. Errors
Gross Regional Product	.0129948	.0236738
Interest Rate	-.0831033	.3548713
Exchange Rate Index	-.8202334	.4358095
$Dist_{Göteborg,t-1}$	-.0008507	.0036671
$Dist_{Stockholm,t-2}$	.0017618	.0015098
$Dist_{Malmö,t-1}$	.0001539	.0032725
$Unemployment_{t-2}$	.6094595***	.091222
R^2	0.7451	

Source: STATA 13 regression. See full output in Appendix 4

Note: * = 10 % confidence level; ** = 5 % confidence level; *** = 1 % confidence level

Table 5 below illustrates the results from estimating the third model specification and a first observation is that the fit of the model, represented by R^2, is high. This model, using differences and REV, almost explains 93 % of the variance. Furthermore, no variables have been omitted and all variables of interest are significant except for grp and KIX which are insignificant. The exact reason for their insignificance is unclear, but there are plenty of potential reasons such as them not having any effect, yet that seems highly unreasonable from a theoretical standpoint as explained earlier in regards to Table 3. However, the relationship between the KIX variable and unemployment may not be as immediately apparent. Yet exchange rates and their movements have an indirect impact on unemployment through its impact into other areas of the economy. Exchange rates are affected by interest rates and effect growth sectors such as exports which will have an impact on economic wellbeing. If a sector contracts due to negative movements in the exchange rate this may affect expansion and investment plans leading to potential halting a new recruitment and even layoffs. Consequently, the insignificance of these variables in terms of them not having an impact on unemployment is unreasonable. The reason for their insignificance may be that there is not enough data and scope in this thesis to accurately estimate their significance but may in be observed in a more extensive study.

Table 5: 3rd model specification using differenced REV and random effects

Unemployment	Coefficient	Robust Std. Errors
ΔGross Regional Product	-.0056495	.0084725
ΔInterest Rate	-.4262625***	.1377568
ΔExchange Rate Index	.0391211	.0451247
ΔAve.Rent$_{Göteborg}$	.0870293***	.0123663
ΔAve.Rent$_{Stockholm}$	.0782934***	.0083558
ΔAve.Rent$_{Malmö}$	-.0780631***	.010467
ΔUnemployment	.4921315***	.0316354
R^2	0.9259	

Source: STATA 13 regression. See full output in Appendix 4

Note: * = 10 % confidence level; ** = 5 % confidence level; *** = 1 % confidence level

A continued observation of the results illustrated in Table 5 shows that most variables exhibit the positive respective negative relationships that were expected from a theoretical standpoint. Those variables that performed as expected were: grp, KIX, the REV for Göteborg and Stockholm as well as unemployment. The grp variable has a negative coefficient, showing that an increase in regional growth would have decreasing effect on unemployment. The rest of the variables which performed as expected has a positive coefficient showing that an increase in either of these variables will have an increasing effect on unemployment.

The surprising results found in this table is that of the interest rate variable and the REV for Malmö. Both of which do not perform as expected. The interest rate variable is showing a negative coefficient and a quite high one as well, stating that an increase in the interest rate would have a decreasing effect on unemployment. This negative relationship could potentially be explained by inflows from abroad. As the interest rate increases the incentives for foreign investment increases, this may have a reducing effect on unemployment. However, the coefficient seems unreasonably high and may be overestimated. Another surprising result was that the REV for Malmö had a negative coefficient, as opposed to the other REV. The reason for why increased rents in Malmö would have a decreasing effect on unemployment is uncertain. If discussing the phenomenon in general, an explanation could be that an increase in rents in Malmö leads to increased investments in the construction sector which may mean expansions which require additional workers. This would mean that an increase in rents would ultimately lead to a reduction in unemployment.

Table 6: 4th model specification using differenced DIV and random effects

Unemployment	Coefficient	Robust Std. Errors
ΔGross Regional Product	-.0056011	.0084486
ΔInterest Rate	-.4264001***	.1373428
ΔExchange Rate Index	.0390773	.0449888
$\Delta Dist_{Göteborg}$	.0869868***	.01233
$\Delta Dist_{Stockholm}$	.0782805***	.0083308
$\Delta Dist_{Malmö}$	-.0780284***	.0104362
ΔUnemployment	.4920756***	.0315484
R^2	0.9260	

Source: STATA 13 regression. See full output in Appendix 4

Note: * = 10 % confidence level; ** = 5 % confidence level; *** = 1 % confidence level

Table 6 above is the last table and represents first differences in a random effects model but instead of having REV in the model they have been traded with the DIV. The results does not differ much in comparison to those illustrated in Table 5. The R^2 value has slightly increased, yet this change is so small that it is essentially negligible. The coefficients and standard errors have also changes slightly, mostly they have gone down, with the exception of the coefficient for interest rate which have gone up slightly. But as with the R^2 these changes are so small, at the 4th -, 5th -, and 6th – decimal place, that they are negligible.

5. Conclusion

The aim of this thesis was to observe the relationship between rising housing prices and unemployment from the perspective of Sweden. It would attempt to add to the current research by observing rising housing costs as opposed to falling prices, an approach not widely observed or examined. In terms of observing the Swedish market, the approach of this thesis is better suited to this environment as the fastest growing areas of the country are experiencing rising housing costs as opposed to falling in value. The expectation was that there would be a positive relationship indicated by the variables of interest: the housing prices in three greater city areas and unemployment.

Throughout this thesis, the studies and previous research found has explained and built a framework from which it is easy to conclude that there is a relationship between unemployment and housing prices and that this relationship exist through the linkages of labour mobility. When observing the theory and results rationally, it is clear that the effect of rising housing prices operate in the same manner as falling prices, in that both act as a hindrance to labour mobility. Most of the previous research mainly focused on falling housing prices and their effect on unemployment through the decrease in asset value. This would become a hindrance to labour mobility problems as workers no longer could afford to move without making major losses. In terms of rising housing prices, obstacles to labour mobility is a problem of accessibility, in terms of availability and possibility to relocate.

The results of this thesis are difficult to assess, the results generally indicate a positive relationship and that a one percent increase in housing costs in Göteborg or Stockholm would cause unemployment to rise by 7.5 % to 8.9 %. However one result does indicate that this number may increase if lags are introduced to the model, which may indicate that the true effects of increased housing costs may not be immediately observed, and may require a longer time scope than what this thesis offers. This explanation may also explain why variables which should be significant in an estimation of this kind are in fact insignificant in this thesis. Unexpectedly, there was a recurring result between housing prices in Malmö and unemployment in which several estimations found the relationship to be negative. This finding was unexpected and an explanation could be that an increase in the prices in Malmö would have a stimulating effect in the supply sector leading to a reduction in unemployment. Yet this explanation cannot be proven and is merely speculation. Another explanation for this result may perhaps lie in the fact that the REV/DIV for the greater city area of Malmö uses alternative data sources and proxies due to missing data points for two of the years. A clear explanation for this result is not obvious.

It is important to note that whilst the estimations and results in the thesis have generally performed as expected they are likely biased and inconsistent due to flaws in the methodology. There were problems with the data, the approach and correlation amongst others and consequently the analysis above does not enable us to make reliable conclusions to as the, in reality, relationship between rising housing prices and unemployment in Sweden. Subsequently, further studies, preferably larger in scope and with stronger methodological and econometric foundations, would be of interest. This is necessary to establish a solid framework from which one can discuss the potential harmful consequences of rising costs in terms of labour mobility and unemployment. There is a need for a framework, especially when considering the potential exclusion of certain groups from what are some of the most important things in life; a job and a purpose, and a home.

In conclusion, this thesis indicates the existence of a positive relationship between rising housing prices and unemployment. However the thesis is flawed and the results are likely biased and inconsistent, yet there is justification for further studies into the potential effects increasing housing prices to the detriment of labour mobility in terms of accessibility and consequently its effect on unemployment. It is an important approach to consider, not only from an economic perspective but also from a societal welfare one.

References

Aslanidis, N. & Fountas, S. (2013). Is real GDP stationary? Evidence from a panel unit root test with cross-sectional dependence and historical data. *Empirical Economics*, 46(1), pp.101-108.

Boverket, (2014). Låst läge på bostadsmarknaden. Available online at: http://www.boverket.se/globalassets/publikationer/dokument/2014/marknadsrapport-maj-2014.pdf [Accessed 10 August 2015].

Dohmen, T. (2005). Housing, Mobility and Unemployment. *Regional Science and Urban Economics*, 35(3), pp.305-325.

Farber, H. (2012). Unemployment in the Great Recession: Did the housing market crisis prevent the unemployed from moving to take Jobs? *American Economic Review*, 102(3), pp.520-525.

Granger, C. & Newbold, P. (1974). Spurious regression in econometrics. *Journal of Econometrics,* 2(2), pp. 111-120.

Gustafsson, P., Stockhammar, P., & Österholm, P. (2015). Macroeconomic Effects of a Decline in Housing Prices in Sweden, Working Paper, National Institute of Economic Research, no. 138, March 2015.

Head, A. & Lloyd-Ellis, H. (2012). Housing Liquidity, Mobility, and the Labour Market. *The Review of Economic Studies*, 79(4), pp.1559-1589.

Hsiao, C. (2003). Analysis of panel data. Cambridge: Cambridge University Press.

Hsiao, C. (2007). Panel data analysis—advantages and challenges. *TEST*, 16(1), pp.1-22.

Liker, J., Augustyniak, S. & Duncan, G. (1985). Panel data and models of change: A comparison of first difference and conventional two-wave models. *Social Science Research*, 14(1), pp.80-101.

Lux, M. & Sunega, P. (2011). Labour Mobility and Housing: The Impact of Housing Tenure and Housing Affordability on Labour Migration in the Czech Republic. *Urban Studies*, 49(3), pp.489-504.

McManus, P. (2011). Introduction to regression models for panel model analysis. Available online at: http://ssrc.indiana.edu/seminars/wimdocs/2011-10-07_mcmanus_panel_slides.pdf [Accessed 19 July 2015].

OECD, (2009). Economic Policy Reforms 2009: Going for Growth, OECD Publishing, Paris. Available online at: http://www.keepeek.com/Digital-Asset-Management/oecd/economics/economic-policy-reforms-2009_growth-2009-en#page1

OECD, (2011). Economic Policy Reforms 2011: Going for Growth, OECD Publishing, Paris. Available online at: http://www.keepeek.com/Digital-Asset-Management/oecd/economics/economic-policy-reforms-2011_growth-2011-en#page1

Oswald, A.J. (1998). A Conjecture on the Explanation for High Unemployment in the Industrialized Nations. Economic Research Papers No. 475. University of Warwick.

Regionfakta, (2015). Bruttoregionprodukt per invånare 2012. Tusental kronor. Available online at: http://www.regionfakta.com/Skane-lan/Regional-ekonomi/BRP-per-invanare-lan/

Rupert, P. & Wasmer, E. (2012). Housing and the labour market: Time to move and aggregate unemployment. *Journal of Monetary Economics*, 59(1), pp.24-36.

SCB, (2012a). Bostad- och byggnadsstatistisk årsbok 2012. Boende, byggande och bebyggelse. Statistiska Centralbyrån, p.173. Available online at: http://www.scb.se/statistik/_publikationer/BO0801_2012A01_BR_BO01BR1201.pdf [Accessed 15 May 2015].

SCB, (2012b). Hyror i bostadslägenheter 2011. Bostads- och hyresundersökningen. [Statistiska Centralbyrån, pp.24, 30. Available online at: http://www.scb.se/Statistik/BO/BO0406/2011A01/BO0406_2011A01_SM_BO39SM1201.pdf [Accessed 15 May 2015].

SCB, (2015a). Befolkningen 15-17 år (AKU) efter region, arbetskraftstillhörighet och kön, kvartal 2005K2-2015K2. Available online at: http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__AM__AM0401__AM0401N/NAKUBefolkningLK/?rxid=e428eef4-db55-4daf-b277-309750ac3ecf [Accessed 8 May 2015].

SCB, (2015b). Bruttoregionprodukt (BRP), sysselsatta och löner (ENS2010) efter region (län, riksområde), År 2000 – 2013. Available online at: http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__NR__NR0105__NR0105A/NR0105ENS2010T01A/?rxid=e428eef4-db55-4daf-b277-309750ac3ecf [Accessed 8 May 2015].

SCB, (2015c). Funktionella regioner, kommungrupper - Statistiska centralbyrån. Available online at: http://www.scb.se/sv_/Hitta-statistik/Regional-statistik-och-kartor/Regionala-indelningar/Funktionella-regioner-kommungrupper/ [Accessed 10 May 2015].

Smith, L.B., Rosen, K.T., & Fallis, G. (1988). Recent Developments in Economic Models of Housing Markets. *Journal of Economic Literature,* 26(1), pp.29-64.

Stata, (2015a). Hausman specification test. Available online at: http://www.stata.com/manuals13/rhausman.pdf [Accessed 27 June 2015].

Stata, (2015b). Panel-data Unit-root test. Available online at: http://www.stata.com/manuals13/xtxtunitroot.pdf [Accessed 1 Aug. 2015].

Statens Bostadskreditnämnd, (2008). Samband mellan bostadsmarknad, arbetskraftens rörlighet och tillväxt. Available online at: http://www.boverket.se/globalassets/publikationer/dokument/2008/samband-mellan-bostadsmarknad-arbetskraftens.pdf [Accessed 10 August 2015].

Sveriges Riksbank, (2015). Penningpolitisk rapport. April 2015 - Sifferunderlag. Available online at: http://www.riksbank.se/Documents/Rapporter/PPR/2015/150429/rap_ppr_sifferunderlag_150429_sve.xlsx [Accessed 15 May 2015].

Sveriges Riksbank, (2015). Penningpolitisk rapport. April 2015. Available online at: http://www.riksbank.se/Documents/Rapporter/PPR/2015/150429/rap_ppr_150429_sve_reviderad.pdf [Accessed 15 May 2015].

Sørensen, P. & Whitta-Jacobsen, H. (2010). Introducing advanced macroeconomics. New York: McGraw-Hill Higher Education.

Torres-Reyna, O. (2007). Panel Data Analysis Fixed and Random Effects using Stata. Available online at: http://www.princeton.edu/~otorres/Panel101.pdf [Accessed 6 July 2015].

Verbeek, M. (2012). A guide to modern econometrics. Hoboken, NJ: Wiley.

Appendices

Appendix 1

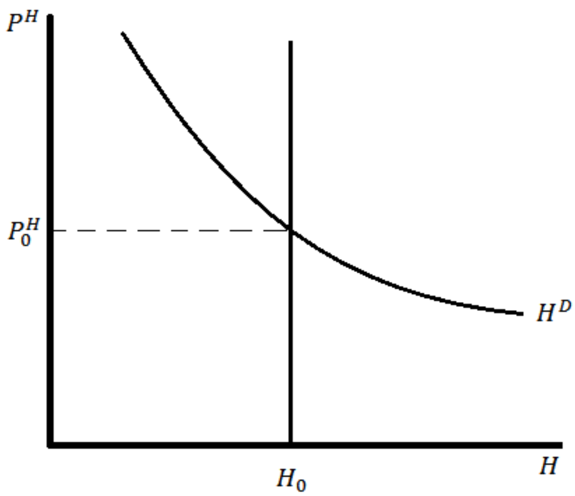

Figure 1- Short Run Equilibrium in the Housing Market

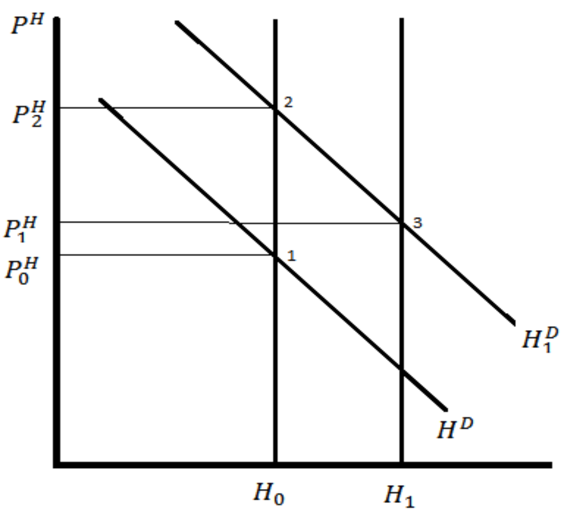

Figure 2- Long Run Equilibrium in the Housing Market

Appendix 2

Unit Root Test 1: Unemployment

```
. xtunitroot fisher unemployment, dfuller lags(0)

Fisher-type unit-root test for unemployment
Based on augmented Dickey-Fuller tests
------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P        30.4467       0.7297
 Inverse normal            Z        -0.2850       0.3878
 Inverse logit t(94)       L*       -0.2778       0.3909
 Modified inv. chi-squared Pm       -0.6545       0.7436
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test 2: GRP

```
. xtunitroot fisher grp, dfuller lags(0)

Fisher-type unit-root test for grp
Based on augmented Dickey-Fuller tests
------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P       180.0967       0.0000
 Inverse normal            Z        -9.3600       0.0000
 Inverse logit t(94)       L*      -11.5763       0.0000
 Modified inv. chi-squared Pm       16.9820       0.0000
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test 3: Interest Rate

```
. xtunitroot fisher interestrate, dfuller lags(0)

Fisher-type unit-root test for interestrate
Based on augmented Dickey-Fuller tests
--------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
--------------------------------------------------------------------
                                    Statistic      p-value
--------------------------------------------------------------------
 Inverse chi-squared(36)    P         21.2783       0.9756
 Inverse normal             Z          0.5732       0.7168
 Inverse logit t(94)        L*         0.5075       0.6935
 Modified inv. chi-squared Pm         -1.7350       0.9586
--------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test 4: KIX

```
. xtunitroot fisher lnkix, dfuller lags(0)

Fisher-type unit-root test for lnkix
Based on augmented Dickey-Fuller tests
--------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
--------------------------------------------------------------------
                                    Statistic      p-value
--------------------------------------------------------------------
 Inverse chi-squared(36)    P         28.1929       0.8203
 Inverse normal             Z         -0.4585       0.3233
 Inverse logit t(94)        L*        -0.4058       0.3429
 Modified inv. chi-squared Pm         -0.9201       0.8212
--------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test 5: Rentgbg

```
. xtunitroot fisher lnrentgbg, dfuller lags(0)

Fisher-type unit-root test for lnrentgbg
Based on augmented Dickey-Fuller tests
----------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P        13.3564       0.9998
 Inverse normal            Z         2.1042       0.9823
 Inverse logit t(94)       L*        1.8821       0.9685
 Modified inv. chi-squared Pm       -2.6686       0.9962
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test 6: Rentsthlm

```
. xtunitroot fisher lnrentsthlm, dfuller lags(0)

Fisher-type unit-root test for lnrentsthlm
Based on augmented Dickey-Fuller tests
------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P        28.5307       0.8078
 Inverse normal            Z        -0.5042       0.3071
 Inverse logit t(94)       L*       -0.4463       0.3282
 Modified inv. chi-squared Pm       -0.8803       0.8106
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test 7: Rentmalmö

```
. xtunitroot fisher lnrentmalmö, dfuller lags(0)

Fisher-type unit-root test for lnrentmalmö
Based on augmented Dickey-Fuller tests
--------------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      8

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(36)   P        45.4958       0.1334
 Inverse normal            Z        -2.4403       0.0073
 Inverse logit t(94)       L*       -2.1911       0.0155
 Modified inv. chi-squared Pm        1.1191       0.1316
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test with Differentiated Variables 8: Unemployment

```
. xtunitroot fisher dunemployment, dfuller lags(0)
(18 missing values generated)

Fisher-type unit-root test for dunemployment
Based on augmented Dickey-Fuller tests
--------------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      7

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(36)   P        62.6220       0.0039
 Inverse normal            Z        -3.4233       0.0003
 Inverse logit t(94)       L*       -3.3441       0.0006
 Modified inv. chi-squared Pm        3.1374       0.0009
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test with Differentiated Variables 9: Interest Rate

```
. xtunitroot fisher dinterest, dfuller lags(0)
(18 missing values generated)

Fisher-type unit-root test for dinterest
Based on augmented Dickey-Fuller tests
--------------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      7

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(36)   P        58.5335       0.0102
 Inverse normal            Z        -3.6205       0.0001
 Inverse logit t(94)       L*       -3.3086       0.0007
 Modified inv. chi-squared Pm        2.6556       0.0040
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test with Differentiated Variables 10: KIX

```
. xtunitroot fisher dkix, dfuller lags(0)
(18 missing values generated)

Fisher-type unit-root test for dkix
Based on augmented Dickey-Fuller tests
--------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      7

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(36)   P        55.2680       0.0210
 Inverse normal            Z        -3.3423       0.0004
 Inverse logit t(94)       L*       -3.0400       0.0015
 Modified inv. chi-squared Pm        2.2708       0.0116
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test with Differentiated Variables 11: Rentgbg

```
. xtunitroot fisher drentgbg, dfuller lags(0)
(18 missing values generated)

Fisher-type unit-root test for drentgbg
Based on augmented Dickey-Fuller tests
---------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      7

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P       551.4742       0.0000
 Inverse normal            Z       -21.4198       0.0000
 Inverse logit t(94)       L*      -36.0261       0.0000
 Modified inv. chi-squared Pm       60.7492       0.0000
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test with Differentiated Variables 12: Rentsthlm

```
. xtunitroot fisher drentsthlm, dfuller lags(0)
(18 missing values generated)

Fisher-type unit-root test for drentsthlm
Based on augmented Dickey-Fuller tests
---------------------------------------
Ho: All panels contain unit roots           Number of panels  =     18
Ha: At least one panel is stationary        Number of periods =      7

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P       473.1006       0.0000
 Inverse normal            Z       -19.5815       0.0000
 Inverse logit t(94)       L*      -30.9062       0.0000
 Modified inv. chi-squared Pm       51.5128       0.0000
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Unit Root Test with Differentiated Variables 13: Rentmalmö

```
. xtunitroot fisher drentmalmö, dfuller lags(0)
(18 missing values generated)

Fisher-type unit-root test for drentmalmö
Based on augmented Dickey-Fuller tests
-----------------------------------------
Ho: All panels contain unit roots            Number of panels  =     18
Ha: At least one panel is stationary         Number of periods =      7

AR parameter: Panel-specific                 Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                   ADF regressions: 0 lags
------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------
 Inverse chi-squared(36)   P        91.7544       0.0000
 Inverse normal            Z        -6.0136       0.0000
 Inverse logit t(94)       L*       -5.8026       0.0000
 Modified inv. chi-squared Pm        6.5707       0.0000
------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Appendix 3

Hausman Test 1: Lagged REV

	— Coefficients — (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
grp	.0161705	.0150303	.0011403	.
unemployment				
L2.	.1069065	.6015611	-.4946545	.0825746

```
                   b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       35.80
            Prob>chi2 =      0.0000
            (V_b-V_B is not positive definite)
```

Hausman Test 2: Lagged DIV

	— Coefficients — (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
grp	.0161705	.0129948	.0031757	.
unemployment				
L2.	.1069065	.6094595	-.502553	.0712401
year				
2008	.001706	.023063	-.021357	.
2009	.0294492	.1163787	-.0869295	.
2010	.0292319	.0589099	-.029678	.

```
                   b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       35.39
            Prob>chi2 =      0.0000
            (V_b-V_B is not positive definite)
```

Hausman Test 3: Differentiated REV

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
grp				
D1.	-.0043656	-.0056495	.0012839	.0013341
unemployment				
D2.	.4906425	.4921315	-.001489	.0053218

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

            chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                    =        0.93
        Prob>chi2 =       0.6289
```

Hausman Test 4: Differentiated DIV

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
grp				
D1.	-.0043656	-.0056011	.0012355	.0014776
unemployment				
D2.	.4906425	.4920756	-.0014331	.0058154

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

            chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                    =        0.70
        Prob>chi2 =       0.7048
```

Appendix 4

Regression 1; Model 1; Random Effects

```
Random-effects GLS regression                   Number of obs      =       108
Group variable: region1                         Number of groups   =        18

R-sq:  within  = 0.7464                         Obs per group: min =         6
       between = 0.8662                                        avg =       6.0
       overall = 0.7511                                        max =         6

                                                Wald chi2(7)       =    296.78
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

unemployment	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
grp	.0150303	.0230525	0.65	0.514	-.0301517	.0602123
interestrate	4.586388	1.527756	3.00	0.003	1.592042	7.580734
lnkix	.6784983	.1583669	4.28	0.000	.368105	.9888917
lnrentgbg						
L1.	.196215	.0710639	2.76	0.006	.0569323	.3354977
lnrentsthlm						
L2.	.154167	.0400169	3.85	0.000	.0757353	.2325988
lnrentmalmö						
L1.	.2926785	.0731596	4.00	0.000	.1492884	.4360687
unemployment						
L2.	.6015611	.081105	7.42	0.000	.4425981	.7605241
year						
2008	0	(omitted)				
2009	0	(omitted)				
2010	0	(omitted)				
2011	0	(omitted)				
2012	0	(omitted)				
_cons	-7.701969	1.989564	-3.87	0.000	-11.60144	-3.802496

Regression 2; Model 2; Random Effects

```
Random-effects GLS regression                   Number of obs      =       108
Group variable: region1                         Number of groups   =        18

R-sq:  within  = 0.7451                         Obs per group: min =         6
       between = 0.8535                                        avg =       6.0
       overall = 0.7562                                        max =         6

                                                Wald chi2(10)      =    295.27
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

unemployment	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
grp	.0129948	.0236738	0.55	0.583	-.0334051	.0593947
interestrate	-.0831033	.3548713	-0.23	0.815	-.7786383	.6124317
lnkix	-.8202334	.4358095	-1.88	0.060	-1.674404	.0339375
lndistgbg						
L1.	-.0008507	.0036671	-0.23	0.817	-.0080381	.0063366
lndiststhlm						
L2.	.0017618	.0015098	1.17	0.243	-.0011974	.004721
lndistmalmö						
L1.	.0001539	.0032725	0.05	0.962	-.0062601	.0065679
unemployment						
L2.	.6094595	.091222	6.68	0.000	.4306677	.7882513
year						
2008	.023063	.0106628	2.16	0.031	.0021643	.0439617
2009	.1163787	.0523527	2.22	0.026	.0137693	.2189881
2010	.0589099	.0204686	2.88	0.004	.0187922	.0990276
2011	0	(omitted)				
2012	0	(omitted)				
_cons	4.000542	2.112341	1.89	0.058	-.1395697	8.140654

Regression 3; Model 3; Random Effects

```
Random-effects GLS regression                   Number of obs      =       108
Group variable: region1                         Number of groups   =        18

R-sq:  within  = 0.9259                         Obs per group: min =         6
       between = 0.1947                                        avg =       6.0
       overall = 0.9135                                        max =         6

                                                Wald chi2(7)       =   1056.25
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
D.           |
unemployment |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         grp |
         D1. |  -.0056495   .0084725    -0.67   0.505    -.0222552    .0109563
             |
interestrate |
         D1. |  -.4262625   .1377568    -3.09   0.002    -.6962609   -.1562641
             |
       lnkix |
         D1. |   .0391211   .0451247     0.87   0.386    -.0493216    .1275639
             |
 lnrentsthlm |
         D1. |   .0782934   .0083558     9.37   0.000     .0619164    .0946704
             |
   lnrentgbg |
         D1. |   .0870293   .0123663     7.04   0.000     .0627917    .1112668
             |
 lnrentmalmö |
         D1. |  -.0780631    .010467    -7.46   0.000     -.098578   -.0575481
             |
unemployment |
         D2. |   .4921315   .0316354    15.56   0.000     .4301272    .5541358
             |
        year |
       2008  |          0  (omitted)
       2009  |          0  (omitted)
       2010  |          0  (omitted)
       2011  |          0  (omitted)
       2012  |          0  (omitted)
             |
       _cons |  -.0030874   .0006039    -5.11   0.000     -.004271   -.0019037
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  .00436437
```

Regression 4; Model 4; Random Effects

```
Random-effects GLS regression                   Number of obs      =       108
Group variable: regionl                         Number of groups   =        18

R-sq:  within  = 0.9260                         Obs per group: min =         6
       between = 0.1946                                        avg =       6.0
       overall = 0.9135                                        max =         6

                                                Wald chi2(7)       =   1062.51
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

D. unemployment	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
grp						
D1.	-.0056011	.0084486	-0.66	0.507	-.0221602	.0109579
interestrate						
D1.	-.4264001	.1373428	-3.10	0.002	-.6955871	-.1572132
lnkix						
D1.	.0390773	.0449888	0.87	0.385	-.049099	.1272537
lndiststhlm						
D1.	.0782805	.0083308	9.40	0.000	.0619524	.0946086
lndistgbg						
D1.	.0869868	.01233	7.05	0.000	.0628205	.1111532
lndistmalmö						
D1.	-.0780284	.0104362	-7.48	0.000	-.098483	-.0575738
unemployment						
D2.	.4920756	.0315484	15.60	0.000	.4302418	.5539094
year						
2008	0	(omitted)				
2009	0	(omitted)				
2010	0	(omitted)				
2011	0	(omitted)				
2012	0	(omitted)				
_cons	-.0030866	.0006078	-5.08	0.000	-.0042778	-.0018954