

# COLLEGE OF BUSINESS, ARTS AND SOCIAL SCIENCES

## DISSERTATION / FINAL YEAR PROJECT SUBMISSION COVERSHEET

Dissertations / Final Year Projects MUST be submitted online via Blackboard Learn under the relevant modular block course page and by TWO bound hard copies to the Taught Programmes Office.

|  |  |
| --- | --- |
| Student Number: | 1337453 |
| Dissertation Module Code: | EC3000 |
| Dissertation Supervisor | Alessandra Canepa |

|  |
| --- |
| I confirm that I understand a complete submission of coursework is by one electronic copy of my assignment via Blackboard Learn. I understand that assignments must be submitted by the deadline in order to achieve an uncapped grade. Separate guidelines apply to reassessed work. Please see the [Coursework Submission Policy](http://www.brunel.ac.uk/about/quality-assurance/documents/pdf/Policy-for-Coursework-Submission-1.0.pdf) for details.  Any coursework or examined submission for assessment where plagiarism, collusion or any form of cheating is suspected will be dealt with according to the University processes which are detailed in [Senate Regulation 6.](http://www.brunel.ac.uk/about/documents/pdf/SR6-aug-14-on-revised-feb-15.pdf)  You can access information about plagiarism [here.](http://www.brunel.ac.uk/services/library/learning/plagiarism)  The University regulations on plagiarism apply to published as well as unpublished work, collusion and the plagiarism of the work of other students.  Please ensure that you fully understand what constitutes plagiarism before you submit your work.  I confirm that I have read and understood the guidance on plagiarism. I also confirm that I have neither plagiarised in this coursework, nor allowed my own work to be plagiarised.  The submission of this coversheet is confirmation that you have read and understood the above statements. |

A selection of dissertations may be put on Blackboard Learn to be read by other students. I hereby consent to my dissertation being published on the Department’s Taught Programme Office organisation on Blackboard Learn, for teaching and research purposes.

**YES**

[](http://www.google.co.uk/url?sa=i&rct=j&q=&esrc=s&frm=1&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjd8Kyc4sDKAhXCXhQKHbAaCEgQjRwIBw&url=http://iworkat.brunel.ac.uk/&psig=AFQjCNGKIi4jCds8FVFgNC01qtBbbuAeQQ&ust=1453667064959906)

House Prices and Financial Stability

BSc Economics and Business Finance   
College of Business, Arts and Social Sciences

Student Number: 1337453

Table of Contents

1.0 Introduction 5

2.0 Literature Review 6

2.1.0 The relationship between Money Supply (M2) and house price index 7

2.2.0 The relationship between inflation and house price index 10

2.3.0 The relationship between household income and house price index 10

2.4.0 The relationship between gross domestic product and house price index 12

3.0 Data Collection Methods 14

3.1.0 Variable Descriptions 15

3.2.0 Dependent Variable 15

**3.2.1.0 House Price Index** 15

3.3.0Independent Variable 15

**3.3.1.0Consumer Price Index** 15

**3.3.2.0Money Supply (M2)** 16

**3.3.3.0 Gross Domestic Product** 17

**3.3.4.0 Household Income** 17

4.0 The Research Methodology 17

4.1.0Empirical Model of the Study 17

4.2.0Research Findings and Interpretation 20

4.3.0Japan 20

**4.3.1.0** **Results of Regression Analysis** 20

**4.3.2.0** **Interpretation** 23

4.4.0United States of America (USA) 23

**4.4.1.0** **Results of Regression Analysis** 23

**4.4.2.0** **Interpretation** 25

4.5.0United Kingdom (UK) 25

**4.5.1.0** **Results of Regression Analysis** 25

**4.5.2.0** **Interpretation** 27

5.0 Conclusion 27

6.0 Recommendations 28

Bibliography 30

**Appendix: OLS Results………………………………………………….…………34**

# 

# **Abstract**

This study investigates the relationship between financial and macroeconomic determinants of housing market globally with a key emphasis on USA, UK and Japan from the period year 1995 first quarter to the year 2015 fourth quarter, which is comprised of quarterly data of 84 observations. This study employed time series econometrics to investigate the effect of financial variables and macroeconomic on the residential housing price in the highlighted countries. Macroeconomic factors such as gross domestic product (GDP) and inflation (INF), and the financial elements such as household income (HI) and Money Supply (M2) are used in this study. The literature review establishes that economic theory expects the relationship between the house pricing index and money supply, GDP and household income to be positive while its relationship with inflation to be negative. As per the data analysis, the model does is not suitable for the Japanese housing market. Despite the Japan regression yielding a 0.0000 f test p value, which is statistically significant, its coefficient of determination (r-squared value) is below the acceptable threshold of 75% with a value of 24.07%. Despite some regression coefficients not conforming to the expectations set by economic theory, the model is suitable for the US and UK markets with the countries achieving r-squared values of 93.03% and 98.22% respectively. Similarly, they each achieved a perfect t-test p value of 0.000. The study recommends that further research be carried out on the Japanese housing market to determine the factors that could be included to develop a working model for the market.

# **Acknowledgements**

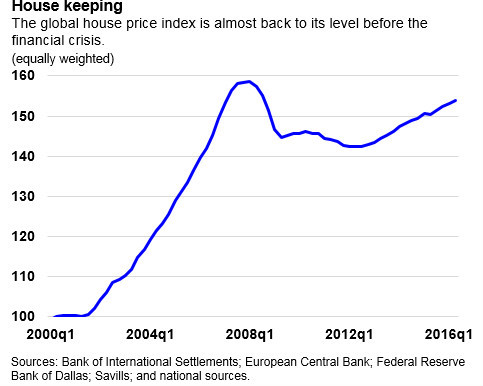
I would like to appreciate my supervisor Alessandra Canepa for the endless support she has offered to see this task become a success. For that reason, I will forever remain indebted to my supervisor. I cannot also forget to thank my family for always being there for me. Lastly, to my professors and colleagues with who I have always interacted, I am grateful for their support too.

# 

# **1.0 Introduction**

Housing is regarded as one of the most invaluable assets of a household and a vital part of its portfolio. It offers positive externalities regarding public health, economic and social environment development. The literature has discounted for a long time the relationship between the macroeconomic and the financial factors and the housing market by putting housing beside other consumption goods (Leung, 2004, p. 250). The latest US subprime crisis and the next collapse of the housing market revitalized the focus on the housing market.

The global house price index initially witnessed a steady growth till a peak of 160 points in the year 2008 third quarter, later, it dramatically fell about 15 points until a bottom of 145 points in the year 2009 second quarter. The global HPI swung between indexes due to the United Stated global financial crisis in the year and subprime mortgage crisis 2008. Global HPI has seen fluctuations between 140 and 155 points after the year 2009 onwards. The drastic decline of world house price index is due to the United States subprime mortgage crisis and global financial crisis in the year 2008. Crotty (2009, p. 564) indicated that the collapse of financial markets in the year 2008 was the most adverse case since the Great Depression and consequently led to housing bubble and global economic recession. However, the global HPI has seemed to recover most of the points lost during the crisis and is making a fast comeback.



# **Literature Review**

Housing remains a fundamental and basic need to all human being because houses not only provide living space for the human accommodation but also offers people with protection. In that essence, the fluctuations of house prices in any given nation affect the spending and borrowing behaviours of households by influencing the household perceptions of lifetime wealth. Other than the provision of protection and shelter, houses also act as an investment vehicle. According to Madsen (2012, 24), the price of a house is largely dependent on the cost of construction cost. When the housing price rises above the construction costs, new house developments translate to increased profits. In that regard, the investment in real estates and residential houses has been presumed to be positively correlated with increased housing price.

This chapter presents an analysis of the literature on topics related to the macroeconomic determinants of the housing market of the sampled nations namely USA, UK, and Japan to guide this inquiry. There exist several viewpoints on the interrelation between financial and macroeconomic variables towards the housing prices globally. In this chapter thus, is the literature review concerning the relationship between the dependent variable (HPI) and explanatory variables (Independent Variables), which include Consumer Price Index (CPI), Gross Domestic Product (GDP), Money Supply (M2) and Household Income (HI) will be discussed in detail. These variables are known to be very significant when it comes to the financial stability in a country. The chapter will review past empirical literature to examine the relationship between the dependent variable and independent variables. Subsequently, this section will explain the relevant theoretical framework of house price index with the financial and macroeconomic variables.

## **The relationship between Money Supply and house price**

Usually, the central banks of different countries are tasked with regulating the amount of money that is in circulation in a particular economy and mortgages loans are as well an important part of the bank credit portfolio. Most central banks necessitate depository institutions to hold minimum reserves against their liabilities, predominantly in the form of balances at the central bank and regulate the commercial banks lending rates. When either the central bank raises the minimum reserves, or the base lending rate of banks is reduced, banks are made able to provide lower bank lending rates, which encourage more people to participate in current and future housing market (Adams and Füss, 2010, p. 38). When the central bank of host countries raises its lending rates to the commercial banks, this limits the lending capacity of commercial banks and finally confines the investments in the housing sector that results in a decrease in the house price level. Adams and Füss (2010, p. 37) indicate that any increase in the house prices significantly increases the bank lending capacity as high as greater is the ratio of loan to the value of the collateral. Therefore, any variation towards bank lending rate will significantly influence the pricing of both existing and latest floating interest rate home borrowings.

According to Welke, & Berkeley (2006, p. 14), interest rate denotes the amount in percentage rate that is charged on the principal sum or assets from borrowers to lenders. The use of interest rate is used to enable the banks to get some compensation or return over a period based on the usage of the assets from borrowers. Commonly, an interest rate is laid down in contracts among involved parties with the higher risk of loan or assets being charged at a higher interest rate for significant return and vice versa (Shiller, 2007, p.31). Nevertheless, different kinds of interest rate are associated and affect each other. For example, the increase of the interest rate benefits the investor because they can get better profits from bond or bank deposits. In such cases, debtors are supposed to make higher repayment because of the increase of interest rate (Economicswebinstitute.org, 2017).

Concerning the objectives of this paper, it discusses how interest rate influences the dependent variable in this study, which is housing prices. Wang, Tumbarello, and Wang (2010, p. 41) disputed that interest rate played a significant role as the primary determinant of house price activities is fundamentally incontestable. There is a significant remark that the extent of variation in housing prices will ultimately rely on whatever that will lead to the estimation of income and interest rates. Based on the previous studies, Tse, Ho, and Ganesan (1999, p. 625) also emphasized that interest rate is a significant variable in determining the housing prices and it cannot be ignored.

Regarding Chandler and Disney (2014, p. 372), interest rate considerably influences the housing prices in a negative way. Kearl (1979, p.1115) studied the inflationary environment and decided that, in the case of false expectation, relative housing prices are affected. Correspondingly, Feldstein (1992, 294) conclude this adverse effect of inflation on demand and housing investments. On the other hand, Nielsen and Sorensen (1994, p.198) established that an increasing inflation creates housing investment motives because of the falling real user cost after taxes. In overall, there are conflicting views regarding the actual effect of inflation on the housing market (Manchester, 1987, pp.107). Tumbarello and Wang (2010) found that interest rate has a significant impact on housing price. Besides that, Hott (2009) stated that the willingness of banks to provide mortgage loan could have a significant effect on the demand for houses, thus affecting the residential housing prices.

The lower interest rate will lead to a considerable increase in money supply, as well as slackening in particular mortgage credit policy will boost the enlargement of the house price. As well, Xu and Chen (2012) expected that house price and bank loan rate is negatively correlated. Moreover, Muellbauer and Murphy (1997) agreed that the development of bank lending could lead to house price development. If the availability of credit of banks increased, those banks could offer lower bank lending rates, because of encouraging more people to participate in current and future housing market. Zainuddin (2010) also stated if the loan rate decreased, housing demand in any country is likely to increase due to the lower cost of mortgage financing. The higher lending rates imply higher credit costs, whereby it should depress the demand for housing (Ong & Chang, 2013).

## **2.2.0 The relationship between inflation and house price**

An inflation rate is an economic tool that is used to measure the level of economic stability of a particular country. It normally represents an incessant rise or fall in the general price of goods and services in a country (Labonte, 2008, p. 67). Sometimes, the inflation rate is used to refer to the purchasing power of consumers on goods and services in a host country’s economy. The level of inflation rate is one of the main worries of any government and central because they strive to maintain their country’s growth. High inflation rate usually causes macroeconomic imbalances, which leads to dawdling of economic growth. On the other hand, low inflation rate does not guarantee a healthy growth in the economy.

Kearl (1979, p.1115) studied the inflationary environment and decided that in the case of false expectation relative house prices are affected. Correspondingly, Feldstein (1992, p. 294) concluded about this adverse effect of inflation on demand and housing investments. Nielsen and Sorensen (1994, p.198) established that an increasing inflation creates housing investment motives because of the falling real user cost after taxes. All in all, there are conflicting views regarding the actual effect of inflation on the housing market (Manchester, 1987, pp.107).

## **2.3.0 The relationship between household income and house price**

Household income is defined as a measure of the aggregated earnings of members sharing a particular household of residence. A household comprises any income, and the level of income is an essential risk measure that is used by financial institutions and residential market lenders of for underwriting loans criteria, in addition to being used as an indicator of consumption capability of a household. Thus, household income level is applied to represent household borrowing capability and affordability to buy a house for housing demand (Gallin, 2006, 418; Gomes, Vasconcellos, and Anjos, 2009, p. 32).

According to Gomes, Vasconcellos, and Anjos (2009, p. 33), the increment in the level of household income is altered the demand circumstances in the housing market. Campbell and Cocco (2007, pp.593) also established that household consumption rates are determined by predictable changes in house prices. Usually, the growth in household income boosts households to increase their consumption and expenditures of both normal and luxury goods, as well as enhances their living standard. Similarly, an increased household income increases the demand side of the housing market by positively influencing the house prices. Contrary, a rise in income inequality leads to a decline in housing prices depending on the market forces, which is both demand and supply sides of the housing market (Määttänen&Terviö, 2014, pp. 381).

According to existing economics literature, many researchers (Lind, 2009, p. 78; Capozza, 2002, p. 63; Malpezzi, 1999) deliberated that housing price is related to income regarding its long-run relationship. Besides, the rise in household income always results in the decline in the cost of the home loan as a proportion of total income, as well as increases the affordability of households. For that reason, household income and house prices are positively correlated. In addition, Kupke and Rossini (2011, p. 358) also studied the relationship between housing prices and household income levels, as well as the variation in each relative that affected on the other. The two authors established that household incomes increment comes along with the high standard of housing affordability and the intention to buy houses. Consequently, it induces housing demand side and thus leads to the increase in house prices. (Määttänen and Terviö, 2014, p.386).

Additionally, the ratio of the property price to annual household income is regularly used as a standard to assess the affordability of house prices. Besides this, Nielsen and Sorensen (1994, p.206) also when studying effects of household income as one of the determinants of house price established that family income is positively correlated with house prices. Nielsen and Sorensen concluded that an increase in household income enhances the affordability of houses and the purchasing power of the households and vice versa. Notwithstanding the effects of household income on housing prices and affordability, Capozza (2002, p.96) proposed that there exists a long-run equilibrium between household income and house price.

## **2.4.0 The relationship between gross domestic product and house price**

Gross domestic product (GDP) refers to a measurement of state’s business cycle over a financial year. The GDP of a country is comprised of things such as government expenditure, aggregate household, consumption, total income, and net exports. Most of the economists use GDP as one of the independent variables to examine the independent variable, which is housing price.

The high correlation between GDP, income and the housing market has been studied in the literature. Hirata, Kose, Otrok, and Terrones (2013, p. 57) while studying global macroeconomic effects on real estate prices discovered that real estate market is highly correlated with GDP and another macroeconomic variable. According (Guerrieri, Hartley, Hurst, & National Bureau of Economic Research, 2010, p. 14), the strength of GDP to residential housing price is influenced by the openness of the country. The authors found the GDP and housing prices correlations on average to fall between 0.33 and 0.44.

Iacoviello, Neri, and Banca d'Italia (2008, p. 42), examined the response of GDP to housing market variations and concluded that in the USA a drop in home prices affected the consumption and GDP negatively. Adams and Füss (2010, p. 42) observed that the GDP growth has an upward cumulative impact on the housing market. Katrakilidis and Trachanas (2012, p. 1065) using data from 17 manufacturing countries and through variance decomposition indicated that the long-term contribution of GDP does not exceed the 10% of the total variation of housing price. Many types of research (Katrakilidis and Trachanas, 2012, p. 1067; (Iacoviello, Neri, & Banca d'Italia, 2008, p. 49) conform that a substantial short-term correlation exists between the housing market and GDP. Nevertheless, Madsen (2012, p. 21) specifies that in the long term this nexus becomes weak.

Different states have different trends of relationship between GDP and housing price. When a country leads in export, the depreciation of a country’s currencies might be good news for the host country since the depreciation in its currency makes other countries to become attracted by cheaper products in such country. As a result, the exporting country leads to an increased Balance of Payment (BoP), which favours the economy of the host country. In other words, a positive balance of payment (surplus) stimulates a country’s economic condition when exports are more than imports and thus highly influence the GDP of a country.

Furthermore, the most empirical finding indicates that GDP positively affects the residential housing price in the end (Capozza, 2202, p. 38; Gomes, Vasconcellos, andAnjos, 2009, p. 33). This phenomenon is because of the increment in income level in a country. High income causes a high consumption of good and services, and thus the demand and supply of residential house are not in equilibrium in the property market. Otherwise, investing in residential property is an alternate way for investors, and it directly affects the housing price in the market. Even though the results obtained from previous studies are not consistent, there is a proof are significant to house price and thus the conclusion that the GDP is a major indicator that can be used to determine housing price in a country.

# **Data Collection Methods**

To examine the relationship between residential house price and the selected macroeconomic and financial variables, research data was collected mainly from the secondary source DataStream. Gujarati and Porter (2009, 42), describes secondary data as data that is already existence and is used to authenticate new research or justify previous findings.

In this study, the data of five variables inclusive of the dependent variable was collected with the timeliness of quarterly data from the year 1995 first quarter to the year 2015 fourth quarter, which formed a total number of 84 observations. Other than the residential housing prices, other time series data that were used in this study include CPI (a proxy for inflation), Money supply (base lending rate), household income (a proxy for income level) and GDP. Notably, the selected macroeconomic and financial variables in this study are presumed to be the most relevant factors, which influence the residential housing market and thus the housing price movements. The particulars the all of the data that was used in this study are summarized in the table in the appendices section.

## **3.1.0 Variable Descriptions**

## **3.2.0 Dependent Variable**

### **3.2.1.0 House Price Index**

In reality, housing price is a central concern of most of the citizens in any particular country. Besides, it signifies the overall condition of the economy in a nation. Thus, to study the determinants of housing price, house price index is used as a proxy for measuring the cost of housing in the country. According to Tse, Ho and Ganesan (1999, p. 34), unstable housing price significantly influences the economic status of any particular nation regarding GDP and demographic changes. In the wake of the 21st century, the demand for swelling and since the number of buyers surpasses the supply of the houses in a housing market; the housing price is projected to increase thus causing disequilibrium in the housing market.

## **3.3.0Independent Variable**

### **3.3.1.0 Consumer Price Index**

Customarily, inflation rate is measured by consumer price index (CPI). Consumer price index (CPI) used by economist to express the changes in prices of services and goods which households consumed in index form. Nevertheless, consumer price index (CPI) simply refers to the average measurement of goods since not all of them are changes in the same magnitude. Notably, CPI is closely connected to real purchasing power since the later relates the value of a currency with the price of services and goods. From experience in global market, an increase in CPI leads to a decline in the intensity of consumers’ real purchasing power. The global and accepted statistical methodologies that is mostly applied by economies of several states for computation of inflation rate and which is in line with the International Monetary Fund standards is summarized by the formula below.

Consumer Price Index =

### **3.3.2.0 Money Supply (M2)**

Money supply refers to the total stock of financial media of exchange or money is in circulation in the economy and which is available to society for use in connection with the economic activities of a particular country. Money supply plays a significant role in the determination of price level and interest rate. In economic analysis, it is believed that money supply is influenced by the policy of the Government and Central Bank of a host country. In this study the money supply component being used is the money supply M2. The M2 consists of notes and coins in the circulation of an economy and short-term deposits in banks.

### **3.3.3.0 Gross Domestic Product**

Gross domestic product (GDP) is defined as the market value of the entire authoritatively acknowledged final products, which are supplied by a nation in a specified period. In another hand, GDP per expenditure is commonly measured as an indicator of a country’s standard of living, which reveals the economic condition of the country in question. According to Wang, Tumbarello and Wang (2010, p.87), indicated that economic performance of a country plays a significant role to affect the housing market.

When a nation is an export oriented, the depreciation of a country’s currency is good news for the country since its exports get cheaper in comparison to other countries. As a result, foreign currencies that are not affected by depreciation of its value are attracted by the lower price of goods in the country, which its currency is losing value. Accordingly, the exporting country gets higher exports returns, which positively favours its Balance of Payment (BoP). In other words, a positive balance of payment has a tendency of stimulating a host country’s economic condition since exports surpass imports, which highly influential to the GDP of a country. Based on observation from Adam and Fuss (2010, p. 38), GDP per expenditure is negatively related to residential housing price in any country.

### **3.3.4.0 Household Income**

Household income proxy in this study will represent household income in millions for the UK and in Billions for USA and Japan. Household income is a measure of the aggregate incomes of all members sharing a specific household in housing. It is comprised of every type of income and acts as collateral for important risk measurement that is used by lenders for underwriting mortgage loans. Household income level can signify households’ borrowing capability and affordability to buy a house for housing demand (Gallin, 2006, p.426). Briefly, this study will is interested in establishing whether there is a positive and a significant relationship between household income and housing prices.

# **The Research Methodology**

This section discusses the methodology that will be employed to create the empirical model of the study. The sections also summarize details about the regressions run and the reason for selecting such kind of analysis for the empirical data.

## **4.1.0 Empirical Model of the Study**

The model this paper will make use of a linear multivariate OLS (ordinary Least Squares) regression model since the model is normally easier to run for time series data. In this case, the regression will be run out for each of the three selected countries i.e. the United State of America, United Kingdom and Japan. The main objective of regression analysis is to approximate or forecast the regular value of the dependent variable based on fixed values of independent variables. The appropriate results needed for the regression is dependent on the available and fitting data. Ordinary Least Squares is preferred by a majority of data analyst since it is easy to use apply the model and its results are easy to understand and interpret. In addition, the model is a popular technique among the data analysts as it tries to investigate the function that offers close estimates of the data.

This study was rolled out to investigate the effect Of Consumer Price Index (INF), Money Supply (M2), Gross Domestic Product (GDP) and Household Income (HI) on the house price index in three different states; United States of America, United Kingdom and Japan. The empirical model that guided the analysis of this study is as specified below:

𝒍𝒏**HPIt=𝜷+𝜷2𝒍𝒏M2𝒕+𝜷𝟏𝒍𝒏*INF*𝒕 +𝜷3𝒍𝒏𝑯𝑰𝒕+ 𝜷4𝒍𝒏𝑮𝑫𝑷𝒕+u𝒕**

Where,

HPI = House price index of respective countries

M2 = Money Supply M2 (which is controlled by the Central Banks of respective countries)

GDP = Gross domestic product by expenditure of each of the three countries in question

HI = Household income (Billions for USA and Japan; Millions for UK)

INF = The Consumer Price Index in the respective countries signifying the inflation

Notably, when the natural logarithm of the independent variables is used in any regression model, Ut signifies the uncorrelated white-noise error terms. β0 denotes the intercept of the regression model while β (1, 2, 3, 4,) signifies the slope of coefficient of each of the independent variable in the regression model. There are several reasons why this study opted to apply natural logarithm form of the variables. Foremost, log the variables usually helps a researcher (an analyst or a statistician) to transform the data series into linear trend. Mostly, a majority of the economic variables are subjected to an underlying rate of growth that could make the data of study to be either constant or not constant. As a result, the derived means do have a tendency of continuing to increase and thus the data is not integrated since no amount of differencing can make the data stationary (Asteriou and Hall, 2007, p 54).

The second reason is used to narrow down the scale of data when the scale of the sample data is too big. For instance, unit measurement of GDP of the three states or household income is in billions of USA dollars. Evidently, the figures of the data are comparatively large in relation to the recorded figures of the data of consumer price index that is small. Lastly but not the least, the coefficients on the natural logarithm scale are easily to interpret directly with disproportional variations of the independent variables in relation to the dependent variable (Gujarati and Porter, 2009, p.79). For instance, a small percentage changes in independent variable (X) in this case; Consumer Price Index (INF), Money Supply (M2), Gross Domestic Product (GDP) or Household Income (HI) of any of the singled out states corresponds to an estimated small percentage changes in dependent variable (Y), which in this case is House Price Index (HPI).

Another reason for logarithmically transforming the data is to account for the different currencies between the two countries as well as (possibly) the different methods of achieving the house pricing and consumer pricing indices. With natural logs, the regression considers the percentage differences between the values, which standardize the regression outputs.

In this study, a multiple regression analysis was conducted to test the relationship among predictor variables. The research used statistical software Eviews for econometrics to code, enter and compute the measurements of the multiple regressions. The obtained descriptive statistics from different regression analysis was used to enable the researcher to determine whether there was a significant relationship between the independent variables and the dependent variable. The results of the findings were interpreted thereafter.

## **4.2.0 Research Findings and Interpretation**

This chapter discusses the analysis and results of the findings. It presents analysis of the data to determine the effect of the macroeconomic and financial determinants of the housing market, which is a case study of USA, UK and Japan. The chapter also provides a comprehensive discussion of the descriptive statistics that are derived from the regression analysis of the study variables. Some of the statistics that are essential in determining whether there is a significant relationship between variables include Coefficient of determination (R-squared) and the P-value of the f-test.

## **4.3.0 Japan**

### **Results of Regression Analysis**

|  |  |  |
| --- | --- | --- |
| Dependent Variable: HPI | | |
| Number of Observations: 84 | | |
| R-squared: 24.07% | | |
| Prob(F-statistic): 0.000 | | |
| Variable | Coefficient | Prob. |
| C | -1.994 | 0.559 |
| M2 | 0.091 | 0.037 |
| GDP | -0.387 | 0.167 |
| HI | 0.021 | 0.645 |
| INF | 2.271 | 0.000 |

The table above shows the results of the regression analysis for Japan. There are two results that are used to determine the effectiveness and suitability of a regression model, the r-squared value and the p value for the model’s f-test. The r-squared value, known as the coefficient of determination, shows to what percentage the model accounts for the variance in the dependent variable(s). The higher the coefficient of determination, the more data points are close to the regression line of good fit. The coefficient of determination (r-squared) value for Japan’s regression model is 24.07%. This is a disappointing figure as it shows that the model can account for only 24.07% of the variance in Japan’s house price index. The acceptable range for the r-squared value is between 75% and 100%. Therefore, concerning Japan, the model does not sufficiently account for the house price index.

The f-test establishes whether the model subjected to regression analysis is more effective than a model without any independent variables. The important value in the f-test is the p-value of the f-statistic. If the p-value of the f statistic is less than the critical value (in this case 0.05) then we can state that the model is more effective than a model with no predictors. If the p-value exceeds the critical value, then the probability of the model being similar to a no-predictor model increases. In Japan’s regression model, the p-value for the f statistic is 0.000. With the figure being below 0.05, we can conclude that the model is statistically significant as a no-predictor model could not be as effective as the current model.

Based on the low coefficient of determination, we can begin to see that, concerning Japan, the model seems to be largely ineffective. As per the coefficients identified by the regression analysis results, Japan regression model results, presented in equation form, would be:

***lnHPI = -1.99 + 0.0919 lnM2 - 0.387 lnGDP + 0.0208 lnHI + 2.271 lnINF***

Regarding the regression results concerning the individual variables, the coefficients show the extent to which the different independent variables affect the housing price index. It is important to note, at this point, that since the regression involved logarithmic transformation, the influence between the variables will not be on a ‘per unit’ basis but will be expressed in percentages. The p-value of the different independent variables shows the statistical significance of these variables in terms of influencing the dependent variable (in this case the housing price index). With a confidence level of 95%, the critical value, which the p-values should not exceed, is 0.05. Of the four independent variables, two of them have p values exceeding the critical value; theses are GDP (p=0.166) and Household income (p=0.645). These p values show that their influence towards house prices in Japan is not statistically significant. The remaining two variables have achieved significance with money supply having a p value of 0.037 and inflation having a perfect p value of 0.000. With a coefficient of 0.0919, it means that all other conditions remaining constant, a single percentage point increase in the money supply would result in the housing price index increasing by 0.0919%. With the coefficient being positive, an increase in the independent variable would result in an increase in the dependent variable. The inflation variable has a positive value of 2.271, which means that a 1% increase in inflation would result in a 2.271% increase in the house price index.

### **Interpretation**

With the model failing to satisfy all the suitability tests, it is clear that the regression model does not effectively account for the changes in the country’s housing market. Two of the variables, GDP and Household income, were proven to be statistically insignificant. The literature review section however has established that these variables are influential determinants of the house prices within a given nation. Therefore, we have to conclude that Japan’s housing market is influenced by other factors that are unique to the nation, especially in light of the low coefficient of determination.

## **4.4.0 United States of America (USA)**

### **Results of Regression Analysis**

|  |  |  |
| --- | --- | --- |
| Dependent Variable: HPI | | |
| Number of Observations: 84 | | |
| R-squared: 93.03% | | |
| Prob(F-statistic): 0.000 | | |
| Variable | Coefficient | Prob. |
| C | -8.148 | 0.000 |
| M2 | -0.997 | 0.000 |
| GDP | 3.447 | 0.000 |
| HI | 0.373 | 0.611 |
| INF | -2.679 | 0.000 |

The table above shows the USA results of the regression analysis. To determine the models suitability, the coefficient of determination (r-squared) and the t-test’s p-value will be analysed. The r-squared value for the model is 0.9303. This shows that the model can account for 93.03% of the variance witnessed in the housing price index. This is impressively above the 75% threshold, which shows that the model is suitable. Similarly, the p-value for the f-test is 0.000, which is below the 0.05 critical values for models using a 95% confidence interval.

Therefore, the initial results are positive regarding the effectiveness and suitability of the model concerning the USA housing market. As per the coefficients identified by the regression analysis results, the USA regression model results, presented in equation form, would be:

***lnHPI = -8.15 - 0.997 lnM2 + 3.447 lnGDP + 0.373 lnHI - 2.679 lnINF***

The p-values for the independent variables signify how statistically significant they are in terms of influencing the housing price index. With the critical value being 0.05, one of the independent variables, household income, does not achieve statistical significance with a p value of 0.611. The other three variables; money supply, inflation, and GDP, each have a perfect p value of 0.000. Concerning the statistically significant coefficients, money supply has a coefficient value of -0.997. This means that, all other variables remaining constant, a 1% increase in the money supply in the US market would result in the house price index reducing by 0.997%. This does not confirm with expectations, as it was hypothesized that an increase in the money supply would have a positive influence on the house price index. Conforming to expectations is the GDP, which has a positive coefficient of 3.447. This shows that, all other variables remaining constant, a 1% increase in the GDP would result in a 3.447% increase in the house price index. Similarly conforming to expectation is the negative inflation coefficient of -2.679. This shows that when inflation increases by 1%, the house price index reduces by 2.679.

### **Interpretation**

The statistical insignificance of the household income variable is surprising, as it is one of the more influential determinants of house prices. This could signify presence of an external entity influencing the US housing market, and/or the presence of an unconsidered variable that mitigates the impact of household income. The negative nature of the money supply coefficient is also surprising. Economic theory predicts that when there is increased liquidity within a market, the purchasing power of the market increases leading to increased demand for housing, which is generally accompanied by a price increase. The negative nature of the relationship might suggest that the US housing market is currently not in a state of equilibrium, with supply significantly exceeding demand. Economic theory has also established the negative relationship between inflation and commodity prices; as inflation increases, the spending power in the economy reduces resulting in diminished demand. This leads to price reductions to incentivise purchasing.

## **4.5.0 United Kingdom (UK)**

### **Results of Regression Analysis**

|  |  |  |
| --- | --- | --- |
| Dependent Variable: HPI | | |
| Number of Observations: 84 | | |
| R-squared: 98.22% | | |
| Prob(F-statistic): 0.000 | | |
| Independent Variable | Coefficient | Prob. |
| C | -17.455 | 0.000 |
| M2 | 0.085 | 0.255 |
| GDP | 3.126 | 0.000 |
| HI | -0327 | 0.240 |
| INF | -3.040 | 0.000 |

The table above shows the UK results of the regression analysis. To determine the models suitability, the coefficient of determination (r-squared) and the t-test’s p-value will be analysed. The r-squared value for the model is 0.9822. This shows that the model can account for 98.22% of the variance witnessed in the housing price index. This is impressively above the 75% threshold, which shows that the model is suitable. Similarly, the p-value for the f-test is 0.000, which is below the 0.05 critical values for models using a 95% confidence interval.

Therefore, the initial results are positive regarding the effectiveness and suitability of the model concerning the UK housing market. As per the coefficients identified by the regression analysis results, the UK regression model results, presented in equation form, would be:

***lnHPI = -17.46 + 0.0853 lnM2 + 3.126 lnGDP - 0.327 lnHI - 3.040 lnINF***

The p-values for the independent variables signify how statistically significant they are in terms of influencing the housing price index. With the critical value being 0.05, only two of the four independent variables achieve statistical significance. Money supply and household income do not achieve statistical significance, as the p-values are 0.255 and 0.240 respectively. GDP and inflation, both has achieved perfect p-values of 0.000. The coefficient for money supply is 0.0853, which shows that all other variables remaining constant, a 1% increase in the money supply would result in an increase of 0.0853% in the house price index. The GDP variable has a positive coefficient of 3.126 which shows that a 1% increase in the GDP would result in a 3.126% increase in the house pricing index while a 1% increase in the household income would result in a 0.327% decrease in the house pricing index when all other variables are held constant. Concerning the inflation variable, a 1% increase in the consumer pricing index would result in the 3.040% decrease in the housing pricing index, all other variables being held constant, due to the negative coefficient.

### **Interpretation**

The variables that did not conform to expectations are the household income and money supply because of the p-values. The household income also achieved a negative coefficient, which should have a positive relationship with the house price index as well as other commodity pricing indexes within an economy. The model suits very well with the UK housing market. The r-squared value of 0.9822 or 98.22% tells that the dependant variables chosen were satisfactory and explains most of the movement of the HPI.

# **Conclusion**

The purpose of this study is to determine the variables that influence house pricing and the nature of their relationship. The house price index, and complex index that shows the average cost of purchasing a house was used to represent the house prices in the three countries. Ordinary Least Squares regression analysis was used to determine the nature of the relationship between the dependent variable (house pricing index) and the four identified independent variables (inflation, GDP, money supply and household income).

Of the three countries that have been analysed, Japan has proven that the model chosen in this paper cannot effectively account for the pricing in its housing market. This is highlighted by the fact that its coefficient of determination (r-squared) is at 24.07% with the ideal range for model suitability being above the 75% mark. Similarly, of the four independent variables, two of them (GDP and Household Income) have not achieved the desired level (p values below 0.05) of statistical significance. This shows that the country’s housing market is influenced by other entities and/or variables that have not been taken into account by this mode.

Concerning the US and UK, the model has proven generally suitable in terms of the positive f-test p values and r-squared values for the two countries. However, each of the countries has not achieved 100% suitability in terms of variable statistical significance and the coefficients meeting the expectations set by the theoretical foundations set in the literature review. As per the literature review, the money supply, GDP and household income variables should exhibit a positive relationship with the house price index while the inflation should have a negative relationship with the house price index. Of the statistically significant variables, two in Japan (GDP and Inflation) and one each in the US and the UK (money supply and household income respectively) failed to meet the hypotheses established in the literature review. Nevertheless, the results of this study revealed that different macroeconomic and financial variables affect the Housing Price Index of the respective countries in different magnitudes.

# **Recommendations**

One of the most significant outcomes of this research study has been the realization that the Japanese housing market cannot be effectively analysed using this mode. Given its suitability in the other two markets, and the theoretical background in the literature review supporting the suitability of the variables used in the mode, it is evident that the Japanese housing market is unique and has other influences not factored in this model. Further study into the Japanese market is therefore recommended to understand its unique make-up and to determine the variables that can be used to create a model that is suitable for the market. The USA and UK markets analysis has established very well fit models, however other variables can also be included to obtain even more accurate results.

.

# **Bibliography**

Adams, Z., &Füss, R. (2010). Macroeconomic determinants of international housing markets. *Journal of Housing Economics*, *19*(1), 38-50. doi:10.1016/j.jhe.2009.10.005

Asteriou, D., & Hall, S. G. (2009). *Applied econometrics: A modern approach using EViews, SPSS and Microfit* (2nd ed.). Basingstoke [u.a.: Palgrave Macmillan.

Campbell, J. and Cocco, J. (2007). How do house prices affect consumption? Evidence from micro data. *Journal of Monetary Economics*, 54(3), pp.591-621.

Capozza, D. (2002). *Determinants of real house price dynamics*. 1st ed. Cambridge MA: National Bureau of Economic Research.

Chandler, D. and Disney, R. (2014). The Housing Market in the United Kingdom: Effects of House Price Volatility on Households. *Fiscal Studies*, 35(3), pp.371-394.

Crotty, J. (2009). Structural causes of the global financial crisis: a critical assessment of the 'new financial architecture'. *Cambridge Journal of Economics*, 33(4), pp.563-580.

Economicswebinstitute.org. (2017). *Interest rates: a key concept in Economics*. [online] Available at: http://www.economicswebinstitute.org/glossary/interest.htm [Accessed 13 Feb. 2017].

Feldstein, M. (1982). Inflation, Tax Rules and the Accumulation of Residential and Nonresidential Capital. *The Scandinavian Journal of Economics*, 84(2), p.293-311.

Gallin, J. (2006). The Long-Run Relationship between House Prices and Income: Evidence from Local Housing Markets. *Real Estate Economics*, 34(3), pp.417-438.

Gomes, F., Vasconcellos, M. and Anjos, L. (2009). The use of income information of census enumeration area as a proxy for the household income in a household survey. *Population Health Metrics*, 7(1), pp. 32-64.

Guerrieri, V., Hartley, D., Hurst, E., & National Bureau of Economic Research. (2010). *Endogenous gentrification and housing price dynamics* (2nd ed.). Cambridge, MA: National Bureau of Economic Research.

Gujarati, D. N. (2012). *Basic econometrics* (4th ed.). New York: McGraw-Hill.

Hirata, H., Kose, M. A., Otrok, C., &Terrones, M. (2013). *Global House Price Fluctuations* (3rd ed.). Washington: International Monetary Fund.

Hott, C. (2009). *Banks and real estate prices* (3rd ed.). Zurich: Swiss National Bank.

Iacoviello, M., Neri, S., & Banca d'Italia. (2008). *Housing market spillovers: evidence from an estimated DSGE model* (6th ed.). Roma: Banca d'Italia.

Katrakilidis, C., &Trachanas, E. (2012). What drives housing price dynamics in Greece: New evidence from asymmetric ARDL cointegration.*Economic Modelling*, *29*(4), 1064-1069.

Kearl, J. (1979). Inflation, Mortgage, and Housing. *Journal of Political Economy*, 87(5, Part 1), pp.1115-1138.

Kupke, V. and Rossini, P. (2011). Housing affordability in Australia for first home buyers on moderate incomes. *Property Management*, 29(4), pp.357-370.

Leung, C. (2004). Macroeconomics and housing: a review of the literature. *Journal of Housing Economics*, 13(4), pp.249-267.

Lind, H. (2009). Price bubbles in housing markets. *International Journal of Housing Markets and Analysis*, 2(1), pp.78-90.

Määttänen, N. and Terviö, M. (2014). Income Distribution and Housing Prices: An Assignment Model Approach. *SSRN Electronic Journal*, 151(6), pp. 381-410.

Madsen, J. B. (2012). A behavioural model of house prices. *Journal of Economic Behaviour & Organization*, *82*(1), 21-38.

Malpezzi, S. (1999). A Simple Error Correction Model of House Prices. *Journal of Housing Economics*, 8(1), pp.27-62.

Manchester, J. (1987). Inflation and housing demand: A new perspective. *Journal of Urban Economics*, 21(1), pp.105-125.

McQuinn, K., & O'Reilly, G. (2008). Assessing the role of income and interest rates in determining house prices. *Economic Modelling*, *25*(3), 377-390.

Nielsen, S. and Sorensen, P. (1994). Inflation, Capital Taxation, and Housing: The Long Run in a Small Open Economy. *The Canadian Journal of Economics*, 27(1), p.198-217.

Shiller, R. (2007). *Understanding Recent Trends in House Prices and Home Ownership*. 1st ed. Cambridge, Mass.: National Bureau of Economic Research.

Tse, R., Ho, C. and Ganesan, S. (1999). Matching housing supply and demand: an empirical study of Hong Kong's market. *Construction Management and Economics*, 17(5), pp.625-633.

Turnovsky, S. J., &Okuyama, T. (1994). Taxes, housing, and capital accumulation in a two-sector growing economy. *Journal of Public Economics*, *53*(2), 245-267.

Wang, S., Tumbarello, P., & Wang, S. (2010). *What Drives House Prices in Australia? A+L4584 Cross-Country Approach* (2nd ed.). Washington, DC: International Monetary Fund.

Welke, G. M., & Berkeley. (2006). on the interest rate risk of housing government sponsored enterprises (6th Ed.). University of California.

Xu, X. and Chen, T. (2012). The effect of monetary policy on real estate price growth in China. *Pacific-Basin Finance Journal*, 20(1), pp.62-77.

**Appendix: OLS Results**

**Japan**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: HPI | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 03/13/17 Time: 15:21 | | |  |  |
| Sample: 1995Q1 2015Q4 | | |  |  |
| Included observations: 84 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | -1.994351 | 3.397958 | -0.586926 | 0.5589 |
| M2 | 0.091891 | 0.043335 | 2.120482 | 0.0371 |
| GDP | -0.387426 | 0.277412 | -1.396574 | 0.1665 |
| HI | 0.020834 | 0.045109 | 0.461862 | 0.6454 |
| INF | 2.270938 | 0.522848 | 4.343396 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.240682 | Mean dependent var | | 4.682163 |
| Adjusted R-squared | 0.202235 | S.D. dependent var | | 0.057602 |
| S.E. of regression | 0.051449 | Akaike info criterion | | -3.038780 |
| Sum squared resid | 0.209111 | Schwarz criterion | | -2.894089 |
| Log likelihood | 132.6288 | Hannan-Quinn criter. | | -2.980616 |
| F-statistic | 6.260168 | Durbin-Watson stat | | 0.635308 |
| Prob(F-statistic) | 0.000199 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**USA**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: HPI | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 03/13/17 Time: 15:24 | | |  |  |
| Sample: 1995Q1 2015Q4 | | |  |  |
| Included observations: 84 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | -8.148461 | 1.053197 | -7.736882 | 0.0000 |
| M2 | -0.996915 | 0.193389 | -5.154964 | 0.0000 |
| GDP | 3.447271 | 0.590863 | 5.834301 | 0.0000 |
| HI | 0.372880 | 0.729657 | 0.511035 | 0.6108 |
| INF | -2.679059 | 0.709914 | -3.773778 | 0.0003 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.930272 | Mean dependent var | | 4.867888 |
| Adjusted R-squared | 0.926742 | S.D. dependent var | | 0.268182 |
| S.E. of regression | 0.072587 | Akaike info criterion | | -2.350382 |
| Sum squared resid | 0.416241 | Schwarz criterion | | -2.205691 |
| Log likelihood | 103.7161 | Hannan-Quinn criter. | | -2.292218 |
| F-statistic | 263.4938 | Durbin-Watson stat | | 0.110155 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**UK**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: HPI | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 03/13/17 Time: 15:13 | | |  |  |
| Sample: 1995Q1 2015Q4 | | |  |  |
| Included observations: 84 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | -17.45547 | 1.614253 | -10.81334 | 0.0000 |
| M2 | 0.085321 | 0.074429 | 1.146337 | 0.2551 |
| GDP | 3.125980 | 0.229027 | 13.64895 | 0.0000 |
| HI | -0.327474 | 0.276376 | -1.184886 | 0.2396 |
| INF | -3.040003 | 0.232052 | -13.10053 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.982176 | Mean dependent var | | 6.007860 |
| Adjusted R-squared | 0.981274 | S.D. dependent var | | 0.407879 |
| S.E. of regression | 0.055816 | Akaike info criterion | | -2.875836 |
| Sum squared resid | 0.246118 | Schwarz criterion | | -2.731145 |
| Log likelihood | 125.7851 | Hannan-Quinn criter. | | -2.817671 |
| F-statistic | 1088.310 | Durbin-Watson stat | | 0.282109 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |