



ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE (APNOR)
INSTITUTO POLITÉCNICO DE BRAGANÇA

**The Impact of Tourism on the Real Estate Market: The Case of the
World's Leading Tourism Destination**

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To obtain the Master's Degree in Management, Specialisation in Business
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Supervisors:

Professor Jorge Manuel Afonso Alves

Professor Nuno Filipe Lopes Moutinho

Bragança, May 2020



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Abstract

Housing market is an important segment of real estate market and the evolution of house prices is not only related with the macroeconomic factors and construction industry factors, but also with the tourism industry factors. The purpose of this master's dissertation is to give an overview of the Portuguese housing market and determine the fundamental factors that have an influence on the housing prices. Considering the recent high growth of tourism activity in Portugal, this study analyzes if tourism has had an impact on the housing prices, in the World's Leading Tourism Destination Country. We focus on answering the following question: What is the impact of tourism on the real estate market? This research seeks to understand the main drivers of the house prices of a European country using the Engle-Granger Cointegration analysis. Using a quarterly database between 1998 and 2019 about Portugal, based on cointegration test we find a positive long run relationship between house prices and inflation rate, housing permits, construction cost, loans and tourism, while unemployment rate has a negative impact on house prices in long term. In addition, based on error correction model, we find that in the short run housing prices are determined by the factors of unemployment rate, housing permits, construction costs and loans in Portugal. In this way, we evidence that tourism only affects the house prices in Portugal in the long run and has no effects on the housing market in the short run.

Keywords: Tourism, Housing prices, Engle-Granger cointegration.

Resumo

O mercado imobiliário é um segmento importante do setor imobiliário e a evolução dos preços da habitação está relacionada não apenas com os fatores macroeconómicos e da indústria da construção, mas também com os fatores da indústria do turismo. O objetivo desta dissertação de mestrado é fornecer uma visão geral do mercado imobiliário português e determinar os fatores fundamentais que influenciaram os preços da habitação. Considerando o recente e elevado crescimento da atividade turística em Portugal, que é um dos principais países de destino turístico do mundo, este estudo analisa se o turismo teve um impacto nos preços da habitação. Com o objetivo de responder à seguinte pergunta: Qual o impacto do turismo no mercado imobiliário? Este trabalho de investigação procura perceber os principais fatores determinantes dos preços das casas de um país europeu usando a metodologia de Cointegração Engle-Granger. Utilizando uma base de dados trimestral entre 1998 e 2019, para Portugal, com base no teste de cointegração, encontramos evidência de uma relação positiva a longo prazo entre os preços da habitação e a taxa de inflação, licenças de habitação, custos de construção, empréstimos e turismo, enquanto a taxa de desemprego tem um impacto negativo nos preços da habitação em Portugal no longo prazo. Além disso, com base no modelo de correção de erros, constatamos que, a curto prazo, os preços da habitação são determinados pelos fatores de taxa de desemprego, licenças de habitação, custos de construção e empréstimos em Portugal. Deste modo, evidenciamos que o turismo afeta apenas os preços da habitação em Portugal a longo prazo e não afeta o mercado imobiliário a curto prazo.

Palavras-chave: Turismo, Preços da habitação, Cointegração Engle-Granger.

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Acronyms

ADF - Augmented Dickey-Fuller Test

ADL - Autoregressive Distributed Lag

CEE - Central and Eastern European

ECM - Error Correction Method

EEC - European Economic Community

EG - Engle-Granger

EU - European Union

GDP - Gross Domestic Product

IMF - International Monetary Fund

INE - Instituto Nacional de Estadística

nHPI - Nominal House Price Index

OECD - Organisation for Economic Co-operation and Development

OLS - Ordinary Least Square

PALOP - African Countries of Portuguese Official Language

UK - United Kingdom

UNESCO - United Nations Educational, Scientific and Cultural Organization

VAR - Vector Autoregression

VECM - Vector Error Correction Model

VIF - Variance Inflation Factor

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Introduction

Real estate prices and the economic growth of a country are very interdependent because real estate developments serve as good predictors of economic growth. The effect of the real estate market developments on growth of an economy has always attracted interest, which is because real estate development helps in creating employment, providing shelter to families, affecting income and lessening poverty (Arku & Harris, 2005; Phang, 2001). Therefore, how a specific national real estate market develops should depend on the performance of the overall domestic economy. Housing prices in Portugal are increasing during the last few years which could happen due to an increased housing demand and improved economic conditions. This evolution of house prices is also expected to be linked to the great increase of the tourist demand, mainly in the greatest cities.

Most of the previous research on the association between tourism and property prices is focused on the impact of tourism on prices of tourism-related accommodations such as hotels, apartments, cottages or holiday homes, concluding that tourism activity can either increase or decrease the housing prices or it can have no impact on the housing prices (Biagi, Brandano & Caudill, 2015). Biagi, Brandano and Lambiri (2014) refer that tourism and tourist-related activities can affect the housing prices directly and indirectly. The first impact is through the increased demand by tourists that competes with the local resident communities for land and housing in tourist destinations. The last is through the effect of recreation or leisure amenities on housing prices, such as the effect of nearby coasts and beaches.

In a research about the relationship between tourism and housing prices, Biagi et al. (2014) show that, on average, tourism has a positive impact on house prices. However, the impact of tourism differs by location due to the heterogeneity in the cities and tourism activities. In this sense, there may be areas where tourism activity has positive impact in house prices (increase house prices), other areas where the impact is negative (reduce house prices), and still others where tourism activity has no significant effect. Here we focus on the impact of tourism inflows on the housing prices. Why do we study Portugal? This country is an important tourist destination in Europe and in the world due to its diversity of landscapes, natural parks, historical, architectural, cultural and religious monuments, culinary traditions, wine regions, historical village, ports and marinas, waterways, lakes etc. In addition, tourism is an extremely significant activity for the Portuguese socio-economy and have an important contribution to annual Gross Domestic Product (GDP) and total employment (Moreira, 2018).

The main goal of the study is to investigate if an increase of the real estate prices in Portugal is induced by an increase of tourist demand, *ceteris paribus*. This study uses descriptive and inferential statistics to investigate the relationship between real estate prices and macroeconomic and construction factors (e.g. unemployment rate, inflation rate, housing permits, construction costs, loans) and tourism. The purpose of this investigation is to investigate the behavior of the economic and construction factors, and mainly the tourism flow, that affect housing prices.

In order to achieve the objective of this dissertation, an econometric analysis is conducted covering a period from the first quarter of 1998 to the second quarter of 2019 in Portugal. The period covers almost twenty years during which the Portuguese economy and the Portuguese housing market have transformed significantly. Secondary data has been used in this study which has been collected from different databases that include, Instituto Nacional de Estatística (INE), Banco de Portugal, Turismo de Portugal and the Organization for Economic Co-Operation and Development (OECD). The econometric analysis was conducted with Gretl statistical package. The empirical evidence is based mainly on the methodology developed by Engle and Granger (1987). However, two models (i.e. without tourism and with tourism) were constructed in this research, to study the impact caused by tourism on the housing prices. The Engle-Granger two-step approach is a methodology that in the first step entails Engle-Granger (EG) cointegration test and the second step contains the estimation of an Error Correction Model (ECM). As a result of the two-step approach it is possible to determine the long-term relationship between the independent variables and house prices. Additionally, the ECM enables to estimate the short-term deviation of house prices from the long-term equilibrium level. Also, the studies of Barksenius and Rundell, (2012); Barot and Yang, (2002); Toome, (2018); Xu and Tang, (2014) use ECM to show the fundamental factors that determine house prices and house price changes. The results of these studies are reviewed later in the thesis.

Using the EG cointegration methodology, we find a positive long run relationship existence between housing prices and inflation rate, housing permits, construction cost, loans and tourism, while unemployment rate has a negative impact on house prices. However, in the short run, housing prices are determined by the historical factors of unemployment rate, housing permits, construction costs and loans in Portugal. So, to sum up, tourism only affects the house prices in Portugal in the long run and has no effects on the housing market in the short run.

This dissertation mainly contributes as a research study of the Portuguese housing market. There is a lack of research done on the effect of tourism on the housing market in Portugal. Therefore, this dissertation aims to fulfil this gap and explain how the Portuguese housing market is heavily reliant on the tourism sector and foreign investments. The boom in tourism activity and the recovery in Portugal's real estate sector from 2014 onwards proves that there is a clear link between tourism and housing market in Portugal.

The framework of this study is organized as follows. Section 1 gives an elaborate overview of the relationship between economic growth and real estate prices, followed by the microeconomic and macroeconomic analysis of the real estate market. The macroeconomic and microeconomic environment of Portugal has also been included in the literature review. Data and methodology are detailed in section 2. Section 3 presents the empirical proceeds, results and discussion on the determinants of Portuguese house prices. And finally, the last section contains the conclusions.

1. Literature Review

This section presents an elaborate overview of the relationship between economic growth and real estate prices, followed by the microeconomic and macroeconomic analysis of the real estate market.

1.1. The Real Estate Market

Real estate is an important area of research because it is very closely related to the general economic cycles (Wang, 2003). Usually it is thought that real estate only concerns with selling property but that is not the case as real estate has also proven to be a very efficient tool in portfolio diversification and investments (Wang, 2003).

Like many other fields, globalization has also contributed to the integration of real estate markets around the world. Also, the interconnection and relevance of real estate with the international economy was evident from the 2007 financial crisis. A fast growth in real estate prices enhanced by excessive lending was one of the key developments in the global economy during the 2005-2007 period (Augustyniak, Laszek, Olszewski & Waszczuk, 2013).

Real estate involves the purchase, sale, and development of land, residential and non-residential buildings. The main players in the real estate market are the landlords, developers, builders, real estate agents, tenants, buyers etc. (Cortesi, 2003). It can be divided into various categories based on the type of the property i.e. residential, commercial, industrial, agricultural etc. Real estate activities are highly diverse and have strong connections with other economic sectors and services that include brokerage, counselling, appraisal, urban planning, education, management, finance etc. (Cortesi, 2003).

The residential real estate market is an important segment of the real estate market, which generates a huge share of turnover. There are three basic factors of production i.e. land, labor and capital. Out of these three factors, land contributes to different businesses by being used for production, and residential properties are not directly used for production but they support production and give people a place to live (Račka & Khalil ur Rehman, 2018). Although the terms like housing market and real estate economy are used interchangeably by the researchers but housing market is just one of the many drivers of the real estate economy. The relationship between economic growth of a country and real estate prices is interdependent, which is described in the next section.

1.1.1. Economic Growth and Real Estate Prices

Given the importance of the real estate sector, it is important to analyze the relationship between the real estate and economic growth. There are a lot of studies in this field (Goodhart & Hofmann, 2008; Groot, 2006; Łaszek et al., 2017). For instance, Groot (2006) has tried to explain this relationship based on the four phases of the economic cycle: prosperity, recession, depression

and recovery. The falling real estate prices can contribute to economic recession. The depression phase of the economic growth cycle, from the mid-point to the lowest in the economic cycle, is the period of uncontrolled deflation, a consequent drop in prices and share prices go down which leads to low economic growth. Real estate prices decline, and interest rates bottom out. The depression phase is followed by the recovery phase which leads to low inflation, slow economic growth and a gradual increase in interest rates.

Goodhart and Hofmann (2008) also found a strong short-term relationship between economic growth and housing prices. However, the relationship between economic growth and the real estate might be more complicated than classical economists or their critics have explored. In addition to the economic growth cycle, the relationship between economic growth and real estate can also be explained by the accelerating theory of investment and investment multiplier theory (Ren, 2016). The investors contribute to the growth of real estate by investing in this sector in the hopes of better returns. Wilhelmsson and Wigren (2009) did a study using cointegration analysis and found a strong mutual relationship between infrastructure investments and economic growth. Recently, Łaszek, Leszczyński and Olszewski (2017) show that the increase in construction investment leads to a revival in the local markets and creates new jobs in the real estate sector (management, repairs, financing, etc.), which has a positive effect on the economy.

Ren (2016) suggests that real estate development has contributed towards the economy since long time ago, because the real estate sector can drive many external sectors, such as construction activity, reinforced concrete industry and furniture manufacturing with a multiplier effect. Construction activity is another phenomenon with large multiplier effects. Moreover, construction activity leads to another phenomenon called industry association that relates economic growth and real estate market (Ren, 2016). The phenomenon of industry association can be explained under the light that real estate development leads to a chain effect on other related industries. Decline in other related industries influence real estate industry (Ren, 2016). For example, if real estate industry declines, the demand for construction material will also decrease which in turn will impact the whole economy.

In addition to all the above-mentioned factors, a shortage of housing supply can also have influence on the economy and lead to instability in the economy. Glossop (2008) presents three ways on how housing supply affects economic growth: labour markets, because labour mobility is affected by the lack of availability and unaffordability of housing; infrastructure, areas with high demand for housing have advanced infrastructure, while areas of low demand often have poor infrastructure (for example, transport), and; business, developed areas often have high demand which leads to an increase in wages and rent higher for business. In contrast, poor housing options make it difficult to attract people with the optimal skills.

In summary, housing market and changes in house prices affect the rest of the economy in the following ways: Consumer spending increases with increasing house prices leading to higher economic growth; similarly, falling house prices affect consumer confidence, construction and economic growth in a negative way causing economic recession; higher house prices can also

redistribute wealth within an economy – as the wealth of homeowners increases and the people with less finance cannot afford to buy properties (Pettinger, 2019).

1.2. Microeconomic Perspective of Real Estate Market

The real estate market is an interesting field of research, both at the macro and micro levels. General microeconomic theory of supply and demand is applicable for real estate markets also.

The housing market is defined as one where housing services are allocated by the mechanism of supply and demand. The demand for and supply of housing differs across countries, provinces, cities and towns. Housing prices are determined by various factors. Several dimensions contribute to the heterogeneity of houses which include space, location, standard and type of ownership, furthermore, the intentions of homebuyers' can vary from property ownership to pure financial investments (Høvring & Parmo, 2016). Adams & Füss (2010) and Égert & Mihaljek (2007) have identified the supply and demand determinants of house prices which include economic and financial indicators, such as GDP, unemployment, interest rate, credit conditions, and demographic indicators, such as population ageing, migration. While macroeconomic determinants mostly influence the capacity to pay for a house, financial costs such as interest rate and credit conditions influence mortgage accessibility.

Although interest rates, housing construction, unemployment, population and household income are significant explanatory factors for house prices (Barksenius & Rundell, 2012; Barot & Yang, 2002; Toome, 2018; Xu & Tang, 2014), what truly determines house prices are housing supply and housing demand (Høvring & Parmo, 2016). The supply factors that affect the demand and supply include the availability of land, construction activities and the local land planning system, whereas the demand factors include interest rates, inflation, wages or income, mortgage loans, population and demographic dynamics in each country (Hofmann, 2003; Stepanyan, Poghosyan & Bibolov, 2010; Tsatsaronis & Zhu, 2004; Zhu, 2005).

Notwithstanding the previously mentioned elements, location is an essential factor in determining the demand and supply of housing. For instance, you could have an extravagant recently built house available to be purchased however if it is in an unwanted area, the interest for it probably won't be high. Then again, you can have a little house available for sale that is in a decent area and the demand for it tends to be excessively high.

1.2.1. The Demand of Housing

A lot of factors influence the demand for housing market, which include, household's wealth, economic growth, general price level, the cost of borrowing, population growth, availability of credit, interest rates, and unemployment (Stepanyan et al., 2010; Tsatsaronis & Zhu, 2004). Furthermore, in the long run, housing demand is also driven by the factors like expected or permanent income, developments in the structure of the population, the user cost of holding the housing asset, and expected capital gains of owning the house (Meen, 2002).

It is also expected that the demanded quantity is not a constant but is influenced by changes in the economic conditions. Zhu (2005) mentions that property price fluctuations can react to the changes in the overall economic conditions. For instant, a positive economic change can lead to an increase in the income of households, which can cause an increased demand for new houses, which in turn can cause the house prices to rise. Selim (2009) show that the expectations of capital gains by investors through rent or selling has a positive impact on the demand for housing. However, increased demand causes high volatility in housing prices and shortage of supply since the supply of housing cannot adjust in the short run.

Additionally, shifts in the demand for housing can also be explained by demographic factors, like the population size, the number of people in the establishment phase, the migration patterns and a strong level of urbanization can aid the increased demand for housing, which in turn lead to a rise in the house prices (Bujang, Zarin, & Jumadi, 2010). However, the above-mentioned factors fail to explain why house prices vary significantly over time.

Continuing the path of demand, unemployment is another relevant factor when considering variations in the demand for houses. Theoretically, the level of unemployment is negatively correlated with the house prices. When the unemployment is high, fewer buyers exist on the market, thus leading to a decreased demand for houses. Finally, Anenberg, Hizmo, Kung and Molloy (2015) emphasize the impact of banks' lending policies. Since, most buyers depend on mortgage to buy a property, changes in the availability of credit can have a great impact on the demand for housing and the price.

1.2.2. The Supply of Housing

The law of supply as explained by the economists maintains that a large supply of something results in the prices for that something to decline. On the contrary, if the supply is restricted, the prices are expected to rise. Nevertheless, in the case of housing market, the supply of housing might rise, and it might also be in high demand, but prices might also rise. It is for this reason that the responsiveness of housing supply to changes in price has proved to be a crucial factor determining the functioning of housing markets (Haneveld, 2018).

The supply side of housing market can be unstable, inflexible, inelastic and constrained in the short-term due to the shortage of land and the time frame needed for new construction to be completed (Stepanyan et al., 2010). The inelasticity housing supply has been discussed in various studies (Adams & Füss, 2010; Høvring & Parmo, 2016; Selim, 2009), and these studies conclude that the inelasticity of supply can be adjusted relatively because new houses must be built in order to maintain a sustainable increase in housing supply. However, in the long term, the housing supply adjusts to demand, and supply turns perfectly elastic due to the increase in the housing stock as the number of new constructions rise.

So, to sum up, the supply within the housing market can be distinguished in two manners i.e. the short and long-term horizons. In the short-term, the supply of housing cannot adjust because it is

relatively stable, whereas in the long-term, due to the reasons mentioned above, the supply of housing adjusts substantially. Due to this reason, the slow adjusting housing supply causes an increase in the house prices.

Costs of construction is another leading factor in modelling the supply side of the housing market. As the costs of constructing new properties rises, the construction of new houses starts to decline because the added costs must be covered by the final consumers or buyers. This results in an increase in house prices (Xu & Tang, 2014).

Over supply and undersupply of housing are also needed to be discussed for the demand and supply considerations of the housing market. In the long run, an increase in the supply tends to bring down housing prices. Moreover, surplus of the housing supply results in construction wastage and of course has an impact on the economic aspects (Glindro et al., 2007).

1.3. Macroeconomic Analysis of Real Estate Market

On the macro level, real estate is closely related to the financial and business sector; therefore, the real estate market is an important part of any country's economic activity (Wang, 2003). It is believed that a stable macroeconomic atmosphere will lead to expansion in the real estate market (Alkali, Sipan & Razali, 2018).

There exists a multidirectional link between house prices and the macro-economy which has been proven by empirical evidences. Various economic variables such as employment, mortgage rates, interest rates and money supply can affect housing markets. Hofmann (2003) and Tsatsaronis and Zhu (2004) examine the house price determination in a number of industrialized economies, and find that economic growth, inflation, interest rates, bank lending and equity prices have significant explanatory power. Similarly, Egert and Mihajjek (2007) compared the house price determinants across eight Central and Eastern European (CEE) and 19 OECD countries, and found that the house prices in CEE countries are determined by some conventional macroeconomic factors, including GDP, interest rate, population, unemployment etc. However, different macroeconomic factors affect the housing market in various ways which are being discussed below.

Gross Domestic Product

GDP represents economic wellbeing of a country and its relationship with real estate price has been investigated widely in the past decades because activities related to real estate constitute an important portion of any country's GDP. According to Eurostat (2019), real estate amounts to approximately 10% of GDP.

The investment in residential house market is deemed to be an essential part of GDP. Egert and Mihajjek (2007) and Goodhart and Hofmann (2008) agree that a strong short-term relationship exists between housing market and GDP. A growth in GDP can lead to an increased interest in housing investments by influencing housing valuations and bank credit, thus influencing house

prices positively. However, the long-term contribution of GDP doesn't exceed the 10% of the total variation of housing price as explained by Tsatsaronis and Zhu (2004).

Additionally, Égert and Mihaljek (2007) established a strong positive relationship between GDP per capita and house prices in their research about the house price determinants across eight CEE and 19 OECD countries.

Interest Rate and Bank Lending

There is a strong interdependence of real estate prices and the financial system. Mortgage rate is the interest rate for the money borrowed from banks by people in order to buy houses. Considering that a house purchase usually requires external financing, therefore mortgage rate can be considered as an important variable that influences the decisions of individuals on whether to invest in a property. An increase in the mortgage rate prevents people from making investments in the housing market. However, Andrews (2010) has pointed out that buyers can be lured into borrowing more and buying more expensive houses by the governments by granting tax relief on mortgage interest payments.

Furthermore, the mortgage interest rates, and bank lending decisions can be affected by various factors that include the monetary policies and the property's current market value (Goodhart & Hofmann, 2008). Finally, an increase in the availability of bank lending can result in lower interest rates, which can cause an increase in the property prices (Hofmann, 2003).

Inflation

Inflation is another factor that can contribute to a decrease in housing demand because when the prices are high, people tend to invest less in real estate. Bernardi and Rodenholm (2013) have distinguished inflation into two ways i.e. expected or unexpected. If the inflation is expected, precautions can be taken to prevent financial losses. On the contrary, if the inflation is unexpected, it can result in financial losses for the investors while certain groups can take advantage of the unexpected increase in prices.

The interdependence of real estate and inflation can also be seen through the increase of the cost of construction and increase in the money supply. Both factors cause an increase in the real estate prices (Alkali et al., 2018). Finally, the bank lending decisions can also be influenced by inflation, as lower inflation results in lower interest rates, hence bigger loans can be lent to the households.

Population

Demographic factors are an important feature in determining house prices (Égert & Mihaljek, 2007). The demand in the real estate market can be influenced by different demographic conditions, including population growth by migration flows (short-run) and new births (long-run). In the short-run, migration flows result in an increase in the population which in turn has an impact on the house prices. However, in the long-run, an increase in the population resulting from the

new babies being born causes a rise in the demand for houses twenty years later (Panagiotidis & Printzis, 2016).

Unemployment

The unemployment rate can have both a direct and an indirect effect on the housing prices (Gan and Zhang, 2013). Directly, from the demand side, unemployed population fails to get a mortgage from the banks due to financial constraints, thus reducing the number of buyers in the market. From the supply side, when the unemployment rate increases, people hesitate to make new housing investments due to the fear of being unemployed in the future, thus the number of buyers in the housing market decreases simultaneously. As a result, the number of sellers decreases as well. As for the indirect effect, unemployment affects prices through the expectation channel. A rise in the unemployment rate lowers a household's expected future income, which in turn makes the households from making any investments in the housing market. On the contrary, when the unemployment rate decreases, people are more certain about future income, which have a positive impact in the demand for housing. So, it is expected that the house prices also increase. Furthermore, Gan and Zhang (2013) have also explained how the impact of unemployment on the housing market can be amplified because of some characteristic features (e.g., down-payment requirement, search friction and heterogeneity) of the housing market.

1.3.1. Macroeconomic Environment in Portugal

The Portuguese economy has faced many increases and decreases in the economic growth in the last two decades. The performance of the Portuguese economy between 2000 and 2012 was among the worst on record in an advanced economy. After entering the eurozone, the period between the years 2000-2007 proved to be quite unfortunate, followed by the global great recession and the Eurozone crisis (Morais, 2018). The effects of the crisis were seen globally, as the grown economies started to enter in recession and emerging economies started to slow down. Similarly, the crisis hit Portugal in the year 2008 (Cardoso, 2015). The GDP growth of Portugal for that period stopped as low as 0%, being only 0.20%. Due to this, the inflation value rose to 2.59% caused by the increase of the oil prices in that period.

In 2011, the GDP of Portugal dropped by 1.83% and the inflation rose to 3.65% due to the severe financial crisis (Cardoso, 2015). Faced by these difficult economic conditions, Portugal had to plead for external help. The situation continued in the following years as the unemployment rate rose as high as 16.2% in 2013, meanwhile, faced by high inflation and long-term unemployment, over 200,000 Portuguese people emigrated over the 2011-2014 period (Morais, 2018).

Nevertheless, the economic conditions in Portugal began to improve by the year 2014 after facing a downfall in the previous five years (OECD, 2019). The progress in the economic conditions became evident in the mid-2016. Consequently, Portugal managed to improve its growth by 2.7% in 2017, which was recorded highest of the century. In the following year 2018, Portugal managed

to expand its GDP (2.3%) back to its pre-crisis level, as estimated by the International Monetary Fund (IMF) (OECD, 2019).

As mentioned above, the high unemployment rate worsened the economic conditions, however, in 2018, it stabilized and dropped below 7%, followed by a further decrease in 2019 (6.3%) (OECD, 2019). This improvement in the unemployment rate has also resulted in lesser outward migration of Portuguese people (Puig & Sánchez, 2018). Although, the economic conditions have developed at a great pace in this decade, the minimum wage in Portugal remains low compared to the European Union (EU), being around €675 per month on a 12-months basis (since it is paid 14 times a year).

In addition, real estate investment has also shown an increase after declining each year between 2009 and 2013, and housing investment in both the new and existing dwelling has also risen (OECD, 2019). Tourism sector has also played a significant role in causing an increase in the housing demand and the prices in some locations, as more foreigners are investing in Portugal now (Banco de Portugal, 2018).

Nevertheless, according to an OECD economic survey (OECD, 2019), the effects of the crisis are remaining. Although the economic conditions of Portugal have recovered after the crisis, the growth is still low as compared to other OECD countries. The poverty rate of the working age population still high, and the public debt which has resulted both from growth in public debt and from the growth in household indebtedness, is still around 121.1% of GDP in 2018. According to Araújo, Lourenço and Pereira (2016), the Portuguese economy will improve at a moderate rate in the next decade and still these improved growth rates are forecasted to be inferior to those observed after Portugal joined the European Economic Community (EEC).

1.3.2. Demographics of Portugal

The real estate market is sensitive to changes in the social, demographic, political, and economic environment (Raçka, 2017). Portugal has been facing a decrease in the total population after 2010, owing to the declining birth rates, low fertility, migration flows and an ageing population, and immigration is unable to balance the losses (Albuquerque, 2015). Net migration could contribute to the increase in population size, but it has been decreasing since 2010.

According to a press release by INE (2014), the population in Portugal has been declining due to various reasons that include an increase in life expectancy, a decrease in infant mortality, increased emigration, the sharp decline in fertility and an ageing population. According to the last census carried out in 2011, Portugal exhibited a demographic growth of 1.4% in that decade and had a population of 10.5 million inhabitants. However, the population declined to 10.3 million inhabitants in 2018 mainly due to emigration and the sharp decline in birth rate. Further projections made by the INE, forecast that the population of Portugal is expected to decline by about 4.5% between 2016 and 2030. Additionally, by 2060, the population of Portugal will decline from the current 10.4 to 8.6 million residents.

According to the 2016 data from The World Bank (2019), 34% of the population lives in rural areas away from the cities and 62.2% of the population lives in cities or urban areas. However, in the past, 65% of residents lived in rural areas in 1960 (World Population Review, 2020). Migration to the larger cities because of higher education institutions, industrial opportunities, healthcare and other benefits, combined with continued growth and expansion of cities is leading to the increase in urban population (World Population Review, 2020).

Nowadays, Portugal has a wider variety of overseas population than in the past. The increase of the foreign populations in Portugal has occurred in three different phases as explained by Norte, Mortágua, Rosa, Silva and Santos (2004). Initially (mid 70's), the increase was due to the immigration from Portuguese Speaking African Countries (PALOP): Angola, Cape Verde, Guinea-Bissau, S. Tome and Principe and Mozambique) after decolonization. Afterwards, immigrants from other nationalities joined: in the 80's, mainly from Brazil and Asia (particularly Chinese, Indians and Pakistanis); in the latest years (since 2000), from Eastern European countries (especially from Ukraine, Moldova, Russia and Romania).

According to the 2011 census, the overseas population represented the 3.7% of the total Portuguese population, majority of which lives in the southern part of the country (INE, 2012). In terms of regions, 12% population of Algarve comprises of foreigners followed by Lisbon (7%) and Alentejo (3%). In Portugal, according to the government's program, housing is an important aspect of economic, occupational and social integration of the immigrants. Portugal has set equal income and housing requirements for all its residents alike, which proves that Portugal is a country that believes in giving the same rights to the foreign citizens as it gives to the national residents (Leilani, 2017).

1.4. Tourism Effect on the Real Estate Prices

1.4.1. Contribution of Tourism in the Economy

Tourism is regarded as an important economic activity for developed or developing countries. Tourism sector has been gaining importance due to its certain positive effects on the economy i.e. tourism increases foreign exchange earnings, gives rise to economies of scale, increases international trade, creates new jobs, supports infrastructure development, protects cultural heritage and boosts national income as a whole. Thus, it has positive impacts on economic growth (Alhowaish, 2016; Bal, Akça & Bayraktar, 2016).

In addition to its direct economic impact, the tourism industry has significant indirect and induced impacts on the economy (World Travel and Tourism Council, 2018). The direct contribution of tourism includes the total spending within a country on tourism by residents and non-residents for business and leisure purposes. It also includes the spending by government on tourism services directly linked to visitors, such as cultural (e.g. museums) or recreational (e.g. national parks). The indirect contribution includes the GDP and jobs supported by the government or private businesses dealing directly with tourists including, e.g. purchases of food and cleaning services

by hotels, of fuel and catering services by airlines, and services by travel agencies. The 'induced' contribution measures the GDP and jobs supported by the spending of those who are directly or indirectly employed by the tourism industry (see Figure 1).

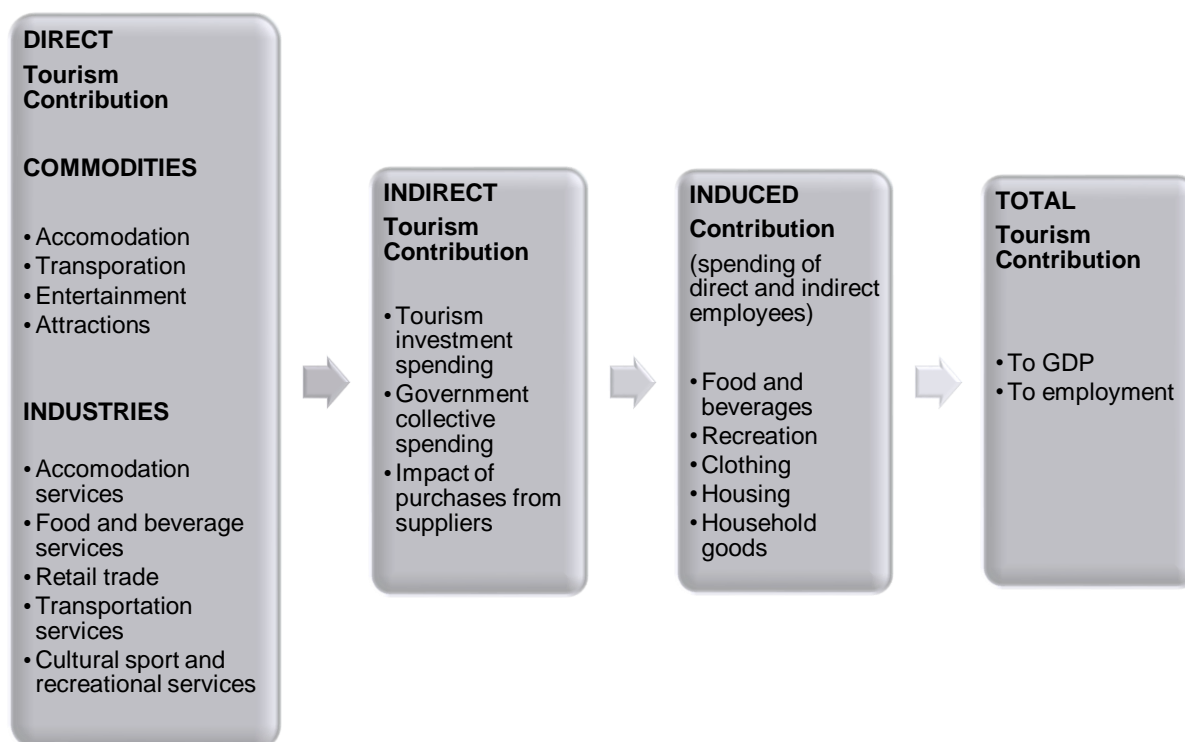


Figure 1. Economic contribution of tourism.

Source: World Travel and Tourism Council (2018, p.2).

Alhawaish (2016) summarizes a few reasons for tourism to be a positive long-run factor in the economic growth of a country. These reasons are as follows: tourism improves the foreign exchange earnings of a country; tourism facilitates the use of valuable resources of a country e.g. cultural, natural and traditional; tourism increases the employment opportunities in tourist destinations; tourism promotes developments in the infrastructure of a country, beneficial for both tourists and residents; tourism can enhance the new technological and managerial skills of an economy; and tourism sector also promotes positive linkages with other sectors of the economy (e.g., agriculture, manufacturing, and other service industries).

1.4.2. Tourism in Portugal

In his study about the 50 years long history of the evolution of tourism in Portugal, Moreira (2018) has explained how tourism industry in Portugal has undergone various changes in order to increase the tourism demand, internationalization and increase the competitiveness of the destination. Also, many of Portugal's tourist attractions have won global awards e.g. UNESCO's World Heritage List. The development of the tourism sector started in the 1960s with the construction of the main national airports and the implementation of the tourism development plans, in terms of high-end products and luxury first-class hotels. In the 1970s, investments in

southern tourist destinations such as the Algarve, Madeira and Tróia were made and tourist complexes were inaugurated. It was in the 1970s that businessmen started to get involved by setting up travel agencies, hotels, restaurants etc. It was in the 1980s that national and regional tourism started gaining popularity. The entry of Portugal in the EEC also increased tourism growth. In the 1990s various steps were taken to promote tourism in Portugal that included investment in road infrastructure, demographic and economic development, diversification of the accommodation etc. Distinctive event venues were built to attract and promote in international cultural, social and sporting events. The 2000s have been characterized as the improvement and diversification of the housing sector. This century has also given rise to the concept of entrepreneurship for small and medium-sized investors. Various departments and officials have been appointed to set policies and strategies for tourism in the medium and long run. Furthermore, the importance of tourism has also been recognized socially as well as politically. Finally, it is concluded that during this period the tourism has contributed significantly to driving Portugal's social restructuring, cultural transformation and economic development.

Several factors have contributed to the rise of tourism and internationalization of Portugal over the last two decades, which are enlisted below (Moreira, 2018).

- The creation of the national airline (TAP) in 1945, building of international airports along with the introduction of low-cost airlines have contributed to the growth of tourist demand.
- Planning of big international events e.g. World Trade Fair - Expo'98, International Cascais Jazz Fest, Web Summit etc.
- Three Portuguese cities have won the title of European Cultural Capitals so far: Lisbon in 1994, Porto in 2001 and Guimarães in 2011.
- Significant investment in national and international promotional campaigns such as Portugal feel free (1974); Going to Portugal (1976); Take a break (2003); Europe's West Coast (2007-2009); Can't Skip Portugal (2017). These campaigns have played a vital role in enhancing the image, identity, values and reputation of Portugal.
- Domestic tourism has also been promoted over the decades, and various campaigns were planned to increase its demand e.g. Descubra um Portugal maior (Discover a greater Portugal - 2009); Escolha Portugal: um país que vale por mil (Choose Portugal, a country worth a thousand - 2011); Ponha Portugal no mapa (Put Portugal on the map - 2016).
- Portugal also has a competitive advantage of its location, its long coastline and the existence of seaports that help to promote it as a nautical tourism destination and attract tourists for activities like surfing, cruise tourism etc.

In addition, Portugal has won 24 awards in 2016 and a lot of Portuguese tourist enterprises also won awards in that year. For example, Turismo de Portugal was awarded as the Europe's Leading Tourist Board; Lisbon was considered Europe's Leading Cruise Destination and Lisbon's Port as Europe's Leading Cruise Port; the Algarve was awarded as Europe's Leading Beach Destination; Madeira as Europe's Leading Island Destination. Passadiços do Paiva (Arouca UNESCO Global

Geopark) was deemed Europe's Leading Tourism Development Project in 2016 and in 2017 (Moreira, 2018). In 2018, Portugal was placed at the 17th position in the ranking of the countries worldwide which received the greatest number of tourists (UNWTO, 2019).

1.4.3. Effect of Tourism on the Portuguese Economy

Tourism is an important economic activity in most countries around the world. The Portuguese economy has improved drastically since the crash in 2009 and tourism has contributed a lot on the road to this recovery (Fedynsky, 2019). In 2016, tourism accounted for 6.4% of Portugal's GDP, followed by 6.8% in 2017. This contribution constitutes the economic activity generated by the tourism related industries such as hotels, travel agents, airlines, transportation services, restaurants and leisure industries. Additionally, in 2016, direct employment in tourism was about 8.1% of total employment, followed by 8.5% of total employment in 2017 (World Travel and Tourism Council, 2018). In 2018, tourism sector employed 1.05 million people i.e. 21.8% of the total employment (World Travel and Tourism Council, 2019). This includes employment by the industries mentioned above that include hotels, travel agents, airlines, transportation services, restaurants and leisure industries directed for tourists.

In 2017, Portugal won the top destination spot in the World Travel Awards, due to a huge increase of 12% (12.7 million) in the number of foreign tourists. Including domestic tourists, the total is about 21 million (Bugge, 2018). In 2018, according to the statistics released by the INE (2019), Portugal attracted a total of 22.8 million tourists, and the tourism sector recorded a highest tourism growth rate across the EU as it grew by 8.1%. Portugal's tourism industry brought in 38.4 billion euros in revenue and it is the largest employer with direct and indirect jobs. Out of the total incoming tourists in 2018, leisure travelers made up 85% of visitors and business travelers accounted for 15% of the total visitors and in terms of international and domestic visitors, 69% of tourists came from abroad and 31% were domestic (Fedynsky, 2019). This growth in the tourism activity can be attributed to the governments Tourism Strategy 2027, which is a ten-year plan aimed at increasing the revenue generated by tourism sector and overnight stays in the country. However, as part of the Tourism Strategy 2027, the government of Portugal has prioritized diversification which aims to pursue policy settings that promote the growth of other export sectors in the economy outside of tourism (Fedynsky, 2019).

Bento (2016) investigated the causal link between tourism and economic growth in Portugal during the period of 1995 to 2015 by distinguishing between domestic and international tourist arrivals. He examined the hypothesis of how and to what extent tourism drives economic growth in Portugal by using econometric models. He applied cointegration and causality tests and concluded that tourism-led growth hypothesis is valid for the Portuguese economy. His findings demonstrate that there exists a positive causal link between tourism and economic growth, as well as amongst domestic tourists and economic growth. So, his findings confirmed that policy makers should pay attention to not only to foreign tourists, but all domestic tourists as well. Therefore, this study confirms that tourism is an important source of economic growth in Portugal.

Figure 2 shows the evolution of the number of tourists in Portugal, that is based on the number of foreign guests and overnight stays in Portugal. This number has been progressively rising since 1998. The higher and lower values each year represent the effect of seasonality in tourism activity, as the number of guests increase in summers and decrease in winters. Currently in Portugal, the main origins of international tourist demand are European: The United Kingdom (UK), Germany, Spain, France and the Netherlands (Moreira, 2018).

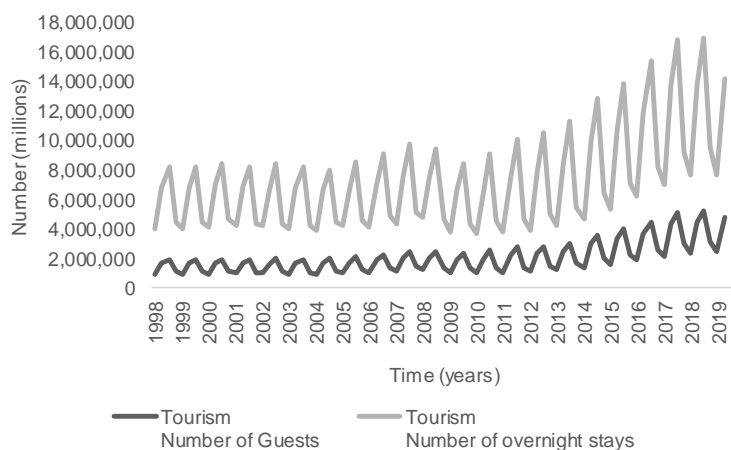


Figure 2. Number of guests and overnight stays in Portugal, 1998 – 2019.

Source: Author's own elaboration.

Additionally, people from all over the world are attracted to Portugal because of the real estate investment opportunities and because of the golden visa, which is a special residence permit for foreigners (acquired through investment activity in Portuguese territory), created in 2012 (CBRE, 2018). It is important to consider that the southern part of the country, especially the Algarve region, and the rural areas of the Centre and North of Portugal have also been popular among retirees from northern and central Europe for decades (Moreira, 2018). Also, the sector of medical tourism is also expanding because of the foreigners seeking health care and rehabilitation in Portugal (Moreira, 2018). Finally, due to the development of real estate and tourism, the capital of the country, Lisbon, is also being developed at a rapid pace as plenty of houses and buildings are being renovated and, as a result, the old and traditional capital of Europe's western edge is becoming more modern (Luo, 2018).

1.5. Residential Market in Portugal

Portugal entered the EU in 1986 and changed its currency to Euro in 1999, which contribute to the elimination of the exchange risk in relation to other member states. This membership proved to be beneficial for Portugal as it led to a decrease in interest rates and stabilization of its inflation (Tavares, Pereira and Moreira, 2014). As expected, the low interest rates increased the demand

of mortgage loans. According to Lourenço and Rodrigues (2014), between 1985 and 1998 house prices rose about 1% a year in Portugal. Between 1999 and 2006, a zero-annual growth in house prices was recorded. Until the beginning of the financial crisis in 2007, the housing prices in Portugal grew on average less than 1% per year. Followed by 4% decline on average per year between 2007 and 2013. In recent years, the housing prices in Portugal have been increasing by 4% on average per year since its lowest level in 2013 (Lourenço & Rodrigues, 2017).

Recently, house prices in Portugal have been increasing when compared with the period between the 1990s and the early 2000s. However, Lourenço and Rodrigues (2017) have observed that the Portuguese housing prices are greatly influenced by the country economic growth and interest rates, which reached extremely low values between the period of 2011 and 2017, and also conclude that if the Portuguese economic evolution continued on this path, the increase in the house prices will be quite high consequently.

As mentioned above, over the past few years there has been a constant rise in the prices of the residential real estate market, in nominal and real terms. Therefore, new loans continue to grow strongly whereas the outstanding amounts of housing loans have shown a slight fall resulting in a decline in the household indebtedness levels following the crisis (Banco de Portugal, 2018).

About the demand and supply of houses in Portugal, Brás (2018) explains that the evolution of housing demand can be explained through the number of transactions of housing units, credit conditions and interest rates. So, Figure 3 shows the absolute number of house transactions which, on average, increase since around 2013, showing significantly higher values in 2018 than in 2009. Similarly, Figure 4 shows that interest rates have reached quite low values recently. With lower interest rates it is expected that the amount of loans will increase as the demand will go up, leading to a subsequent increase in house prices.

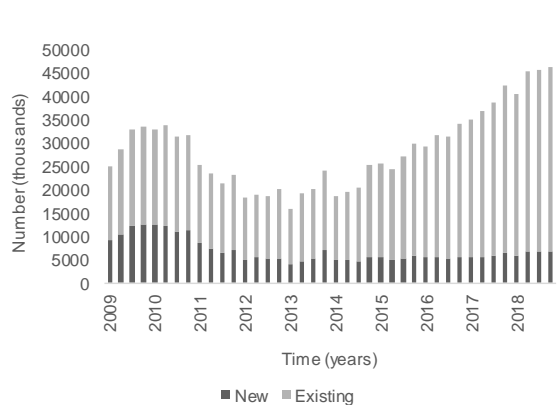


Figure 3. Number of transactions of housing units.

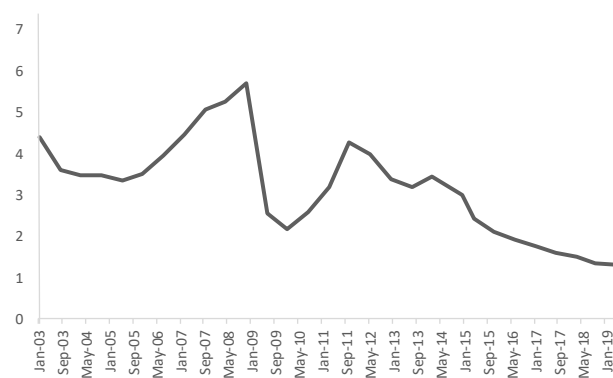


Figure 4. Interest rates on new loans to households.

Source: Author's own elaboration using data from Bank of Portugal.

Figure 5 presents the supply of housing in Portugal in terms of the building permits issued and the completion of the properties. It can be seen that since 2005 there has been a negative trend in supply with a gradual decrease observed both in building permits and completions. According

to the graph, the supply kept on decreasing until recent years, reaching its lowest in 2014. However, the supply stabilized between 2014 and 2016 and has been showing a slow increase since then (Monteiro, 2018).

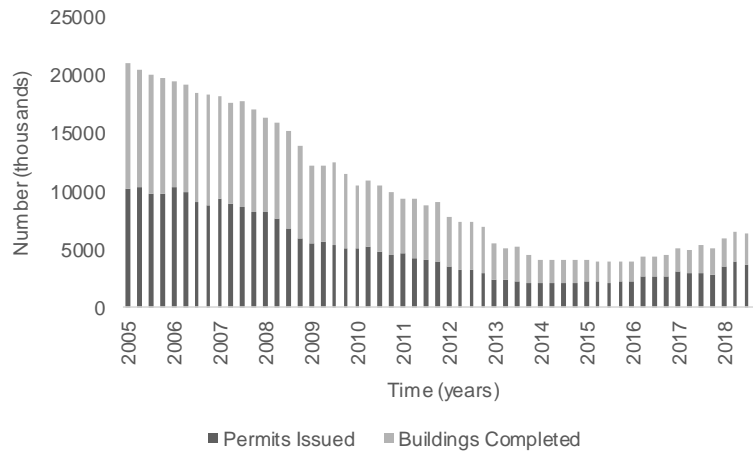


Figure 5. Building permits and completions.

Source: Author’s own elaboration using data from Bank of Portugal.

In terms of the how different macroeconomic factors influence the housing market, several studies have been done in Portugal. Tavares, Pereira and Moreira (2014) study the Portuguese residential real estate market in the decade of 2001 – 2011, in terms of the average house prices by its locations and typologies, and also considered the importance of several macroeconomic indicators (which included GDP, interest rates, construction confidence index, unemployment) and they find that loans, interest rate and unemployment rate exhibit a negative relationship with the house prices, while GDP and the construction confidence index exhibit a positive relation. Besides, the models used by Lourenço and Rodrigues (2014) show that the real disposable income, labour and real interest rates are positively significant in determining the dynamics of house prices in Portugal. In another study, Lourenço and Rodrigues (2017) used multiple regression analysis to study the factors that affected house prices during the crisis and the post crisis periods (2007-2011) in Portugal, and concluded that housing loans increased from 25% in the mid-1990s to almost 90% by the end of 2007 due to low interest rates and higher disposable income, without causing any impact on the house prices. Afterwards, in the first two years of the financial crisis, interest rates showed drastic changes by spiking in 2008 and bottoming in 2009. However, in the more recent period i.e. 2011-2017, lower values of interest rates have been recorded leading to increased demand and consequently higher prices.

Furthermore, the construction industry in Portugal is considered the engine of the economy and the housing market is an essential part of this industry. The President of Associação dos

Industriais da Construção Civil e Obras Públicas (AICCOPN)¹, refers that the crisis in the economy is directly linked to the crisis in the construction industry because the industry (be it housing or public works) is one of the main drivers behind the economic recovery (Pinto, 2014).

Finally, in last year's short-term rental business is another aspect of Portuguese real estate market and in turn another driver of the Portuguese economy. Portugal and its cities are popular tourist destinations because of its mild climate, beautiful beaches and its cultural and historical heritage. As a result of increased tourism, the emergence of short-term rental properties in the city center is inevitable. These rental properties are mostly located in the competitive locations of each touristic city, due to which this accommodation option is popular among the tourists (Leilani, 2017). Because foreign investors buy houses as an investment, and most of them do not stay in Portugal for a longer period, so they opt for renting their properties as Airbnb or by other means.

1.5.1. Affordable Housing in Portugal

Considering that affordable housing of a good quality is a fundamental need and right. In real estate terms, affordability is defined by the ratio of housing costs to income. The demand for affordable homes increased after the crisis because of its direct impact on the unemployment rate and inflation. Housing affordability can be a problem for people with low incomes and for the unemployed population, especially young adults, single-parent families, and the elderly.

Cardoso (2015, p. 17) states that "in terms of consuming goods, in Portugal, being the owner of a house is perceived as a great sensation that is timeless". In Portugal, owning a house is an absolute need, and the one who do not buy a house in Portugal mainly have financial problems, lack of property availability, or some lifestyle opportunity (someone is about to dislocate or enlarge family). The option of social housing can also be availed by the middle/lower class population, however, if the households cannot access the social housing or private rental sector, they choose to buy houses with the support of family and community.

Tavares, Pereira and Moreira (2014) analyzed the differences in the house prices across municipalities in Portugal using the income approach, and conclude that property rates and market values differ not only within the two largest main cities in Portugal, Lisbon and Oporto, but also between the two. They also concluded that the unit house prices (€/sqm) are also different among the different types of housing, in which T1 houses are the most expensive, followed by the T5, T4, T2 and, finally, T3 houses.

Furthermore, the Portuguese housing system consists of the social and private rental markets. The social housing sector is assigned for the very poor population of the country and constitutes only 3% share of the housing stock, whilst the private rental sector represents a total of 20% of the housing stock (Alves & Andersen, 2015). Sometimes due to the lack of availability in the social housing sector and the long waiting list, many poor households have to choose for private rental

¹ AICCOPN is the Association of the Industrial Construction and Public Constructions.

properties located in the least desired neighborhoods (Alves & Andersen, 2015). This situation is mostly common for most vulnerable populations like persons of African descent, persons with disabilities, and single parents. These populations have no option but to rent cheaper (yet not always affordable) housing units on the private market with no basic facilities or to stay in the informal settlements in the poor conditions. Similarly, according to a report by Human Rights Council (2017), due to the high rates of unemployment and the lack of affordable and decent housing after the financial crisis, the number of homeless populations in Portugal has increased, with more young adults facing homelessness than in past decades. Porto is believed to have more homeless people than Lisbon (Leilani, 2017).

One of the main reasons behind the lack of affordable homes in Portugal is also investments by the foreigners. Foreign consumers buy and resell houses at higher prices with the intentions of making profits from each transaction (Luo, 2018). As a result, an increase in the number of purchases lead to an increase in the number of transactions made in the market, which causes the house prices to rise as an outcome. Finally, the business of short-term rentals in Portugal is also causing a loss in the real estate market and as a result in the economy (Leilani, 2017). The report by Human Rights Council (2017) conclude that long-term rentals should be promoted as an alternative means of access to affordable housing and the government should strictly monitor and regulate the short-term rentals targeting the tourist sector to ensure that they do not negatively impact the affordability of housing.

While the economic conditions of the country are on the road to recovery, at the end of 2019 many long-term challenges that directly influence the access to affordable housing remain, e.g. unemployment, low wages, and an overall high risk of poverty (Leilani, 2017). Luo (2018) has explained that the housing prices in Portugal keep going up with low interest rates, Although it is helpful for the economic recovery, the houses should also be equipped with the relevant facilities in response to the growing prices, otherwise, it might lead to the next crisis in the housing market.

1.5.2. Housing Finance in Portugal

The real estate market is an important link between the financial system and the non-financial sector (Banco de Portugal, 2018). Real estate assets (e.g. houses) are lifelong investments that can be used as collateral to guarantee bank loans (Monteiro, 2018). In Portugal, the acquisitions of residential properties require mortgage-backed loan contracts (Menéndez & Carvalho, 2010). These contracts of bank loans must always be set out in writing. In this type of financing, interest is calculated in general on a daily basis, with reference to a 30-day month and a 360-day year.

According to the Guide to property investment in Portugal (Menéndez & Carvalho, 2010, p. 61), “A mortgage is in rem guarantee. It entitles the creditor to enforce its rights against a property with priority over other creditors of the owner of the property who do not enjoy any special privilege or priority in terms of registration”. The maximum amount of mortgage loan lent to the borrower includes the amount of principal, interest and costs associated with its execution. Regarding interests, according to the Portuguese Civil Code, a mortgage only covers up to three years of

interest (both loan interest and default interest). The following assets and rights may be mortgaged: property ownership; surface rights and a share in an item or a shared right (e.g., an undivided share of the co-ownership of assets).

According to the Financial Stability Report (Banco de Portugal, 2018), price over/undervaluation in the housing market should be evaluated with the help of economic fundamentals that explain the supply and demand on this market. These fundamentals include developments in income, interest rates and housing supply. Several methods have been used to estimate the existence of price over/ undervaluation in the residential real estate market, as this is not directly visible.

Tavares et al. (2014) have explained that in the beginning of this century, the finance required for housing acquisitions became expensive and less accessible to the Portuguese population leading to a drop in the annual growth rate of housing loans. They have also pointed out the key factors responsible for the reduction in the housing and individual loans which are as follows: a less favorable perception of risk; higher funding costs; a decline in consumer confidence; and the reduced activity in the housing market.

However, as explained in the previous sections, recently the interest rates in Portugal have been decreasing which leads to the expectations that the amount of acquired loans will eventually increase due to lower borrowing costs (Monteiro, 2018). But this will have further impact on the prices, as the demand for the residential properties will go up, the prices will also go high subsequently.

1.5.3. Housing Investment in Portugal

According to a report from Business Insider (2019), Portugal is regarded as 17th country on the ratings where expatriates live the happiest lives. Moreover, it ranks in the top 5 “dream destination” for the expatriates (Brinded, 2017). The influx of expats in Portugal plays a very important role in improving the Portuguese economy. In the recent years, the investment sector of the Portuguese residential market has been extremely influenced by the country’s unfavorable economic performance. Lourenço and Rodrigues (2014) have done a comparison between Portugal and Spain’s residential investment sectors, and have explained that the downfall of the residential investment in Portugal started in the end of the 90’s, and then residential investment fell at an annual average rate of about 12%, between 2007 and 2013, in Portugal. However, since 2014 there has been an improvement in residential investment and in GDP, both increasing by 2% on average per year. And their models also displayed that the real disposable income, labour and real interest rates are relevant in determining the changing aspects of house prices.

In addition to the investments by the Portuguese population, Portugal is a very attractive country with regards to the foreign investment as well (Luo, 2018). Since, the average salary in Portugal is low, the local Portuguese cannot afford to buy property at the current high prices caused by the international investment, similarly the cost of living is also quite low compared to other European countries (Luo, 2018). Therefore, these residential estate prices and cheap life expenditure are

suitable for foreign investors while unaffordable for the native citizens due to comparatively lower salaries.

The rise in the foreign investment in the residential market can also be attributed to the fact that Portugal has become one of the preferred touristic destinations in the Europe. This increased tourism has led to an increase in investments in new hotels and resident projects for short-term leases and rents. Similarly, the introduction of programs like 'Golden Visa' and the 'Tax Regime of the Resident Status' has also stimulated housing investment by the non-residents in Portugal since the 1990s. The golden visa programme gives foreign investors the possibility of obtaining a Portuguese visa with a minimum of €350,000 investment in real estate, and the non-frequent resident tax regime allows for a 20% taxation on income. The housing investment by non-residents slowed down after the 2011 sovereign debt crisis, but it began to accelerate again since 2014, growing 9% on average per year (Lourenço & Rodrigues, 2017). Foreign investors and home buyers like golden visa holders have also contributed to get out of the debt crisis.

"The World's Best Places To Retire In 2020" (2020) publish that Portugal is in the first place of their latest annual overseas retirement index ranking, and Algarve won the first place of the global ranking in 2018. Algarve is the preferred location for foreign investors who intend to buy a second house. The increase of foreign investment has led to higher average prices of T1 and T2 apartments in Algarve region, which can be explained by the diversified origin of the properties' owners: 41.90% from UK, 19.88% from Portugal, 11.01% from Ireland, 8.26% from Spain, 5.20% from France, and 4.59% from Netherlands (Tavares et al., 2014).

2. Methodology

This section presents the methodology used to answer the main objectives of this dissertation.

2.1. Research Methodology

The empirical study is based on the methodology developed by Engle and Granger (1987). The Engle-Granger (EG) two-step approach is a methodology that consists of two steps. The first step involves EG cointegration test which outlines that if two or more economic variables are cointegrated, analyzing a long run equilibrium relationship, and in the second step, the residuals from the regression are used for the estimation of an ECM.

The cointegration approach and ECM have been widely used in the previous studies in order to analyze the properties of housing prices and to examine the relationship between the housing prices and its determinants. Some of the researchers that have previously applied the EG two-step method in their studies are Barot and Yang (2002), Barksenius and Rundell (2012), Xu and Tang (2014) and Toome (2018). These studies evidence that this method is used to find which factors determine housing prices and housing price changes.

There are lot of investigation about the interaction between macroeconomic variables and housing prices. Table 1 presents a summary of studies that have applied EG method to study the housing markets during the past few years.

Table 1. Previous studies that use Engle-Granger method.

Authors	Country	Time Series	Methodology	Dependent Variable	Independent Variables
Barot and Yang (2004)	Sweden and UK	1970 – 1998 (Quarterly) 28 years	ECM - Integration - Cointegration - Autoregressive distributed lag (ADL)	Real house price	Real personal disposable income, Personal sector financial wealth, Household total debt / Mortgage, Consumer expenditure deflator, Interest rate, Unemployment rate, Population, User cost and the 1991-year tax reform dummy, Number of owner-occupied dwellings / housing stock.
Rundell and Barksenius (2012)	Sweden	1987 – 2011 (Quarterly) 24 Years	ECM - Augmented Dickey-Fuller (ADF) test - Cointegration - Autocorrelation tests	Real estate price index	Bank average interest rate, Long government rate, Disposable income, Financial wealth, Construction cost, Unemployment, GDP, CPIF (inflation), Money supply.
Xu and Tang (2014)	UK	1971 – 2012 (Quarterly) 41 years	EG two-step - Unit root test - Cointegration test - Error correction model	Nominal house prices	Construction cost, Credit, Real GDP, Household disposable income, Interest rate, Money supply, Unemployment rate.
Toome (2018)	Germany	1989 – 2017 (Quarterly) 28 years	EG two-step - Stationarity test - Cointegration test - Autocorrelation test	Real house price	Real long-term interest rate, Real construction cost, Population, Real disposable income, Unemployment rate, Real money supply M3, Housing permits

Source: Author's own elaboration.

Barot and Yang (2002) use the ECM with quarterly data from 1970 to 1998 to estimate the relations between housing price and housing investment in Sweden and UK. Based on the Tobin's q investment theory which is often adopted in order to model the long-term changes in the housing stock, these authors find that Tobin's q was an important determining factor of housing investment in both countries (in the short it is only important in UK, while in the long run it's significant for both the countries), and that household mortgage debt causes the increase of prices, as increased lending increases demand for housing. The change in debt affects prices more in the UK than in Sweden. In addition, increases in both nominal and real interest rate drives prices downwards in the short and long run.

Rundell and Barksenius (2012) use quarterly data and applied the ECM to study the determinants of nominal real estate prices in Sweden between 1987 and 2011, and they conclude that bank lending rate, financial wealth, disposable income, unemployment and money supply are significant factors in determining the real estate prices in the short and long run.

Xu and Tang (2014) study the determinants of UK housing prices with the EG two step approach, i.e. cointegration and an error correction model, using quarterly data in the period between 1971 and 2012. Through cointegration test they conclude that construction costs, credit, GDP and unemployment rate have a positive association with the housing prices, in contrast disposable income and money supply have an inverse association with the housing prices. By applying the error correction model, they identified that in the short-term the growth in housing prices is affected by the growth of construction costs, credit, interest rates and disposable income.

Toome (2018) also examined the determinants of housing prices in real estate market cycles in Germany using the EG two-step approach for quarterly data in the period between 1989 and 2017, and evidence that factors such as real long-term interest rate, real construction costs, real disposable income and unemployment rate have an inverse relationship with house prices in Germany in the long run. On the contrary, population and housing permits have a positive long-term relationship with house prices in Germany. Real money supply was the only variable that was statistically insignificant.

This thesis specifically follows the EG two-step methodology, that is explained by Xu and Tang (2014) and Barot and Yang (2002). The first step consists of determining if all variables are stationary after taking the first difference i.e. $I(1)$. If the variables are $I(1)$, then it is feasible to continue with a cointegration regression, which is done using the Ordinary Least Squares (OLS) method. Afterwards, it is determined whether the residuals from the regression are stationary at level i.e. $I(0)$ or not. In case residuals are $I(0)$ it is possible to continue to the next step, in case the residuals are not stationary at level, it is necessary to estimate a model containing only first differences i.e. $I(1)$. The second step is to build an error correction model that contains the estimated residuals from the initial regression. The results from cointegration regression only determine the long-term association between variables of the model and does not deal with the short-term dynamics. Whereas the ECM measures the short-term dynamics between the variables.

In this study, the house price index is the dependent variable and we use the following specification model:

$$l_nHPI_t = \alpha + \beta_0(l_UNEMP_t) + \beta_1(l_INF_t) + \beta_2(l_HPERM_t) + \beta_3(l_CONC_t) + \beta_4(l_LOANS_t) + \beta_5(TOURISM_t) + \varepsilon_t \quad [1]$$

2.2. Data Description and Sources

In this dissertation secondary sources of data have been used, which was collected from different databases. The study employs quarterly data for the period between the beginning of 1998 and the second quarter of the year 2019.

Table 2 presents the variables used in this study, a description of each variable, the sources of the data and the theoretical relationship of the independent variables with the housing prices.

Table 2. Description of variables.

Variable	Abbreviation	Definition	Source	Theoretical relationship
House Price Index	l_nHPI_t	Logarithm of nominal index of residential property prices over time in period t.	OECD	
Unemployment rate	l_UNEMP_t	Logarithm of the ratio of working age population that are not employed and thus do not generate income in period t.	INE	-
Inflation rate	l_INF_t	Logarithm of general prices increase of goods and services in period t.	Banco de Portugal	+
Housing permits	l_HPERM_t	Logarithm of construction indicator – residential permits issued per year in period t.	Banco de Portugal	-
Construction costs	l_CONC_t	Logarithm of new housing construction cost index; Total index and by construction factors in period t.	INE	+
Loans	l_LOANS_t	Logarithm of house loans from other monetary financial institutions to individuals in period t.	Banco de Portugal	+
TOURISM	$TOURISM_t$	Growth percentage of the number of overnight stays between quarterly period t and quarterly period t-4.	Turismo de Portugal	+

Source: Author's own elaboration.

For this study, the following available housing indexes were considered to be used as a dependent variable: OECD real house price index, that is the house price index covers the sale of newly-built and existing dwellings, following the recommendations from Residential Property Prices Indices manual (with data from 1990), and; INE house price index, that is the housing prices available on INE which are based on bank appraisals. Bank appraisals are expert evaluations, which are carried out on behalf of most of the institutions that provide mortgage credit in Portugal (with data from 2009). We have decided to use the first index because we have access to older available data.

About the factors that influence housing prices, there are many determinants that can be divided into demand and supply factor. The variables used in this dissertation are largely based on the

specification model of Xu and Tang (2014) and Toome (2018). Each one of these variables are related with the housing prices.

First, the unemployment rate is inversely correlated with the housing prices (Adams & Füss, 2010; Égert & Mihaljek, 2007). The demand of housing is affected by the level of unemployment, e.g. the demand for houses decreases when the rate of unemployment is higher because potential buyers do not have financial capacity to buy a home. Similarly, high unemployment decreases the demand of housing because the household mortgages are highly relative to the income (Račka & Khalil ur Rehman, 2018). However, Xu and Tang (2014) find a positive relationship between these variables because in the UK housing market there is no obvious correlation between housing prices and unemployment. Hence, further investigation is needed to determine how the Portuguese house prices respond to changes in unemployment rate.

Then, since owning a home is often a decades-long commitment, it is important that we include inflation in our housing analysis. Since economic growth is affected by inflation, it means that the housing market is also affected by it. However, the literature and empirical work that investigates the relationship between housing prices and inflation is scarce. Hofmann (2003) did a research on the housing markets of a number of industrialized economies and found that inflation plays a significant role in determining the housing prices. In addition, inflation also affects housing prices indirectly, since an increase in the interest rates due to inflation can cause a decrease in housing demand (Račka & Khalil ur Rehman, 2018). Finally, according to Tsatsaronis and Zhu (2004), the change in inflation rate accounts for 50% of the total variation in housing prices, whereas real disposable incomes and interest rates account for around 10% each.

About the housing permits, Borowiecki (2009) has studied the relationship between completed dwellings and housing prices, and find that as the number of completed dwellings increase by 10% per year, the housing prices deflate by 1.2% in the following year and by 0.6% after two years. Although, quarterly data for house completions is not available in Portugal, Toome (2018) uses housing permits as a substitution for completions in his research.

Considering that construction cost and prices of newly built houses play an important role in house prices, the construction cost has a positive impact on the housing prices. When the cost of construction increases, construction activity decreases, which results in a deficiency in the housing supply. This decrease in the housing supply in turn leads to higher rent and higher housing prices. Borowiecki (2009), Adams and Füss (2010), and Xu and Tang (2014) have confirmed a positive association between housing prices and construction costs.

Housing prices are also sensitive to loans, credit constraints and mortgage interest rates. Gimeno and Martínez (2006) use a Vector Error-Correction Model (VECM) to study the relationship between housing prices and loans for house purchase in Spain and they find that both variables have a positive impact on each other in the long run. Additionally, Jiang, Zhao, Sanderford, and Du (2018) find that housing prices cause changes in the supply of housing loans in the long run. Since housing has become an investment for some homebuyers, when the prices increase, the

households are willing to borrow more in expectations of higher returns from their investments. Simultaneously, banks are also willing to lend more during housing price increases.

Regarding tourism, the relationship between tourism and housing prices is positive as confirmed by Biagi, Brandano and Lambiri (2014). However, Biagi, Brandano and Caudill (2015) study the heterogeneity between cities or the heterogeneity between tourism activities of cities (e.g. mountain tourism, art tourism or marine tourism, etc.) and find that the impact of tourism differs by location. So, there may be areas where increases in tourism activity increase house prices, other areas where increases in tourism activity reduce house prices, and still others where tourism activity has little effect.

3. Results and Discussions

In this section, the main results are presented and discussed.

3.1. Descriptive Statistics and Correlation

Figure 6 shows the evolution of housing price index (from OECD) and overnight stays (from INE) in Portugal during the period from 1990 to 2019. Figure 6 shows that the evolution of housing prices in Portugal has been very unsteady. The housing prices reached its maximum in 2007 and started to decline in 2009 reaching its lowest in 2013 and since then the prices have been increasing.

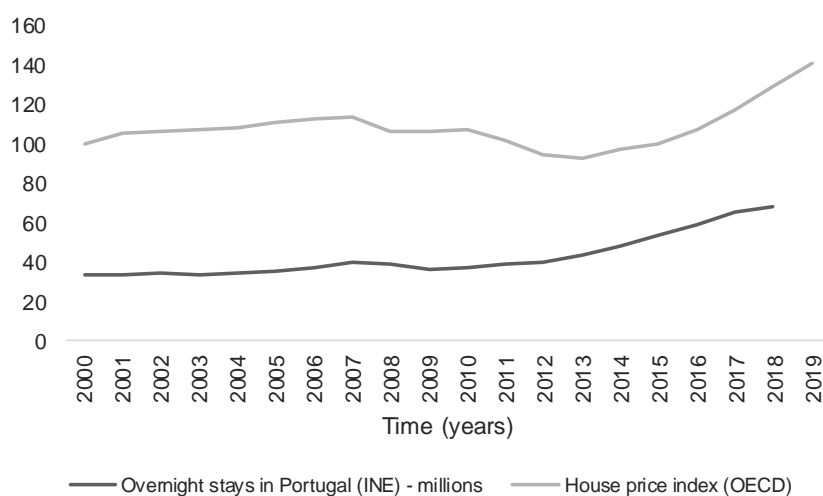


Figure 6. Evolution of tourism and housing indexes in Portugal.

Source: Author's own elaboration using the data from INE and OECD.

The descriptive analysis of the variables used in this research is presented in the table below.

Table 3. Descriptive statistics (1998 Q1 to 2019 Q2).

	nHPI	UNEMP	INF	HPERM	CONC	LOANS	TOURISM
Mean	105.73	8.70	89.86	5,418	90.36	253,610	4.03
Median	106.37	7.80	92.05	3,883	93.50	280,000	4.14
Minimum	83.62	3.70	68.72	2,048	74.95	75,233	-20.18
Maximum	140.73	17.50	104.15	13,565	107.73	343,470	19.21
Standard devi	10.72	3.68	10.69	3,399	10.25	76,074	7.33
C.V.	0.10	0.42	0.12	0.63	0.11	0.30	1.82
Skewness	0.74	0.60	-0.49	0.82	-0.16	-0.78	-0.31
Ex. Kurtosis	1.45	-0.62	-1.05	-0.80	-1.39	-0.57	0.57

Source: Author's own elaboration.

Note: The variables presented in this table are the following: nominal house price index (nHPI); unemployment rate (UNEMP); inflation rate (INF); housing permits issued (HPERM); construction costs index (CONC); and loans issued to individuals by financial institutions (LOANS) and growth percentage of number of overnight stays (Tourism); C.V. = Coefficient of variation; See Table 2 for the description of all the variables; The logs of variables were not used in these calculations; Number of observations = 87.

Table 3 shows that in the period of 20 years being analyzed in this dissertation, the nominal real house price index (nHPI) has a maximum value of 140.73. The nominal house prices in Portugal peaked in the second quarter of 2019. Therefore, it has outgrown its previous maximum achieved in 2007 (114.07) in the period under examination and the bottom level (83.62) was reached in the first quarter of 1998. In terms of tourism variable, the minimum value (-20.18) of tourism in Portugal was observed in 2009 which can be attributed to the crisis in that period. The maximum value of inflation (104.15) was observed in 2019, and also, the maximum construction cost (107.73) was achieved in that year, which can be attributed to the increasing inflation. The maximum unemployment rate (17.50) was observed in 2013, and since then unemployment rate has been decreasing until now.

Table 4 presents the correlation values between the variables used in the model. Since all the economic markets are interrelated, so high correlation can be anticipated. The values that are close to 1 indicate that the variables are strongly correlated, and the sign of the correlation coefficient indicates the direction of the association while the magnitude of the correlation coefficient indicates the strength of the association.

Table 4. Correlation matrix of variables (1998 Q1 to 2019 Q2).

	TOURISM	I_LOANS	I_CONC	I_HPERM	I_INF	I_UNEMP	I_nHPI
I_nHPI	-0.14	0.40	0.39	0.41	0.41	-0.10	1.00
I_UNEMP	0.43	0.81	0.77	-0.24	0.82	1.00	
I_INF	0.43	0.91	0.97	-0.18	1.00		
I_HPERM	-0.44	0.06	-0.29	1.00			
I_CONC	0.40	0.84	1.00				
I_LOANS	0.25	1.00					
TOURISM	1.00						

Source: Author's own elaboration.

Note: The variables presented in this table are the following: nominal house price index (nHPI); unemployment rate (UNEMP); inflation rate (INF); housing permits issued (HPERM); construction costs index (CONC); and loans issued to individuals by financial institutions (LOANS) and growth percentage of number of overnight stays (Tourism); See Table 2 for the description of all the variables; Logs of all variables except TOURISM variable; The correlation coefficients are statistically significant at 5%, with a critical value of 0.2227; The correlation coefficients are from Spearman or Pearson; Number of observations = 78.

Table 4 evidences that, in the sample of 87 observations ranging from 1998 Q1 to 2019 Q2, the highest positive correlation among all the variables exists between the construction costs and inflation rate (0.97). In addition, a strong positive association exists between loans and inflation rate (0.91), and between loans and construction costs (0.84). Fairly strong positive relationship is evident between construction costs and unemployment rate (0.77). Nominal house price index has a moderate positive association with construction costs (0.39), housing permits (0.41), tourism (0.14) and inflation rate (0.41). Additionally, tourism has a moderate positive relationship with unemployment rate (0.43), inflation rate (0.43), and construction costs (0.40).

Whereas on the other hand, a moderate negative correlation is observable for housing permits with tourism (-0.44) and construction costs (-0.29). Housing permits also have a negative correlation with inflation (-0.18) and unemployment (-0.24). Additionally, nominal house price has a negative association with tourism (-0.14), and unemployment rate (-0.10).

3.2. Stationarity Test

A stationary time series portrays statistical properties that remain constant over time i.e. constant mean, constant variance and constant autocovariance. The stationarity must never be ignored as it can lead to inaccurate results. If the time series in a research is not stationary, it is advisable to generate a stationary time series by taking the first difference of the series, although sometimes it might be necessary to take higher order differences to attain stationarity. However, it is useful to take natural logarithm of the data before taking the differences in order to deal with linear trends (Baumohl & Lyocsa, 2011). The most popular methods to study the stationarity of time series data are the Augmented Dickey Fuller (ADF) test (1979), Phillips-Perron (PP) test (1988) and Kwaitowski-Phillips-Schmidt-Shin (KPSS) test (1992).

The most common method to test for stationarity of a time series is the ADF test. The pioneering work on the unit root testing was done by Dickey and Fuller (1979). The ADF test considers higher order of data generating process, which can be presented as:

$$\Delta y_t = \mu + \varphi y_{t-1} + \lambda t + \sum_{i=1}^p \alpha_i \Delta y_{t-1} + \mu_t \quad [2]$$

Where μ is constant and t is trend, respectively (Xu & Tang, 2014). Dickey-Fuller tests examines the null hypothesis that $\varphi = 1$ in:

$$y_t = \varphi y_{t-1} + \mu_t \quad [3]$$

against the one-sided alternative that $\varphi < 1$. Therefore the null hypothesis states that the series contains a unit root, i.e. is non-stationary. The alternative hypothesis states that series does not contain a unit root, i.e. is stationary. So, in the ADF test, if the null hypothesis is not rejected, then the series has a unit root (non-stationary) (Toome, 2018).

Firstly, a graphical interpretation is assumed to evaluate if series under examination are stationary or non-stationary. Figure 7 presents the natural logarithms of the initial time series of all the variables in accordance with the model specification of Xu and Tang (2014) and Toome (2018).

All variables are non-stationary according to the graphs in the next section. However, some series exhibit significant trends such as housing permits, tourism and unemployment. Inflation rate has an upward stochastic trend and appears to be non-stationary as well. Additionally, loans and construction cost have a deterministic trend and are clearly non-stationary. Finally, nominal house price (nHPI) demonstrate a change in the trend during the period under examination i.e. nHPI showed a clear downward trend between the period of 2007 to 2013, but afterwards the trend reverses and a clear upward movement is visible from 2014 onwards. Therefore, the following graphs indicate that all time-series are non-stationary at level.



Figure 7. Time series of natural logarithms of the variables.

Source: Author's own elaboration.

Since the series are non-stationary at level i.e. $I(0)$, it is necessary to take the first difference. Figure 8 shows that obvious trends have been removed by taking the first difference and that it can be assumed the series are stationary after taking the first difference, i.e. the series are integrated at $I(1)$.

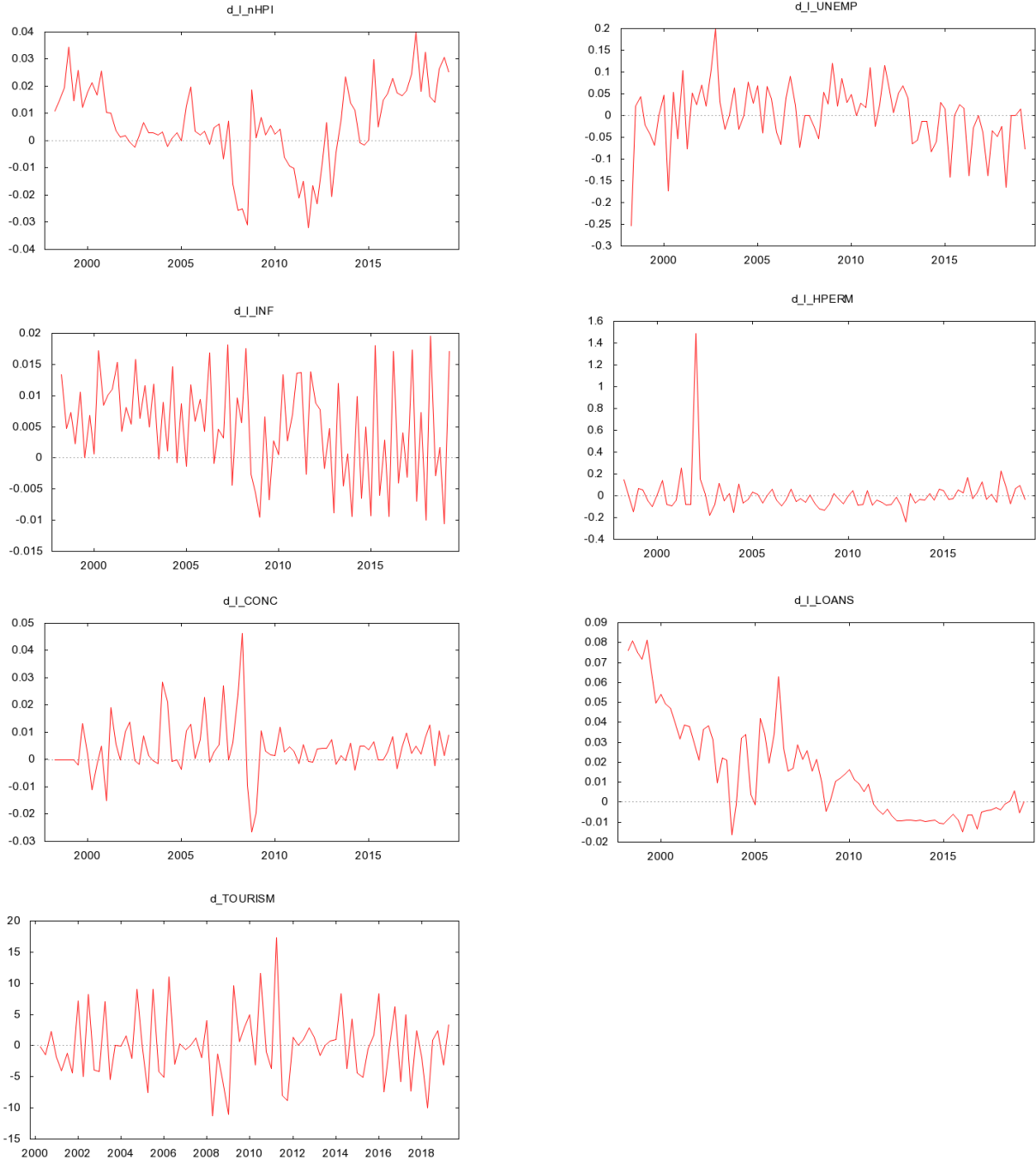


Figure 8. Time series of differenced natural logarithms of the variables.

Source: Author's own elaboration.

Although the graphs above exhibit the time series properties of the variables, it is not a reliable method to determine stationarity. Therefore, in order to determine the accuracy of the initial graphical analysis, a unit root test must be conducted, which makes it possible to identify if the time series are stationary at first difference i.e. I(1) and if EG two-step approach is the appropriate method to follow. This study applied the ADF test to examine the stationarity of variables, and the reason has been stated above. The lag order of the test is set to 0. The results of the ADF unit root tests are reported below.

Table 5. Unit root test results.

	At level			First difference		
	Test Statistic	P-value	Analysis	Test Statistic	P-value	Analysis
I_nHPI	0.219	0.998	Constant and trend	-3.853	0.018	Constant and trend
I_UNEMP	0.420	0.999	Constant and trend	-9.220	0.000	Constant and trend
I_INF	-1.346	0.869	Constant and trend	-14.600	0.000	Constant and trend
I_HPERM	-1.874	0.659	Constant and trend	-8.744	0.000	Constant
I_CONC	-1.986	0.600	Constant and trend	-7.890	0.000	Constant
I_LOANS	-6.228	0.000	Constant and trend	-4.212	0.007	Constant and trend
TOURISM	-4.013	0.012	Constant and trend	-12.464	0.019	Constant and trend

Source: Author's own elaboration.

Note: This table presents the ADF unit root tests of all the variables, at level and after taking the first difference; In the unit root test, the null hypothesis is that there is a unit root (non-stationary) whereas the alternate hypothesis is that the time series is stationary. In this case, the null hypothesis is rejected and proved that the series is stationary after taking the first difference. The variables used are the following: nominal house price index (nHPI); unemployment rate (UNEMP); inflation rate (INF); housing permits issued (HPERM); construction costs index (CONC); and loans issued to individuals by financial institutions (LOANS) and growth percentage of number of overnight stays (Tourism); See Table 2 for the description of all the variables; All variables are with logs except tourism variable.

The unit root tests were conducted in two steps i.e. at level and after taking the first difference. In the first stage, ADF test for unit root is conducted at level and the results evidence that nominal house price, unemployment rate, inflation rate, housing permits and construction cost are non-stationary even at 10% significance level. Loans is non-stationary at 1% significance level and tourism is non-stationary at 5% significance level. So, the null hypothesis cannot be rejected and we conclude that time series are non-stationary at I(0). The next step is to test stationarity after taking first differences of all-time series, because with the first difference most time series in finance achieve stationarity (Baumohl & Lyocsa, 2011). The results of unit root test of first differences evidence that all the time series are significant. Nominal house price and tourism are significant at 5% significance level as their p-value is below 0.05 and the rest of the variables are significant at 1% significance level. In this case, because null hypothesis is rejected we can conclude that time series are I(1). In summary, the ADF unit root test at first difference of non-stationary

evidence that time series are in fact stationary i.e. all variables are integrated at I(1) pursuant to the stationary test above. This means the EG cointegration approach is appropriate in the study.

3.3. Cointegration Test

Cointegration relationship test determines the long-term or equilibrium phenomenon of a variable. Brooks (2008) has explained that in the short-term, the cointegrating variables might deviate from the association, but in the long-term, the short-term deviation from the equilibrium is restored and the relationship is consistent in the long-term.

Engle and Granger (1987) suggest a cointegration test to determine the long term cointegrating relationship among the variables. The first step is to estimate the cointegration regression by OLS. Then the residuals (\hat{u}_t) of the cointegration regression are tested to determine if they are stationary or not using ADF test. If the null hypothesis of a unit root in ADF test is not rejected, the conclusion would be that stationarity has not been found and therefore there is no cointegration. However, if the null hypothesis is rejected, it is found that the variables are stationary i.e. \hat{u}_t is I(0). Therefore, these variables are cointegrated and there is a significant long term relationship existence among the individual variables, and then proceed to the second step (Toome, 2018).

Nevertheless, there are some drawbacks connected to the EG cointegration test. Firstly, if the sample size is small, the test does not provide reliable results. Secondly, EG test is not appropriate if the dependent variable is not known initially. Thirdly, it is impossible to implement the hypothesis tests on the real cointegrating vector in the first step (Xu & Tang, 2014). However, in this study, the dependent variable is known, and the sample size is large enough to provide reliable estimates.

The natural logarithms of the selected variables are used in the initial OLS regression. In this study, the cointegration regression will be performed twice, once without the TOURISM variable (base model) and, then, including the TOURISM variable (tourism model) in order to check how tourism affects the housing prices. In this way, the following regression equations are tested for cointegration:

The base model specification:

$$l_nHPI_t = \alpha + \beta_0(l_UNEMP_t) + \beta_1(l_INF_t) + \beta_2(l_HPERM_t) + \beta_3(l_CONC_t) + \beta_4(l_LOANS_t) + \varepsilon_t \quad [4]$$

and the tourism model specification:

$$l_nHPI_t = \alpha + \beta_0(l_UNEMP_t) + \beta_1(l_INF_t) + \beta_2(l_HPERM_t) + \beta_3(l_CONC_t) + \beta_4(l_LOANS_t) + \beta_5(TOURISM_t) + \varepsilon_t \quad [5]$$

Table 6 shows the results from EG cointegration tests using the nominal house price index as dependent variable and the independent variables. In addition, the results of heteroskedasticity corrections are also given below.

Table 6. Cointegration test results of base model.

	Conitegration regression		Heteroscedasticity corrected	
	Coefficient	P-value	Coefficient	P-value
Constant	-0.596	0.012	-0.809	<0.001
I_UNEMP	-0.294	0.000	-0.319	<0.001
I_INF	1.153	0.000	0.830	<0.001
I_HPERM	0.053	0.000	0.060	<0.001
I_CONC	-0.045	0.807	0.178	0.191
I_LOANS	0.035	0.292	0.088	0.004
R-squared		0.886		0.932
Adjusted R-squared		0.879		0.928
S.E. of regression		0.035		1.634

Source: Author's own elaboration.

Note: This table presents the cointegration test, the null hypothesis is that time series is non-stationary whereas the alternate hypothesis is that the time series is stationary. In this case, the null hypothesis is rejected and proved that the series is stationary i.e. variables are cointegrated; The dependent variable is the first difference of nominal house price index (nHPI) and the independent variables are the following: unemployment rate (UNEMP); inflation rate (INF); housing permits issued (HPERM); construction costs index (CONC); and loans issued to individuals by financial institutions (LOANS); See Table 2 for the description of all the variables; All variables are with logs; Number of observations: 86.

The results of cointegration tests in base model evidence that all coefficients of the cointegration test are significant at 1% confidence level after heteroskedasticity correction except for the construction costs, which means that the other four variables in the model have significant impacts on Portugal's housing prices. The residual is also stationary at 5% confidence level (see Table 7), which indicates that there exists a long run cointegrating relationship between housing prices and unemployment rate, inflation rate, housing permits and loans. Additionally, construction costs don't play a significant role in the determination of housing prices in Portugal.

Table 7. Stationary test of residual.

Augmented Dickey-Fuller test statistic	
t-Statistic	-5.036
Prob.	0.019

Source: Author's own elaboration.

Note: This table presents the ADF test, where the null hypothesis is that there is a unit root (non-stationary) whereas the alternate hypothesis is that the time series is stationary. In this case, the null hypothesis is rejected and proved that the series is stationary.

The table below presents the results of the cointegration test in tourism model, which include the TOURISM variable, as well as the heteroskedasticity corrected model.

Table 8. Cointegration test results of tourism model.

	Conitegration regression		Heteroscedasticity corrected	
	Coefficient	P-value	Coefficient	P-value
Constant	-0.265	0.546	-0.194	0.518
I_UNEMP	-0.274	0.000	-0.280	<0.001
I_INF	0.929	0.003	0.673	0.003
I_HPERM	0.060	0.000	0.070	<0.001
I_CONC	0.189	0.513	0.348	0.085
I_LOANS	-0.003	0.962	0.021	0.537
TOURISM	0.000	0.540	0.001	0.048
R-squared	0.847		0.910	
Adjusted R-squared	0.834		0.903	
S.E. of regression	0.035		1.805	

Source: Author's own elaboration.

Note: This table presents the cointegration test, the null hypothesis is that time series is non-stationary whereas the alternate hypothesis is that the time series is stationary. In this case, the null hypothesis is rejected and proved that the series is stationary i.e. variables are cointegrated; The dependent variable is the first difference of nominal house price index (nHPI) and the independent variables are the following: unemployment rate (UNEMP); inflation rate (INF); housing permits issued (HPERM); construction costs index (CONC); loans issued to individuals by financial institutions (LOANS) and ; the growth percentage of number of overnight stays (TOURISM); S.E. of regression denotes standard error of regression; See Table 2 for the description of all the variables; All variables are with logs; Number of observations: 78.

Table 8 evidences that the coefficients of unemployment rate, inflation rate and housing permits are significant at 1% confidence level, tourism is significant at 5% confidence level whereas construction costs is only significant at 10% confidence level after heteroskedasticity correction, which means that five variables in the model have significant impacts on Portugal's housing prices in the long run. However, the coefficient for loans is not significant, which seems that loans do not play a role in determining housing prices in Portugal in the long run.

The EG cointegration test reveals that the p-value from the unit root test on the residuals stands at approximately 0.098 (see Table 9). Therefore, the null hypothesis can be rejected at a 10% confidence level, which means that cointegration exists as the combination of non-stationary time series is stationary.

Table 9. Stationary test of residual.

Augmented Dickey-Fuller test statistic	
t-Statistic	-4.706
Prob.	0.098

Source: Author's own elaboration.

Note: This table presents the ADF test, where the null hypothesis is that there is a unit root (non-stationary) whereas the alternate hypothesis is that the time series is stationary. In this case, the null hypothesis is rejected and proved that the series is stationary.

3.3.1. Examining the Deviation of House Prices in the Long Run

The residuals of the long-term relationship, i.e. cointegration regression can depict the trends of the housing prices. The residuals represent deviation from the equilibrium relationship. If they go up, it means that the prices are deviating a lot from the equilibrium prices. Figure 9 shows how the actual housing prices deviate from the equilibrium level.

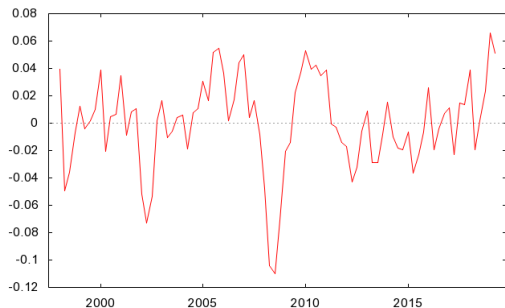


Figure 9. Plots of the cointegration vector of base model.

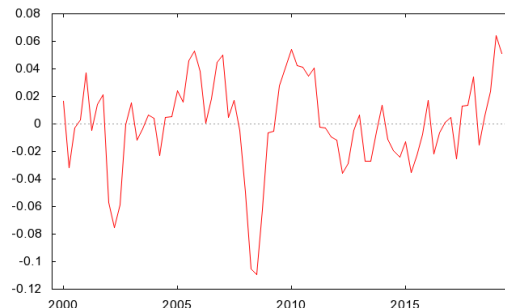


Figure 10. Plots of the cointegration vector of tourism model.

Source: Author's own elaboration.

Figures 9 and 10 show the fluctuations between the negative values and positive values and evidence that real house prices in Portugal are in fact cyclical and do not follow the equilibrium level on a constant basis. The swings in the residuals are with greater amplitude in duration after 2005. Prior to that, deviations from the equilibrium level were smaller and occurred in a shorter time frame. The residuals reach the minimum value in 2008 i.e. during world crisis. The dramatic fluctuations in the cointegration vector also can be found in the period of late 1990s and early 2000s, when bubbles happened during these periods.

3.3.2. Discussions on the Cointegration Results

Whereas EG cointegration test determines the long-term relationship between the variables, our cointegration regression results show several interesting facts about the long-term relationship between explaining variables and housing prices in Portugal.

The unemployment rate is negatively related to housing prices in the cointegration regression in both models, which is consistent with the findings of Égert and Mihaljek (2007), and Adams and Füss (2010) and Barksenius and Rundell (2012). The negative relationship can be explained reasonably. As the unemployment rate rises, housing demand decreases which leads to a reduction in the housing prices in Portugal.

Inflation rate is positively related to the housing prices in the long run according to the cointegration regression results, which means that the housing prices increase as the inflation rises. These results support the conclusions of previous studies of Hofmann (2003) and Tsatsaronis and Zhu (2004).

The long-term relationship between housing permits and house prices is positive for Portugal according to the cointegration regression results. The variable of housing permits is used as an indicator of housing supply, so the results of the cointegration regression imply that, in Portugal, as the housing supply increases, the housing prices also increase. Housing permits is used an indicator of housing supply and in the long run, an increase in land supply tends to bring down house prices (Glindro et al., 2007). Nevertheless, in the case of housing market, the supply of housing might rise, and it might also be in high demand, but prices might also rise. It is for this reason that the responsiveness of housing supply to changes in price has proved to be a crucial factor determining the functioning of housing markets (Haneveld, 2018). This positive correlation is consistent with findings of Toome (2018) but contradicts the findings of an inverse relationship between housing supply and house prices by Borowiecki (2009).

We show that construction costs were not significant in the base model which could be due to the presence of multicollinearity, however it is significant in the tourism model. There exists a positive correlation between construction costs and housing prices in Portugal in the long run (Table 9). An increase in the construction cost (material cost and labor cost) results in a decrease in the construction activity and housing supply, which in turn influences the real estate markets by causing an upsurge in

the housing prices. These findings are consistent with the previous studies (Adams & Füss, 2010; Barot & Yang, 2002; Borowiecki, 2009; Xu & Tang, 2014). In case of Portugal, it has been explained that the construction industry is one of the main drivers of the economy (Pinto, 2014).

We also evidence a similar positive long-term association between loans and housing prices, although loans variable is only significant in the base model. The loans affect house prices positively in Portugal in the long run, (see Table 7), like in previous studies (Égert & Mihaljek, 2007; Gimeno & Carrascal, 2006). An increase in loans supply lowers lending interest rates, as a result, property prices may rise because of higher expected returns on property and a lower discount factor. An increase in the availability of credit may also increase the demand for housing, this increase in demand will be reflected in higher property prices (Goodhart & Hofmann, 2008). In this way, credit plays a significant role in determining house prices and it seems to be a regular way of macro-control in the real estate market in Portugal (Xu & Tang, 2014).

Finally, in Portugal tourism is also positively related to the housing prices in the long run which means as the tourism activity increase, the housing prices also increase. This relationship supports the evidence of Biagi, Brandao and Lambiri (2014) study, who found that a positive correlation between tourism and housing prices can be considered a way to boost local economies; however, it can generate socio-economic problems of affordability and displacement of the resident population.

The long-term relationship between independent variables and house prices becomes evident from the cointegration analysis. The regression results show that variables such as inflation rate, housing permits, construction costs, loans and tourism have a positive long-term association with house prices in Portugal. In contrast, only unemployment rate has an inverse long-term association with house prices. The negative long-term association between unemployment rate and house prices is consistent with the findings of several research papers (Adams & Füss, 2010; Barksenius & Rundell, 2012; Égert & Mihaljek, 2007; Xu & Tang, 2014). It confirms that a decrease in unemployment rate is followed by an increase in demand and consequently higher housing prices. Considering the current unemployment rate of approximately 1.8% in Portugal, it is not reasonable to expect it to decline much further. The positive long-term association between inflation rate and house prices confirms that an increase in the inflation rate increases house prices.

Not all the findings about long-term associations between independent variables and house prices are consistent with economic theory and the results described in reviewed literature. It was expected that real housing permits would have a negative impact on house prices. However, in Portugal, housing permits have a positive long-term association with house prices. Furthermore, as expected, construction costs have a positive impact on house prices, regression results suggest that increased construction costs lead to higher house prices. In addition, the long-term association between loans as well as tourism with house prices was positive as expected. Except for construction costs, all variables are statistically

significant in the base model. Similarly, when tourism is introduced in the second model, the variable of construction costs becomes significant and loans becomes insignificant.

Since the results of the first step of the EG approach shows the cointegration, the next step is to proceed with an ECM. However, if cointegration between the variables didn't exist we should use an alternative methodology such as VAR model. In other words, if the time series should not be cointegrated we should use the VAR method. The findings of cointegration between house prices and the macroeconomic, loans and construction factors are also coherent with the results of Xu and Tang (2014) and Toome (2018).

3.4. Evaluation of the Models

Before moving on to the second step of the EG two step approach, we need to understand if the use of the error correction model specification is appropriate. For that we test for the heteroskedasticity, normality, autocorrelation and multicollinearity.

First, White's test is used in the base model and, due to the problem of degrees of freedom, the Breusch-Pagan test in tourism model to examine the problem of heteroskedasticity. White's test is suitable to determine whether the variance of errors in a regression model is constant and the null hypothesis is that the variance of errors is constant when we have homoskedasticity, i.e. heteroskedasticity is not present. The alternative hypothesis is that the variance of errors are not constant, i.e. heteroskedasticity is present (Brooks, 2008). White's test results provide a p-value of 0.35 and therefore the null hypothesis is not rejected (in Table 12 of Appendix). Similarly, Breusch-Pagan test results provide a p-value of 0.29 for tourism model (in Table 13 of Appendix). Therefore, heteroskedasticity is not present in both models.

Jarque-Bera test is also used in order to test for normality of residuals. The test for normality of residuals is conducted for the correction of degrees of freedom of the sample (Barot & Yang, 2002). The null hypothesis is that the data is normally distributed. The alternative hypothesis is that the data does not come close to normal distribution. Table 14 (in Appendix) shows p-values higher than 10% of significance level in both models. Hence, the residuals are normally distributed.

Next, we use the Breusch and Godfrey Lagrange multiplier test statistic to analyze the autocorrelation in the regression model. A lag order of four is used since quarterly data is analyzed. The null hypothesis indicates no autocorrelation up to order of four, whereas the alternative hypothesis states that autocorrelation exists. Table 15 (in Appendix) shows p-values of 0.29 and 0.22 in both models, which evidence that null hypothesis is not rejected and therefore the model does not contain autocorrelation up to the fourth lag order.

Finally, the models are tested for multicollinearity, which occurs when independent variables are highly correlated with each other (Brooks, 2008). In order to test for multicollinearity a Variance Inflation factor (VIF) test is carried out. The test indicates multicollinearity if the VIF value is higher than 10. Table 16 (in

Appendix) shows that all variables come in below the value of ten and therefore the model does not suffer a problem of multicollinearity.

The results of tests illustrate that these two models are normally distributed, and there are no problems such as autocorrelation and heteroskedasticity in the residuals according to the results of Lagrange Multiplier (LM) test and heteroskedasticity tests. Therefore, the model specification is appropriate and the short run relationship between house prices and other variables can be well explained by the error correction model.

3.5. Error Correction Model

Based on the previous step, EG cointegration test show that there are cointegration in both models. Thus, it is appropriate to construct an ECM in the second step of the EG two-step approach. The following regression is entailed in the first step of the EG two-step approach:

$$y_t = \alpha + \gamma x_t + u_t \quad [6]$$

The results of this regression produce an error correction term u_t :

$$u_t = y_t - \alpha - \gamma x_t \quad [7]$$

The second step of EG two-step procedure is to use u_t and to estimate error correction model that is a combination of first differences and lagged levels (Engle & Granger, 1987):

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (u_{t-1}) + v_t \quad [8]$$

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (y_t - \alpha - \gamma x_t) + v_t \quad [9]$$

Since it has been proved that cointegration exists between y_t and x_t , it is valid to use OLS and standard procedures on statistical inference on the ECM (Toome, 2018).

The error correction model helps to estimate the short-term deviation of house prices from the long-term equilibrium level. So, in this study we use two error correction models with the same variables as the initial regression models, one without TOURISM variable (base model) and another with TOURISM variable (tourism model). In this step, it was included six lags in the model with insignificant lags excluded. The purpose of including the lags is that the lagged independent variables identify a relationship between variables where a change in the dependent variable is explainable by the change in the independent variable at a period in the past. Therefore, a change in the unemployment rate, inflation rate, housing permits, construction costs, loans and tourism industry today might induce a change in the housing prices after a predefined period in the future. ECM contribute to explain the deviations between the evolution of house prices and other variables and also identifies the short-term relationship between house prices with the analyzed variables and the error correction term (deviation from the long-term relationship).

Table 10 presents the results of the ECM of the base model where 74.1% of variation in house prices can be explained by the independent variables. The Durbin-Watson statistics of 2.162 indicates the absence of serial correlation in this regression result. We find that error correction term is negative and significant. So, the error correction term of -0.403 evidence that the model corrects its level of disequilibrium by 40.3% in six quarters. In this sense 40.3% of house prices disequilibrium in previous quarters will be corrected by the model in six quarters. In this way, error correction term also shows the speed of adjustment of the price level from the equilibrium level.

Table 10. Error correction model of the base model

Variables	Coefficient	t-Statistic	P-value	
d_I_nHPI (-6)	0.115	0.638	0.527	
d_I_UNEMP (-1)	-0.107	-2.183	0.035	**
d_I_UNEMP (-5)	-0.117	-2.471	0.018	**
d_I_HPERM (-4)	0.025	1.724	0.096	*
e (-6)	-0.403	-2.350	0.024	**
R-squared	0.741			
Adjusted R-squared	0.519			
S.E. Of residuals	0.005			
F-statistics	3.252			
Durbin-Watson statistic	2.162			

Source: Author's own elaboration.

Note: This table presents the ECM which has been constructed by using the residual from the cointegration regression as an independent variable, along with unemployment rate (UNEMP), inflation rate (INF); housing permits issued (HPERM); construction costs (CONC), and loans (LOANS). The dependent variable is nominal house price index (nHPI). See Table 2 for the description of all the variables and here, only variables with significant values are presented (see all results in Appendix 2 - Table 17). The variables have been included with a combination of different lag settings that have been represented in the brackets. The error correction term "e (-6)" denotes the error correction term (e) with lag 6 and measures the deviation from the long-run relationship in the previous period and estimates how much of the disequilibrium will be restored in the next forecasting period. So, the model corrects its previous level of disequilibrium in six quarters. All dependent variables are with first differences of logs. (**) denotes significance level at 5%; (*) denotes significance level at 10%. Number of observations: 79.

Table 11 presents the results of the ECM of tourism model where about 81.7% of variation in house prices can be explained by the independent variables. The Durbin-Watson statistic of 2.320 indicates the absence of serial correlation in this regression result. We find that error correction term is negative and significant, which is desirable. So, the coefficient of the error correction term (-0.453) evidence that the model corrects its level of disequilibrium by 45.3% in six quarters. In this sense, 45.3% of house

prices disequilibrium in previous quarters will be corrected by the model in six quarters. However, both the models outline a very slow adjustment process as compared with 3.7% in the UK (Xu & Tang, 2014) and 12% in Germany (Toome, 2018).

Table 11. Error correction model of the tourism model

Variables	Coefficient	t-Statistic	P-value	
d_I_nHPI (-6)	0.191	1.002	0.325	
d_I_LOANS (-6)	-0.502	-2.479	0.019	**
d_I_UNEMP (-1)	-0.109	-1.812	0.081	*
d_I_HPERM (-4)	0.025	1.724	0.096	*
d_I_CONC (-2)	0.517	2.178	0.038	**
e (-6)	-0.453	-2.427	0.022	**
R-squared	0.817			
Adjusted R-squared	0.542			
S.E. Of residuals	0.011			
F-statistics	2.902			
Durbin-Watson statistic	2.320			

Source: Author's own elaboration.

Note: This table presents the ECM which has been constructed by using the residual from the cointegration regression as an independent variable, along with unemployment rate (UNEMP), inflation rate (INF); housing permits issued (HPERM); construction costs (CONC), and loans (LOANS). The dependent variable is the nominal house price index (nHPI); unemployment rate (UNEMP), inflation rate (INF); housing permits issued (HPERM); construction costs (CONC); loans (LOANS) and Tourism (TOURISM). See Table 2 for the description of all the variables and here, only variables with significant values are presented (see all results in Appendix 2 - Table 18). The independent variables have been included with a combination of different lag settings that have been represented in the brackets. S.E. of residuals denotes the Standard error of residuals. The error correction term "e (-6)" denotes the error correction term (e) with lag 6 and measures the deviation from the long-run relationship in the previous period and estimates how much of the disequilibrium will be restored in the next forecasting period. So, the model corrects its previous level of disequilibrium in six quarters. All dependent variables are with first differences of logs. (**) denotes significance level at 5%; (*) denotes significance level at 10%. Number of observations: 71.

We can conclude that both ECM explain the deviations between growth of housing prices and the evolution of other factors. In the short run, housing prices are determined by the historical factors of unemployment rate, housing permits, construction costs, loans and the error correction term (the disequilibrium of the long-term relationship). According to the models, most elasticity is significant at the confidence level of 10%. However, the tourism variable was not significant in any error correction model and since, the error correction models only illustrates the short run relationship between the independent and explanatory variables, it can be concluded that the association between tourism and housing prices in Portugal is not meaningful in the short run. In this way, the Portuguese real estate market does not

react to short term movements of tourists because it is much more flexible than the investment in housing market. Investors only invest when they expect to get a return which only happens when real estate supply does not respond to demand required by the tourists in long term.

The relationship between tourism, housing market and economic growth has been discussed widely. Bento (2016) has explained that a significant unidirectional long term association exists between tourism and economic growth in Portugal and Balaguer & Cantavella-Jordá (2002) and Dritsakis (2004) have found that tourism has a long-run economic growth effect. It is also expected that the increase of tourism in a short period of time do not have a significant impact on real estate prices because this market is not flexible enough to adjust to continual movements of tourists. Considering the high value of each real estate investment, there are few investors available to put their money in a market that cannot be persistent, if they do not expect an evolution in long term that can provide them with a value return.

3.5.1. Discussions on the Error Correction Model Results

In both the error correction models, inflation rate and tourism did not turn out to be significant at any significance level, which implies that these two variables do not have any impact on the housing prices in Portugal in the short run, however these variables affect the housing prices in the long run. Therefore, the data does not provide enough evidence about the association of these variables with housing prices in Portugal.

Unemployment rate proved to be statistically significant in both the models at a 5% and 10% significance level. So, it can be concluded that in Portugal, there is a negative relationship between unemployment rate and housing prices in the short-term.

Housing permits variable is positively significant on a 10% significance level. This does not correspond well to the theoretical evidences as the model indicates a positive short-term association with housing prices in Portugal. However, this result is coherent with the findings of Toome (2018) who found a positive short-term association between housing permits and housing prices in Germany.

Loans at a lag order of six is statistically significant at a 5% significance level and demonstrates a negative short-term relationship with housing prices in Portugal.

The results indicate that construction cost, with a lag order of two, is significant at a 5% significance level in the tourism model. The coefficient outlines a positive short-term relationship with housing prices in Portugal. This confirms the analysis of Xu and Tang (2014) who also found that lagged construction costs have a short-term positive association with housing prices in the UK. Feng, Lu, Hu and Liu (2010) also determined a positive short-term relationship between residential construction costs and housing prices in major cities and on a national level in China.

We have described the long run and short run relationship between housing prices and other factors. We have found that unemployment rate has a negative correlation with the housing prices both in the

short run and the long run. Loans affect the housing prices positively in the long run and negatively in the short run. Construction costs and housing permits have a positive relationship with the housing prices in the short run and long run. However, inflation rate and tourism have a positive impact on the housing prices only in the long run.

The tourism sector in Portugal has been one the main drivers of the Portuguese economy after economic crisis. The increased demand for housing due to the rising tourism activity has been putting a high pressure on the prices of the property which have risen after hitting the bottom in 2013. Therefore, the positive relationship between tourism and housing prices in Portugal means that the housing market in Portugal relies heavily on the tourism sector of Portugal.

Conclusion

The residential market is the most important segment of real estate market because for most people around the world to buy a home is the primary investment they make. The demand for houses is directly related to factors such as income and unemployment. In addition, house prices are also affected by the amount of new constructed houses and their respective building costs. The investigation of the determinants of housing prices is important because of its impact on the economic and social factors.

This dissertation discusses the determinants that affect house prices in Portugal, and we focus on tourism because it plays an important role in the Portuguese economy. The impact of tourism on the local economic growth has been widely studied whereas the effect of tourism on the housing prices has not been investigated as much. Therefore, tourism and tourist-related activities can affect housing markets in the tourism driven economies like Portugal. The findings of the study confirm that the impact of tourism on housing market in Portugal is positive and significant. The tourism boom and the competitiveness of the tourism sector in Portugal induce an increase in the housing prices. In the World's Leading Tourism Destination Country, the real estate market seems to be positively linked with tourism activities. In this way, we evidence that tourism seems to be an important driver of real estate market.

The aim of this study was to evaluate to what extent the macroeconomic, financial, construction and tourism issues are driven factors in Portuguese house prices. In terms of square meter prices, Portugal has some of the lowest prices for city center property in Europe (Delmendo, 2020), but the price of houses has undergone changes over time, increasing and decreasing according to the financial capacity of its inhabitants. In this sense, over the past 20 years, the housing prices have changed frequently. The housing prices grew on average less than 1 percent per year until the beginning of the financial crisis in 2007 (Lourenço & Rodrigues, 2014). After a decline in prices from 2007 to 2013, the recovery has been rapid and has reached its highest level in 2019. Hence, a study to determine the macroeconomic, financial, construction and tourism factors that can explain house prices in Portugal and whether these factors can fully explain latest price developments is appropriate.

After the analysis of the background literature, EG two-step approach was used to get the empirical evidence. We have used two models to apply this methodology, one with macroeconomic, financial, construction and tourism factors, and other without the tourism factor. The first step consisted of EG cointegration test to identify whether a combination of non-stationary series is stationary. It was desirable that the time series would be integrated in the first order, $I(1)$, to conduct the cointegration test. The second step involved building an ECM using the residual from the cointegration regression as an independent variable. Thereby, it was possible to analyze the short-term deviation of prices from the long-term equilibrium level.

About the long-term relationship, with a Portuguese quarterly database from 1998 to 2019 and based on cointegration test results, we find a positive long run relationship existence between house prices and inflation rate, housing permits, construction cost, loans and tourism, while unemployment rate has a negative impact on house prices. So, inflation rate, housing permits, construction costs, loans and tourism have a direct long-term association with house prices, but unemployment rate has a negative long-term association with house prices. The association of housing permits is not in line with the work of Borowiecki (2009) that found a negative relationship between housing prices and housing permits. However, in Portugal, the association between these two variables turned out to be positive. Therefore, in case of Portugal, not all these findings are coherent with the economic theory and the conclusions outlined in other academic publications.

We also study a short-term relationship with the ECM, and we find that in the Portuguese housing market, the short-term deviation from the long-term equilibrium level has an adjustment speed of approximately 40% in the first model and 45% in the second model. Hence, when the price deviates from the equilibrium level it will adjust back to the equilibrium by 40-45% in six quarters following the deviation. In the short run, housing prices are determined by the historical (the past quarters) factors of unemployment rate, housing permits, construction costs and loans in Portugal. So, to sum up, tourism only affects the housing prices in Portugal in the long run and has no effects on the housing market in the short run.

For further research, in addition to the determinants analyzed in this dissertation, other variables might be important as well. In order to investigate longer term dynamics, it would be useful to include longer time series into the analysis. This however needs additional resources to gather relevant data. Furthermore, future studies might want to consider using multiple equation methodologies such as vector error correction or vector auto-regression models, depending on the suitability of data. Finally, it must be highlighted that this study is limited to one country under investigation because any empirical study with a national approach may be biased. Therefore, further research needs to be extended to other countries because of the heterogeneous nature of real estate.

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Appendix

Appendix 1: Model evaluation tests

Table 12. White's test for Heteroskedasticity M1.

t-Statistic (TR²)	77.02
P-value	0.35

Table 13. Breusch Pagan's test for Heteroskedasticity M2.

t-Statistic (LM)	47.50
P-value	0.29

Table 14. Normality test.

	M1	M2
t-Statistic	4.06	0.79
P-value	0.13	0.68

Table 15. LM test for autocorrelation.

	M1	M2
t-Statistic (LMF)	1.29	1.57
P-value	0.29	0.22

Table 16. Variance inflation factor (VIF) test.

Variables	M1	M2
d_I_nHPI_6	5.01	4.82
d_I_UNEMP_1	7.03	9.36
d_I_UNEMP_5	6.15	6.59
d_I_HPERM_4	3.09	4.95
d_I_LOANS_6		12.40
d_I_CONC_2		4.37
e_6	20.90	24.37

Appendix 2: Error Correction models

Table 17. Error correction model of the base model

Variable	Coefficient	Std. Error	t-statistic	p-value	
d_I_LOANS_1	0.075	0.197	0.383	0.703	
d_I_LOANS_2	-0.031	0.229	-0.137	0.892	
d_I_LOANS_3	0.073	0.243	0.302	0.765	
d_I_LOANS_4	-0.077	0.248	-0.310	0.758	
d_I_LOANS_5	0.184	0.242	0.762	0.451	
d_I_LOANS_6	-0.264	0.187	-1.414	0.165	
d_I_UNEMP_1	-0.107	0.049	-2.183	0.035	**
d_I_UNEMP_2	-0.061	0.050	-1.217	0.231	
d_I_UNEMP_3	0.004	0.051	0.078	0.938	
d_I_UNEMP_4	-0.014	0.053	-0.268	0.790	
d_I_UNEMP_5	-0.117	0.047	-2.471	0.018	**
d_I_UNEMP_6	0.028	0.029	0.961	0.342	
d_I_HPERM_1	0.018	0.012	1.492	0.143	
d_I_HPERM_2	0.008	0.012	0.706	0.484	
d_I_HPERM_3	-0.009	0.011	-0.779	0.440	
d_I_HPERM_4	0.005	0.011	0.423	0.675	
d_I_HPERM_5	0.015	0.011	1.406	0.167	
d_I_HPERM_6	-0.010	0.009	-1.085	0.284	
d_I_CONC_1	-0.370	0.193	-1.916	0.062	*
d_I_CONC_2	0.110	0.186	0.591	0.558	
d_I_CONC_3	-0.072	0.212	-0.341	0.734	
d_I_CONC_4	0.044	0.199	0.220	0.827	
d_I_CONC_5	0.149	0.202	0.736	0.466	
d_I_CONC_6	0.126	0.184	0.685	0.497	
d_I_INF_1	0.380	0.426	0.892	0.378	
d_I_INF_2	0.438	0.390	1.125	0.267	
d_I_INF_3	0.153	0.356	0.431	0.669	
d_I_INF_4	0.005	0.346	0.014	0.989	
d_I_INF_5	0.025	0.419	0.059	0.953	
d_I_INF_6	0.320	0.386	0.830	0.411	
ECT_1	0.251	0.159	1.579	0.122	
ECT_2	-0.045	0.249	-0.183	0.856	
ECT_3	-0.384	0.240	-1.599	0.117	
ECT_4	0.086	0.251	0.343	0.733	
ECT_5	0.231	0.252	0.919	0.364	
ECT_6	-0.403	0.171	-2.350	0.024	**
d_I_nHPI_6	0.115	0.181	0.638	0.527	

Table 18. Error correction model of the tourism model.

Variable	Coefficient	Std. Error	t-statistic	p-value	
d_TOURISM_1	0.000	0.000	0.807	0.427	
d_TOURISM_2	0.000	0.001	-0.595	0.557	
d_TOURISM_3	0.000	0.000	-0.595	0.557	
d_TOURISM_4	0.000	0.000	-0.125	0.902	
d_TOURISM_5	0.001	0.001	1.310	0.201	
d_TOURISM_6	0.001	0.001	1.211	0.236	
d_I_LOANS_1	0.003	0.209	0.014	0.989	
d_I_LOANS_2	-0.024	0.248	-0.095	0.925	
d_I_LOANS_3	0.097	0.258	0.375	0.711	
d_I_LOANS_4	-0.047	0.272	-0.171	0.865	
d_I_LOANS_5	0.197	0.262	0.749	0.460	
d_I_LOANS_6	-0.502	0.202	-2.479	0.019	**
d_I_UNEMP_1	-0.109	0.060	-1.812	0.081	*
d_I_UNEMP_2	0.017	0.061	0.288	0.776	
d_I_UNEMP_3	0.048	0.062	0.774	0.445	
d_I_UNEMP_4	-0.017	0.057	-0.294	0.771	
d_I_UNEMP_5	-0.082	0.051	-1.603	0.120	
d_I_UNEMP_6	0.002	0.043	0.042	0.967	
d_I_HPERM_1	0.017	0.014	1.180	0.248	
d_I_HPERM_2	0.015	0.014	1.063	0.297	
d_I_HPERM_3	-0.009	0.014	-0.690	0.496	
d_I_HPERM_4	0.025	0.014	1.724	0.096	*
d_I_HPERM_5	0.013	0.014	0.925	0.363	
d_I_HPERM_6	-0.016	0.010	-1.607	0.119	
d_I_CONC_1	-0.199	0.271	-0.734	0.469	
d_I_CONC_2	0.517	0.237	2.178	0.038	**
d_I_CONC_3	0.004	0.273	0.014	0.989	
d_I_CONC_4	0.121	0.248	0.490	0.628	
d_I_CONC_5	0.306	0.261	1.170	0.252	
d_I_CONC_6	0.064	0.204	0.315	0.755	
d_I_INF_1	-0.335	0.598	-0.561	0.579	
d_I_INF_2	-0.041	0.638	-0.064	0.950	
d_I_INF_3	-0.227	0.573	-0.395	0.696	
d_I_INF_4	0.106	0.401	0.264	0.793	
d_I_INF_5	0.575	0.582	0.988	0.331	
d_I_INF_6	0.436	0.469	0.929	0.361	
ECTerm_1	0.263	0.174	1.514	0.141	
ECTerm_2	-0.051	0.290	-0.176	0.861	
ECTerm_3	-0.461	0.288	-1.602	0.120	
ECTerm_4	0.353	0.277	1.276	0.213	
ECTerm_5	0.112	0.261	0.427	0.672	
ECTerm_6	-0.453	0.186	-2.427	0.022	**
d_I_nHPI_6	0.191	0.190	1.002	0.325	