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Key Challenges Facing Business Sciences

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Key Challenges Facing Business Sciences

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THE RELATIONSHIP BETWEEN PORTUGUESE ECONOMY INDICATORS AND HOUSING PRICES

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ABSTRACT

The housing market is an important industry not only in a country's economy but also for the living conditions of the population. Several studies explain how real estate is related to the main economic indicators of a country. Using the Engle-Granger cointegration methodology, this research studies the main drivers of the housing prices of a European country that suffered a financial crisis. Analysing the Portuguese housing market with quarterly data between 1998 and 2019, it is possible to show that in the long term, unemployment and interest rates are negatively related and that population, inflation and money supply are positively associated with housing prices. With this study, it is possible to conclude that economic issues are relevant to the housing market and mainly to home prices.

Keywords: Housing Prices, Long-Term Effects, Cointegration, Economic Factors.

JEL Classification: R30, R31, R32

1. INTRODUCTION

The economic conditions of a country have impacts on the housing market, both in terms of housing supply and demand and the prices borne by the population. Housing prices are formulated based on the population's ability to pay, which is dependent on the country's economy. This study analyses the real estate market in a European country that suffered a severe economic and financial crisis following the 2008 subprime crisis in the United States. Portugal requested foreign aid in April 2011 from a troika made up of the International Monetary Fund, European Commission and European Central Bank during the 3-year period, between April 2011 and May 2014. In view of this context, it seems relevant to verify the impact of the evolution of the economy over the last 30 years on housing prices. In this way, it is possible to analyse the significant effects of economic conditions on the housing prices of a European country that had experienced a strong financial shock during the last 10 years.

Housing prices are related to the intrinsic value of the properties, i.e., land and construction costs, but it is also important to understand the role of the main stakeholders in the real estate market, such as landlords, developers, builders, real estate agents, tenants and buyers. Through these stakeholders, this industry has important links with other economic activities, such as brokerage, counselling, appraisal, urban planning, education, management and finance (Cortesi, 2003).

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In this work, the main economic indicators of a country that potentially have impacts on housing prices are analysed. The idea is that in a country with more unemployment, higher long-term interest rates, higher inflation and money supply, the population would be expected to have less financial capacity to buy a house or the prices will be too expensive for most people. All these factors affect housing demand or supply. In addition, population growth is also a relevant factor for this analysis because it influences housing demand.

This study uses the Engle-Granger (EG) cointegration methodology and a quarterly sample of the Portuguese market. The results show that unemployment and interest rates are statistically negatively related to housing prices, but population, inflation and money supply are statistically positively related to the prices of houses in Portugal.

This paper is organized as follows. The next chapter presents the theoretical framework explaining how macroeconomic and microeconomic characteristics of a country may affect the housing market. Then, the methodology is presented. In the fourth section, the results are presented and discussed. Finally, the paper ends with the conclusion.

2. THEORETICAL FRAMEWORK

2.1 Country's Economy and Real Estate Prices

It is relevant to analyse the relationship between the real estate market and economic growth because of the effect of the real estate industry. Groot (2006) explains that a decrease in real estate prices can contribute to economic recessions and that in a recessionary period, the prices decrease, which leads to low economic growth. In this case, there is a lower interest rate. Then, in a recovery phase, there is low inflation, slow economic growth and a gradual increase in interest rates.

Therefore, Ren (2016) presents the relationship between economic growth and real estate based on the idea that investors contribute to the growth of this industry by putting their money in houses (real estate market) with the expectation of better returns. The real estate industry is also important because of its positive impact on construction activity and furniture manufacturing, for example. Łaszek, Leszczyński and Olszewski (2017) show that an increase in construction helps to reshape the local housing market and also helps to create jobs, which has a positive effect on the economy.

There are three areas in which the housing supply affects economic growth: labour markets, infrastructure and business (Glossop, 2008). The first is important because labour mobility is affected by the lack of availability and unaffordability of housing. The second is relevant because locations with higher housing demand have better infrastructure, while locations with lower housing demand often have poor infrastructure (for example, transportation). Third, locations with business buildings often have high demand, which leads to an increase in wages and higher rents. In contrast, poor housing locations make it difficult to attract people with higher financial capacities.

2.2 Microeconomic Perspective of the Real Estate Market

The housing market differs across locations, between countries, provinces, cities and towns, and its prices are influenced by several factors such as space, location, standard and type of ownership. Furthermore, the homebuyers can have the objective of being property owners or pure financial investors (Høvring & Parmo, 2016). However, location is an essential factor to analyse in this issue. For example, a house with good construction and excellent living conditions but in an undesirable location will possibly not have a very high price, while a

small house without great amenities and without great alternatives in a given location (and possibly with a lot of demand) will tend to have an excessively high price.

The interest rates, home construction, unemployment, population and household income are important explanatory factors for home prices (Barot & Yang, 2002; Barksenius & Rundell, 2012; Xu & Tang, 2014). The most important factors are related to the housing supply and demand (Høvring & Parmo, 2016), which are interrelated. The supply factors are related to 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; Tsatsaronis & Zhu, 2004; Zhu, 2005; Stepanyan, Poghosyan & Bibolov, 2010).

2.2.1 The Demand for Housing

Regarding housing demand, it is important to analyse factors such as household wealth, economic growth, unemployment and population growth, general price level, the cost of borrowing, credit availability and interest rates (Tsatsaronis & Zhu, 2004; Stepanyan et al., 2010). Furthermore, in the long run, housing demand is related to, for example, expected or permanent income, structure of the population, real estate service companies, and the expected capital gains of home ownership (Meen, 2002). Thus, it is expected that housing demand will not be constant.

Zhu (2005) states that housing price variations are related to the overall changes in economic conditions. For example, economic growth has a positive impact on households' income, which can increase housing demand, and it is also positively related to housing prices. Selim (2009) the locational value is usually analyzed by hedonic methods that use multiple regression techniques on large data sets and require a formality based on microeconomic theory in the analyses. Because of potential non-linearity in the hedonic functions, artificial neural network (ANN) finds that investors also have a positive impact on housing demand. Considering that it is not easy to change the housing supply in the short term, the housing prices are mostly influenced by the demand.

Additionally, demographic factors, such as population size, migration patterns and level of urbanization, have positive impacts on housing demand, which is also directly related to home prices (Bujang, Zarin & Jumadi, 2010). Anenberg, Hizmo, Kung and Molloy (2015) also emphasize the impact of banks' lending rules. As buyers rely on mortgage loans to purchase their homes, any changes in the availability of loans and credit conditions have significant impacts on the demand for and prices of housing.

2.2.2 The Supply of Housing

In the short term, the housing supply tends to be inelastic, unstable and constrained due to lack of land and deadlines to finish new construction (Stepanyan et al., 2010). Hence, Selim (2009) and Adams and Füss (2010) conclude that supply inelasticity can be relatively adjusted with the construction of new houses. Thus, in the long term, the housing supply adjusts to the housing demand with the construction of new houses.

When the construction costs of new houses increase, construction declines because it has a positive impact on the house's final price, and few buyers have the financial capacity to buy them. An increase in construction costs has a positive impact on home prices (Xu & Tang, 2014).

In the long run, an increase in the supply tends to decrease housing prices because there is not enough demand to buy. Moreover, if there is an excess in the housing supply, it is possible to find negative impacts on the economy (Glindro, Subhanij, Szeto & Zhu, 2007).

2.3 Macroeconomic Analysis of the Real Estate Market

The real estate market is an important industry in a country's economy (Wang, 2003), and it is expected that a stable macroeconomic environment can cause an expansion in the real estate market (Alkali, Sipan & Razali, 2018). The macroeconomic factors mostly influence the owners' capacity to pay for a house, financial costs such as the interest rate and credit conditions that influence mortgage accessibility (Cohen & Karpavičiūtė, 2017).

Égert and Mihaljek (2007) and Adams and Füss (2010) present the supply and demand determinants of housing prices, which are related to economic and financial indicators such as Gross Domestic Product (GDP), unemployment, interest rate, credit conditions, and demographic indicators, e.g., population ageing and migration. Other studies identify several economic factors such as interest rates, economic growth, inflation, bank lending and equity prices (Hofmann, 2003; Tsatsaronis & Zhu, 2004); GDP, population, and unemployment (Égert & Mihaljek, 2007). The main ideas in this study are presented below.

2.3.1 Interest Rate

Real estate prices are strongly linked to the financial system. Considering that home acquisition usually requires external financing, the mortgage rate is an important factor that influences the buyer's decisions on whether to invest in a property. It is expected that an increase in the mortgage rate will have a negative impact on the buyer's decisions. However, Andrews (2010) suggests that due to the tax benefits granted for mortgage interest payments, home buyers may be attracted by governments to buy houses with loans and thus acquire more expensive houses. Furthermore, the mortgage interest rates and bank lending decisions can be affected by various factors that include the monetary policies and the houses' current market values (Goodhart & Hofmann, 2008). Finally, an increase in the availability of bank lending is expected to lower interest rates, which has a positive impact io property prices (Hofmann, 2003).

2.3.2 Inflation

Inflation is another factor that is expected to be negatively related to real estate demand. Bernardi and Rodenholm (2013) state that if inflation is expected, precautions can be taken to prevent financial losses, but if inflation is unexpected, it can provoke financial losses for the investors while certain groups can take advantage of this unexpected increase in prices.

Inflation is also important because of its impact on construction costs and the money supply, which are positively related to the real estate prices (Alkali et al., 2018). Finally, bank lending decisions can also be influenced by inflation, as lower inflation results in lower interest rates. Hence, bigger loans can be offered to households.

2.3.3 Population

Demographic factors can also be important for the housing prices (Égert & Mihaljek, 2007). Housing demand can be influenced by demographic conditions, for example, population growth by migration flows (short run) and new births (long run). In the short run, migration flows have a positive impact on housing prices because of the growth of populations in the receptive locations. However, in the long run, the growth of the population through births is only reflected in the housing demand twenty years later (Panagiotidis & Printzis, 2016).

2.3.4 Unemployment

The level of unemployment, theoretically, is negatively related to housing prices. When unemployment is high, there are fewer buyers in the market, thus leading to a decrease in

housing demand. The unemployment rate can have both a direct and an indirect effect on the housing prices (Gan & Zhang, 2013). Directly, the unemployed population fails to get a mortgage from the banks due to financial constraints, thus reducing the housing demand. In addition, the construction companies (that are the sellers) slow down the construction of new houses because of its expectation of a decrease in buyers. Indirectly, when the unemployment rate increases, it is possible to suppose a negative impact on the expected future incomes of the potential future owners, so they move away from home purchase decisions, causing a negative impact on housing demand and, consequently, on housing prices. However, when the unemployment rate decreases, it is possible to suppose a positive impact on the expected future incomes of the potential future owners, which has a positive impact on the housing demand and, consequently, on the housing prices.

2.3.5 Money Supply

The money supply has a positive influence on housing prices (Adams & Fuss, 2010; Barksenius & Rundell, 2012). Goodhart and Hofmann (2008) explain that an increase in the money supply can cause an increase in asset prices and that, theoretically, an increase in the money supply has a positive impact on housing prices (Goodhart & Hofmann, 2008). However, Xu and Tang (2014) found that the money supply has a negative effect on housing prices.

2.4 The Case of Portugal

2.4.1 The Portuguese Economy

The Portuguese economy has faced many economic changes in the last twenty years. Since entering the European Union, the Portuguese economy has been improving substantially, but it has had periods of lesser brilliance. The period after entering the Eurozone (between 2000 and 2007) was not very positive for the economy, and it was followed by the global great recession and a Eurozone crisis (Morais, 2018). An economic and financial crisis started in Portugal. The GDP growth for that period slowed down to 0.20% and inflation increased to 2.59%, which was also related to the oil prices. The Portuguese GDP decreased 1.83% and inflation increased to 3.65% in 2011 due to a severe financial crisis. Because of the financial and economic conditions, Portugal had to ask for foreign aid. In the following years, the economic situation of the country was not very good, with a high unemployment rate (that increased to 16.2% in 2013) and, because of that, more than 200,000 Portuguese emigrated between 2011 and 2014 (Morais, 2018).

After facing a collapse in the previous five years, the Portuguese economic conditions began to recover by the year 2014 (OECD, 2019). The improvement in economic conditions enabled economic growth of 2.7% to be achieved in 2017, with an increase of 2.3% in GDP in the following year (OECD, 2019), which are good indicators, considering its historic numbers. In these years, it is still possible to perceive a decrease in the unemployment rate and a substantial decrease in emigration (Puig & Sánchez, 2018). In addition, after declining each year between 2009 and 2013, real estate investments have also begun to increase, such as investments in new and existing homes (OECD, 2019).

Nevertheless, the OECD (2019) states that despite the improvement in economic conditions in Portugal, the effects of the previous crisis are still felt, and economic growth is still relatively low in the context of OECD countries. It should also be noted, for example, that public debt has increased a lot during the last few years and stands at 121% of GDP in 2018, which is too high. Araújo, Lourenço and Pereira (2016) expect that the Portuguese economy will continue to grow at a moderate pace in the coming years but be below the growth of the European Union.

2.4.2 Demographics of Portugal

The real estate market is sensitive to changes in the social, demographic, political and economic environments (Rącka, 2017). Although there has been an increase in immigration, Portugal has seen a decrease in the total population, which is related to low fertility, declining birth rates, ageing population and migration flows (INE, 2014; Albuquerque, 2015). Hence, from 2008 to 2011, the population decreased from 10.5 million inhabitants to 10.3 million inhabitants. INE (2014) forecasts that the Portuguese population is expected to decline about 4.5% until 2030 and 17.3% until 2060.

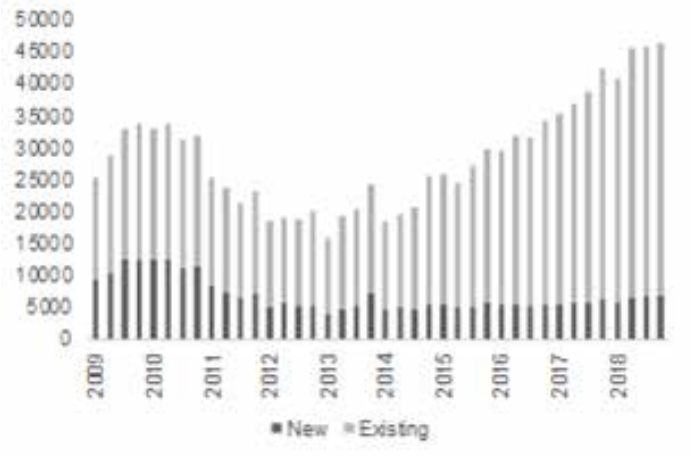
Today, Portugal has a wider variety of foreign inhabitants, which is related to immigration from Portuguese-speaking African Countries (PALOP), Brazil and Asia (Chinese, Indians and Pakistanis), and lately from Eastern European countries (Norte, Mortágua, Rosa, Silva & Santos, 2004). The foreign population is about 3.7% of the Portuguese population (INE, 2012).

2.4.3 Housing Market in Portugal

Between 1999 and 2006, the housing prices in Portugal rose on average less than 1% per year. Then, housing prices declined 4% on average per year between 2007 and 2013. After its lowest level in 2013, housing prices have been increasing by 4% on average per year (Lourenço & Rodrigues, 2017). Over the past few years, there has been a constant increase in housing prices, in nominal and real terms, and new loans continue to grow strongly and spreads have been progressively lower (Banco de Portugal, 2018). In a study about the Portuguese real estate market, Lourenço and Rodrigues (2017) show that housing prices are related to the country's economic growth and interest rates, and if the Portuguese economy continues to improve, the housing prices will also increase.

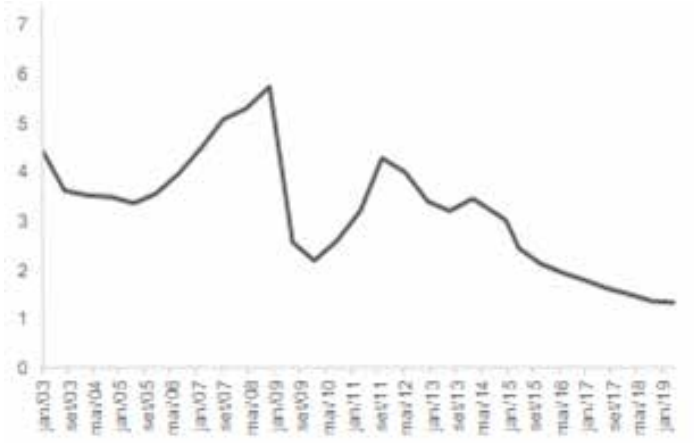
Additionally, Monteiro (2018) explains that the evolution of housing demand can be explained through the number of houses for sale, credit conditions and interest rates. Thus, Figure 1 shows the absolute number of real estate transactions which, on average, have increased since around 2013, showing significantly higher values in 2018 and 2009. Similarly, Figure 2 shows that interest rates have got low values recently. With lower interest rates, it is expected that the amount of loans will increase, which leads to a higher housing demand and the subsequent increase in housing prices.

Figure 1. Number of Transactions of Housing Units



Source: Own elaboration using data from INE

Figure 2. Interest Rates on New-Loan Households



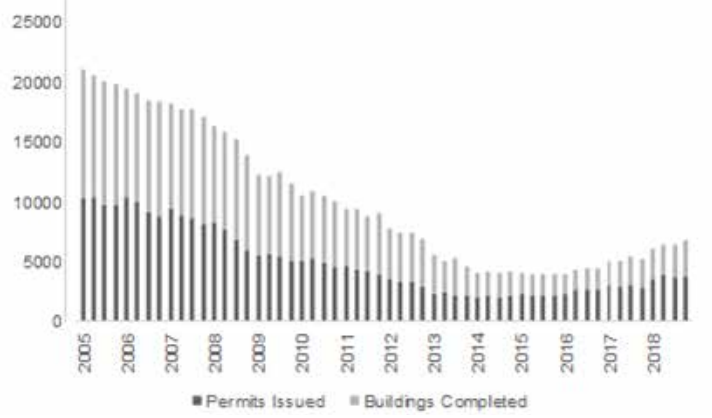
Source: Own elaboration using data from the Bank of Portugal

Figure 3 presents the housing supply in terms of the building permits 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 until 2014 observed both in building permits and completions. According to the figure, after a stabilized period between 2014 and 2016, it has begun a slow increase (Monteiro, 2018).

There are several studies about how macroeconomic factors influence the housing market in Portugal. Tavares, Pereira and Moreira (2014) studied the Portuguese real estate market between 2001 and 2011, and they found negative impacts of loans, the interest rate and the unemployment rate on housing prices and a positive impact of GDP and construction confidence on housing prices. Besides, Lourenço and Rodrigues (2014) show a positive impact of real disposable income, labour and real interest rates on the Portuguese housing prices.

In another study, Lourenço and Rodrigues (2017) found that housing loans increased 25% in the 1990s and 90% in 2007 due to lower interest rates and higher disposable income, without any impact on the housing prices. With the financial crisis, the interest rates reached the highest values in 2008. Between 2011 and 2017, the interest rates decreased to low levels, which induced an increase in housing demand and, consequently, higher prices.

Figure 3. Building Permits and Completions



Source: Own elaboration using data from the Bank of Portugal

Finally, because Portugal and its cities are becoming more and more important tourist destinations, short-term rentals have emerged in the city centre (Leilani, 2017). Alternatively, foreign investors can buy houses as investments.

3. METHODOLOGY

There are a lot of authors who have studied real estate markets. Barot and Yang (2002) studied the Swedish and United Kingdom (UK) housing markets between 1970 and 1998, and they conclude that household mortgage debt has a positive impact on housing prices because more available loans increase housing demand. This is more important for the housing prices in the UK than in Sweden in the short term but less important in the long term. In a study of the Swedish market between 1987 and 2011, Barksenius and Rundell (2012) found evidence that the bank lending rate, financial wealth, disposable income, unemployment and the money supply are important in relation to the housing prices, both in the short and long terms. Based on a UK database between 1971 and 2012, Xu and Tang (2014) show that construction costs, credit and the GDP have positive impacts on UK housing prices, while money supply and disposable income have a negative impact on housing prices. Analysing the long-term German housing market between 1989 and 2017, Toome (2018) determine the fundamental factors that have influenced housing prices and provide evidence of the cyclicality of German housing market. The perspective of this study is relevant for real-estate investors and home-buyers alike. It can serve as a guideline for navigating in the German housing market and provides insight for investment decisions. This study provides a thorough overview of the German real estate market and housing market in particular. The mechanics of the real estate and housing markets are explained in detail. Furthermore, the difference of fundamental and speculative aspects of housing prices is outlined. The resulting cyclical behavior of real estate markets is elaborated and the formation of bubbles within the real estate markets is discussed. For the econometric analysis Engle-Granger two-step approach is used. In the first step cointegration relationship between variables is determined and the residuals from the regression used as an input for the error correction model (ECM found that the real long-term interest rate, real construction costs, the unemployment rate and real disposable income are negatively associated with housing prices and that population and housing permits are positively associated with housing prices. All these studies have used the EG method.

3.1 Research Methodology

This work specifically follows the EG cointegration methodology (Engle & Granger, 1987) that is explained by Barot and Yang (2002) and Xu and Tang (2014). The first step involves the analysis of stationarity of all variables after taking the first difference. If stationarity is confirmed, a cointegration regression can be applied. This cointegration regression only studies long-term behaviour and does not analyse short-term effects. Following the cointegration regression, White's test of heteroskedasticity is performed to determine whether the variance of errors in a regression model is constant. At the end, heteroskedasticity-corrected cointegration regression is performed.

In this study, the house price index is the dependent variable in the following specification model:

$$l\_\mathrm{nHPI}_t = \alpha + \beta_0(l\_\mathrm{UNEMP}_t) + \beta_1(l\_\mathrm{POP}_t) + \beta_2(l\_\mathrm{LTIR}_t) + \beta_3(\mathrm{INF}_t) + \beta_4(l\_\mathrm{M3}_t) + \varepsilon t \quad [1]$$

The definition of variables in model [1] and its theoretical relationship is presented in Table 1.

3.2 Data Description and Sources

Secondary data have been collected from different databases: the OECD, Instituto Nacional de Estatística (INE) and Banco de Portugal. This study uses quarterly data between the first quarter of 1998 and the second quarter of 2019. The house price index is the dependent variable that is explained by the unemployment rate, population, long-term interest rate, inflation rate and money supply. All variables used in this study are explained in Table 1, along with a description, the sources of the data and the theoretical relationship with house prices. The variables used in this work are based on the specification model of Xu and Tang (2014) and Toome (2018)determine the fundamental factors that have influenced housing prices and provide evidence of the cyclicality of German housing market. The perspective of this study is relevant for real-estate investors and home-buyers alike. It can serve as a guideline for navigating in the German housing market and provides insight for investment decisions. This study provides a thorough overview of the German real estate market and housing market in particular. The mechanics of the real estate and housing markets are explained in detail. Furthermore, the difference of fundamental and speculative aspects of housing prices is outlined. The resulting cyclical behavior of real estate markets is elaborated and the formation of bubbles within the real estate markets is discussed. For the econometric analysis Engle-Granger two-step approach is used. In the first step cointegration relationship between variables is determined and the residuals from the regression used as an input for the error correction model (ECM).

Table 1. 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, which is measured by the OECD real house price index. This house price index refers to the sale of new and existing homes, following the recommendations from the Residential Property Prices Indices manual (with data from 1990).	OECD	
Unemployment rate	l_UNEMP_t	Logarithm of the ratio of the working age population who are not employed and thus do not generate income in period *t*.	INE	-
Population	l_POP_t	Logarithm of the number of inhabitants of a place in period *t*.	INE	+
Long-term interest rate	l_LTIR_t	Logarithm of long-term interest rates, measured by the government bonds' maturity in ten years. Rates are mainly determined by the price charged by the lender, the risk from the borrower and the fall in the capital value in period *t*.	OECD	-
Inflation	INF_t	General price increases of goods and services in period *t*.	Banco de Portugal	+
Money supply	l_M3_t	Logarithm of the money supply is the total value of money available in an economy at a point in time in period *t*.	INE	+

Source: Own Elaboration

The unemployment rate is negatively related to the housing prices (Égert & Mihaljek, 2007; Adams & Füss, 2010). The housing demand decreases when the unemployment

rate increases because potential buyers do not have the financial capacity to buy a home. However, Xu and Tang (2014) found a positive relationship between these variables because in the UK, the housing market has no obvious correlation between housing prices and unemployment. Hence, further investigation is needed to understand the behaviour of the Portuguese housing prices in relation to changes in the unemployment rate.

Égert and Mihaljek (2007) and Borowiecki (2009) show that population is important to the housing prices. Égert and Mihaljek (2007), Borowiecki (2009), Adams and Fuss (2010), and Xu and Tang (2014) found a strong negative association between interest rates and housing prices. Although there are few studies about the relationship between housing prices and inflation, Hofmann (2003) found that inflation was important in determining housing prices in a pool of industrialized countries. Tsatsaronis and Zhu (2004) showed that a change in the inflation rate has more impact on the total variation in housing prices than real disposable incomes and interest rates. Regarding the monetary factors, Adams and Füss (2010) found a positive effect of the money supply on housing prices in the short term. The following section presents the main results.

4. RESULTS

4.1 Descriptive Statistics

To understand the data used in this study, the descriptive statistics of variables used are in the table below. The nominal house price index has a maximum value of 140.73 in the second quarter of 2019 and the minimum value of 83.62 in the first quarter of 1998. The unemployment rate has a mean of 8.69% and a maximum value of 17.50% in 2013, and it was decreasing until the second quarter of 2019. The Portuguese population stabilized in the period under study at about 10,413,000 inhabitants, with a standard deviation of 125. After increasing slightly until 2009, it started to decrease slightly since 2010. The long-term interest rate reached the maximum values in 2011 and 2012 during the financial crises, and from then on, it fell to very low values, until reaching the minimum value of 0.93 in the last period under analysis. The inflation rate has a relatively low mean of 1.97% and the higher values were in 2001. During the period under analysis, there were negative inflation rates in 2009 and 2014. The money supply had a mean of 144,660 and a standard deviation of 25,662.

Table 2. Descriptive Statistics

	Mean	Median	Standard Deviation	Minimum	Maximum
nHPI	105,73	106,37	10,72	83,62	140,73
UNEMP	8,69	7,80	3,68	3,70	17,50
POP	10 413	10 443	125,15	10 138	10 574
LTIR	4,72	4,36	2,25	0,93	13,22
INF	1,97	2,29	1,42	-1,51	4,79
M3	144 660	147 000	25 662	95 116	207 200

Note: This table presents the database of descriptive statistics, analysing the period between 1st quarter 1998 and 2nd quarter 2019. The variables used are the following: nominal house price index (nHPI); unemployment rate (UNEMP); population or number of inhabitants (POP); long-term interest rates (LTIR); inflation rate (INF); and money supply (M3). See Table 1 for the description of all variables. Number of observations: 86.

Source: Own Elaboration

Table 3 shows the correlation coefficients between the variables used in this study. l_nHPI has a strong positive relationship with l_M3 (0,632) and with l_LTIR (0,622). These correlations support the idea that a set of variables can explain the housing prices in Portugal, mainly l_M3, l_LTIR and INF.

Table 3. Correlation Matrix

Correlation coefficients using all observations 1998:1 - 2019:2

5% critical value (bilateral) = 0,2120 where, n = 86

l_M3	l_UNEMP	l_POP	l_LTIR	l_nHPI	INF	
1,0000	0,591	0,326	0,348	0,632	0,501	**l_M3**
	1,000	0,420	0,147	0,101	0,524	**l_UNEMP**
		1,000	0,407	0,138	0,093	**l_POP**
			1,000	0,622	0,438	**l_LTIR**
				1,000	0,060	**l_nHPI**
					1,000	**INF**

Note: This table presents Pearson correlation coefficients that are statistically significant at 5%. See Table 1 for the description of all variables. Number of observations: 86.

Source: Own Elaboration

4.2 Stationarity Test

Before the analysis, it is important to understand whether the time series is stationary or not. Thus, the Augmented Dickey-Fuller (ADF) unit root test is carried out (see Table 4). When the time series data is not stationary, at a significance level of 10%, it should be done the first (or higher) difference of the series until a stationary time series is obtained.

Table 4. Unit Root Test Results

	At level			First difference		
	Test Statistic	***p*-value**	**Analysis**	**Test Statistic**	***p*-value**	**Analysis**
l_nHPI	0,219	0,998	Constant and trend	-3,853	0,018	Constant and trend
l_UNEMP	0,420	0,999	Constant and trend	-9,220	0,000	Constant and trend
l_POP	-3,300	0,073	Constant and trend	-5,213	0,000	Constant and trend
l_LTIR	0,325	0,999	Constant and trend	-4,663	0,002	Constant and trend
l_INF	-1,346	0,869	Constant and trend	-14,600	0,000	Constant and trend
l_M3	-1,373	0,862	Constant and trend	-7,790	0,000	Constant and trend

Note: This table presents the ADF unit root tests of all the variables, at level and after taking the first difference; Null hypothesis of the unit root test: there is a unit root (non-stationary time series). See Table 1 for the description of all variables.

Source: Own Elaboration

The results allow us to understand that only the population variable is stationary at the level. Then, the unit root of the first difference is studied. These results show that all time series are significant and that they are stationary. Thus, the series are stationary after taking the first difference. This means that the EG cointegration method can be applied.

4.3 Engle-Granger Cointegration

To understand the impact of the macroeconomic variables on housing prices, firstly, it is necessary to know whether it is possible to use the cointegration method. The ADF test in Table 5 shows that it is possible to use this method because the *p*-value for this test is lower than the significance level used.

Table 5. Cointegration Estimation

1st step: Cointegration regression				
Ordinary least Squares, using observations 1998:1-2019:2 (n = 86)				
Dependent variable: **l_nHPI**				
Variables	*Coefficient*	*Standard error*	*t-test*	*p-value*
Const	−30,323	3,863	−7,849	<0,001
l_UNEMP	−0,280	0,027	−10,46	<0,001
l_POP	3,360	0,438	7,676	<0,001
l_LTIR	−0,065	0,013	−5,170	<0,001
l_INF	0,922	0,162	5,687	<0,001
l_M3	0,036	0,075	0,485	0,629
R-square: 0,882 / Adjusted R-square: 0,875				

2nd step: Unit root test for residuals

Augmented Dickey-Fuller test
Included 4 lags
t= 81
Null hypothesis: a = 1
Statistic test: tau_c(6) = -4,5077
Asymptotic p-value: 0,082
Coefficient of 1st order: 0,055
Lag differences: F (4,76) = 8.368 [0.0000]

Note: This table presents the cointegration test results. The 1st step shows the cointegration regression, with the dependent variable that is the first difference of the nominal house price index (nHPI) and the independent variables are the following: unemployment rate (UNEMP); population (POP); long- term interest rate (LTIR); inflation rate (INF); and money supply (M3). The 2nd step shows the ADF unit root test, with the following null hypothesis: time series is non-stationary, and the variables are non-cointegrated. See Table 1 for the description of all variables.

Source: Own Elaboration

Then, it is important to understand whether the regression results have heteroscedasticity problems. In this way, the White test in Table 6 allows us to understand that there is that kind of problem to solve. Because the null hypothesis must be rejected, there are heteroscedasticity problems. Therefore, the correction of this problem is the following step.

Table 6. White test

White test for heteroscedasticity
Null Hypothesis: without heteroscedasticity
Statistic test: LM = 60,383
p-value = p (Qui-square (20) > 60,383) = <0.001

Note: This table presents the White test. Null hypothesis: Homoscedasticity.

Source: Own Elaboration

Table 7 shows the results of the correction of heteroscedasticity regression regarding the impact of macroeconomic factors on housing prices in Portugal. Results show that, as

expected, unemployment and the interest rate are statistically negatively related to housing prices, but population, inflation and money supply are statistically positively related to the prices of houses in Portugal. These independent variables can explain more than 92% of the variation in housing prices.

Table 7. Correction of Heteroscedasticity Regression

Heteroscedasticity corrected, using observations 1998:1-2019:2 (n = 86)

Dependent variable: **l_nHPI**

Variables	*Coefficient*	*Standard error*	*t-test*	*p-value*
Const	−30,265	3,3072	−9,151	<0,001
l_UNEMP	−0,236	0,0193	−12,17	<0,001
l_POP	3,231	0,3815	8,470	<0,001
l_LTIR	−0,057	0,0096	−5,931	<0,001
l_INF	0,503	0,1399	3,599	0,001
l_M3	0,281	0,0717	3,921	0,000

R-square: 0,930 /Adjusted R-square: 0,926 / F (5,80): 212,357 / p-value (F): <0,001

Note: This table presents the results of the cointegration regression, with the dependent variable that is the first difference of the nominal house price index (nHPI) and the independent variables are the following: unemployment rate (UNEMP); population (POP); long-term interest rate (LTIR); inflation rate (INF); and money supply (M3). See Table 1 for the description of all variables.

Source: Own Elaboration

These results allow us to confirm the Gan and Zhang (2013) ideas about unemployment because an increase in the unemployment rate lowers a household's expected future income and induces lower construction of new homes; thus, the housing prices decrease. In addition, Tavares *et al*. (2014), Égert and Mihaljek (2007) and Adams and Füss (2010) found similar results. This study also shows that lower interest rates to finance home acquisitions are related to an increase in housing prices, in which is similar to the findings by Andrews (2010), Égert and Mihaljek (2007), Borowiecki (2009), Adams and Fuss (2010), and Xu and Tang (2014).

In Portugal, in the period of this study, it is evident that the housing prices increased and that it was related to inflation. In addition, Hofmann (2003) and Alkali *et al*. (2018) found that inflation has a positive impact on the construction costs and on real estate prices. Goodhart and Hofmann (2008) studied the impact of the money supply and demonstrated that an increase in it leads to an increase in asset prices, such as housing prices. This study and Adams and Füss (2010) reach the same conclusion. Finally, because of the demand for houses, population is an important factor since there are short-term and long-term positive impacts of population on housing prices. Égert and Mihaljek (2007) and Panagiotidis and Printzis (2016) also state the same.

5. CONCLUSION

The aim of this work was to evaluate which factors have impacts on the housing prices in Portugal. The housing prices in this country rose on average less than 1% per year until the beginning of the international financial crisis in 2007. Then, the housing prices decreased until 2013, and they recovered quickly until reaching the highest value in 2019. Hence, a study to determine the macroeconomic factors that can explain housing prices in Portugal and whether these factors can fully explain the latest price developments is appropriate.

A lot of studies in the last thirty years have used the EG method to analyse how the real estate market is related to the main economic issues of a country. Barot and Yang (2002) showed that in UK and Sweden, debt financing of houses is positively related to housing demand. The impact is more pronounced in the UK in the short term and is greater in Sweden in the long term. Barksenius and Rundell (2012) also showed that in Sweden, the bank lending rate, financial wealth, disposable income, unemployment and the money supply are important in relation to the real estate prices. Xu and Tang (2014) found evidence that construction costs, credit, GDP and the unemployment rate are positively related to UK housing prices and that disposable income and money supply are negatively related to housing prices. Toome (2018) determine the fundamental factors that have influenced housing prices and provide evidence of the cyclicality of German housing market. The perspective of this study is relevant for real-estate investors and home-buyers alike. It can serve as a guideline for navigating in the German housing market and provides insight for investment decisions. This study provides a thorough overview of the German real estate market and housing market in particular. The mechanics of the real estate and housing markets are explained in detail. Furthermore, the difference of fundamental and speculative aspects of housing prices is outlined. The resulting cyclical behavior of real estate markets is elaborated and the formation of bubbles within the real estate markets is discussed. For the econometric analysis Engle-Granger two-step approach is used. In the first step cointegration relationship between variables is determined and the residuals from the regression used as an input for the error correction model (ECM showed that the real interest rate, real construction costs, real disposable income and the unemployment rate are negatively associated and that population and housing permits are positively linked with long-term housing prices in Germany.

In order to understand the determinants of housing prices in Portugal, this paper used data from 1998 to 2019 at a quarterly frequency. To understand the impact of the economic factors on real estate, this paper studied whether inflation, unemployment, population, the long-term interest rate and the money supply were relevant. The EG cointegration methodology was used to reach the empirical results. The cointegration test shows that all factors are significant for studying the real estate market. The results allow us to understand that there is a negative long-run relationship between housing prices and unemployment and between housing prices and the interest rate, while population, inflation and the money supply have positive impacts on housing prices.

In the future, it is important to use other variables to justify housing price evolution, e.g., foreign population or the flow of tourists. Although this study has analysed the impact of economic variables in housing prices in the long term, it would also be very important to understand that impact in the short term. In addition, in order to investigate longer-term dynamics, it would be useful to include longer time series into the analysis. It would also be important to use Vector Error Correction or Vector Autoregressive methodologies.

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THE INVESTIGATION OF THE ROLE OF INFORMATION TECHNOLOGY IN CREATING AND DEVELOPING A SUSTAINABLE COMPETITIVE ADVANTAGE FOR ORGANIZATIONS THROUGH THE IMPLEMENTATION OF KNOWLEDGE MANAGEMENT

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ABSTRACT

The main purpose of this study was to investigate the role of Information Technology in the development of sustainable competitive advantage in organizations through implementing knowledge management. This research is applied research in terms of purpose and correlational research in terms of data analysis. the statistical population of this study was 45 Companies active in the electronic insurance industry of Iran. Questionnaires were used for data collection. Structural equation modeling was used to analyze the data. The results showed that IT has a positive and significant association with a sustainable competitive advantage and knowledge management of the companies under study. The results of this study showed that companies operating in the electronics insurance industry can achieve a sustainable competitive advantage by using the appropriate tools of IT and implementing knowledge management.

Keywords: Information Technology, Sustainable Competitive Advantage, Knowledge Management, Structural Equation Model.

JEL Classification: M1, M16, O31

1. INTRODUCTION

Information Technology (IT) is a tool used by organizations to deal with pressures and threats. IT not only enables effective business operations, but also changes the way in which a competitive advantage is achieved in the business environment. (Rusly et al., 2014). The advent and in-depth use of IT, particularly communication networks and the Internet, have brought a fast, safe, and convenient method of obtaining, sharing, and storing knowledge by increasing collaborations and reducing costs (Mohamed et al., 2006). Therefore, IT policies and strategies should be consistent with the organization's vision, important activities, and mission to include targeted goals (Ziraba & Okolo, 2018). In recent years, rapid development of IT helped staff, customers, suppliers, and business partners to interact with each other. Also, inter-professional partnerships have been effective in product development, marketing, distribution, and customer service (Tseng, 2014). Recent studies have shown that the use of IT can improve a company's performance and competitive position (Bharadwaj, 2000). IT can create a competitive advantage for an organization and improve its competitive position in the marketplace (Anderson, 2001). Previous empirical and theoretical analyzes have shown consistent results in terms of the effect of integration

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between IT and sustainable competitive advantage (Mao et al., 2016). Many companies have used knowledge management to survive and to continue working in their industry. Knowledge management is defined as managing the knowledge of the company's employees and stakeholders. Many companies through the use of knowledge management, have been able to survive in the current economic situation and gain sustainable competitive advantage (Sultan, 2013). Today, in addition to using the knowledge of their employees, Companies should consider the idea of using the knowledge of customers as well. The most important tool used by companies to communicate with their customers is the customer relationship management tool, which is a kind of Simultaneous management tool (Lin & Kozhikode, 2008). A sustainable competitive advantage in an organization is created by the unique combination of the organization's resources and skills (Mao et al., 2016). The resources of the organization are physical, human, and organizational capital. Nowadays, IT and knowledge management are the most important of these organizational resources (Yassen et al., 2016). The main purpose of this study was to investigate the role of IT in creating and developing a sustainable competitive advantage of organizations operating in the Iranian insurance industry with the help of knowledge management implementation. The main purpose of this study was to investigate the role of IT in creating and developing a sustainable competitive advantage about the mediating role of knowledge management among companies operating in Iran's e-insurance industry. The provision of electronic insurance services is influenced by the development of IT by insurance companies, in other words, from the insurance company, the use of IT tools such as the Internet significantly reduces the physical costs of insurance services. Insurance companies around the world are shifting their business strategies to new opportunities through e-insurance, because the provision of e-services enables insurance companies to expand on a large scale and change strategic behavior, ultimately achieving facilities. Therefore, it is necessary to study the relationship between IT and sustainable competitive advantage of companies operating in this field, and in the meantime, the role of knowledge management as a facilitator is undeniable.

2. LITERATURE REVIEW

2.1 Information Technology and Sustainable Competitive Advantage

Nowadays, there is a wide and continuous interest in information systems and their effects on business strategy, especially systems that can provide a sustainable competitive advantage for innovative companies (Clemons & Row, 1991). Organizations can now take advantage of the sustainable competitive advantage of IT in a way that meets the needs of the business (Lohrke et al., 2016). Organizations need to know how to use this technology in their organizational activities and processes. Experience shows that implementing successful business strategies using IT has improved organizational efficiency and effectiveness (Ajhvan, 2004). Despite the relatively short history of IT and its rapid expansion, various definitions and perceptions have been presented for it; which with a thorough and deep look, there are also inconsistencies between them (Tanui et al., 2016). The term "Information Technology" was first used by Leavitt and Whisler in 1985 to express the role of computers in supporting decision-making and information processing in organizations. In the early years, IT was only seen as a supportive tool in the overall corporate strategy. But with the successful implementation of IT innovations, these beliefs have changed. As we can see today, IT plays an important role in organizational processes, creating new needs, developing new products, and the advent of new procedures (Chang, 2005). With the advent of e-commerce, the use of technology is becoming an acceptable and fully anticipated solution in business management. As a result, organizations are increasingly looking at technology as a tool

to create new business processes and opportunities and try to increase their competitive advantage. Accordingly, the first hypothesis of the research will be as follows:

H1: Information Technology has a positive and significant association with a sustained competitive advantage.

2.2 Information Technology and Knowledge Management

Benefiting from the usefulness of the knowledge management process depends a lot on the coordination of issues such as organizational culture, human resource management, and IT, the weakness of each of which is considered as one of the harms of the knowledge management process (Chan, 2002). The rapid development of new technologies and digital communications has led to an increase in the importance of knowledge management as a vital source for gaining competitive advantage by organizations (Donate & Pablo, 2015). Malhotra (2000) defines knowledge management as Knowledge management is the process by which organizations obtain skills in internalizing (learning) and externalizing knowledge (coding), and knowledge distribution and transfer (Malhotra, 2000). Knowledge management is the transfer of skills related to the specific task and the transfer of conventional and empirical knowledge, including appropriate organizational behavior and comprehensive decision-making skills (Sprinkle & Urick, 2016) Knowledge management consists of several processes including the production of new knowledge, making knowledge accessible from external sources, applying knowledge in processes, products or services, transferring existing knowledge in the organization, applying existing knowledge in decision making and knowledge management impact (Masadeh et al., 2017). Performing these processes requires the use of IT in knowledge management (Ray, 2008). Accordingly, the second hypothesis of the research will be as follows:

H2: Information Technology has a positive and significant association with knowledge management.

2.3 Knowledge Management and Sustainable Competitive Advantage

Due to the challenges facing organizations in the knowledge economy, organizations are constantly forced to do business Maintain their competitive advantage (Kasemsap, 2015; Torres et al., 2018). They need to differentiate between setting up and using growth strategies at the same time, which can be long-term or short-term, knowledge management strategy is long-term and sustainable. (Bazrkar et al., 2018). Create balanced innovation and high-risk activities. Hard competition, technological change, change The preferences and demands of consumers and the formation of new business models force organizations Builds to review their activities and processes, including knowledge management (Nowacki & Bachnik, 2016). Most organizations focus mainly on solving the problems and weak points in their systems and processes so that they can enhance their efficiency and finally sustain in the competitive environment of world trade (Bazrkar & Iranzadeh, 2017). Competitive advantage is the value delivered by the organization to its customers so that at that time this value is not delivered by potential and actual competitors (Chuang, 2004). Organizational awareness of the factors affecting knowledge management, which leads to its successful acceptance and implementation, will lead to the realization of their goals. Also, improving the quality of work, increasing efficiency, having up-to-date information, increasing efficiency, increasing motivation, creating a common culture to maximize innovation performance and also, creating a competitive advantage is another reason organization use knowledge management (Margilaj & Bello, 2015). Accordingly, the Third hypothesis of the research will be as follows:

H3: Knowledge management has a positive and significant association with a sustainable competitive advantage

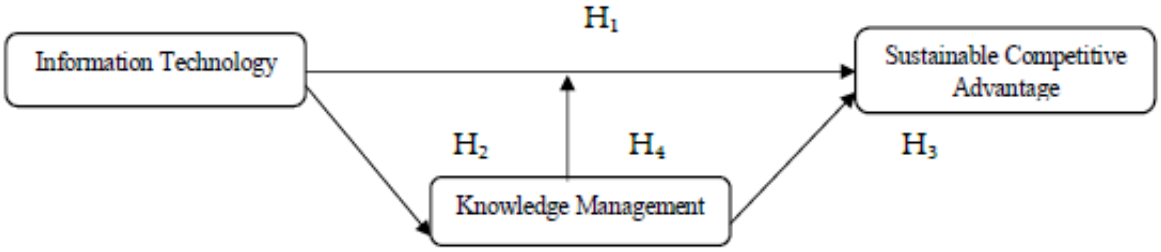
2.4 The Mediating Role of Knowledge Management in the Relationship between Information Technology and Sustainable Competitive Advantage

IT achieves success by creating a competitive advantage. IT increases the organization's long-term competitiveness by increasing capabilities, reducing costs, and improving services (Hou & Huang, 2006) knowledge management, in addition to improving innovation performance, is also needed to create a competitive advantage for the organization. In order for an organization to have a competitive advantage, it needs to be able to continuously monitor the progress of its products and services (Guimaraes et al., 2018). In general, it should be borne in mind that the main basis for the success of a company is to find and maintain a stable competitive advantage (Kim et al., 2012). Today, without increasing the competitiveness of companies, there will be little economic justification for sustaining one's life and financially declining (Darroch et al., 2015).in such circumstances, the only firms able to survive their position to promote their focus on all aspects of competition, the quality, price, speed, customer responsiveness, and innovation-oriented country, to gain a sustainable competitive advantage to its competitors to take the lead (David & David, 2016). Accordingly, the fourth hypothesis of the research will be as follows:

H4: Information Technology through knowledge management has a positive and significant association with a sustainable competitive advantage.

According to the main purpose of the research and the hypotheses, the conceptual model of the research is shown in Figure 1.

Figure 1. Conceptual Model of Research



Source: Own Elaboration

3. METHODOLOGY

This study is considered to be applied research because it seeks to develop applied knowledge in a specific field. This research is survey-based because data will be collected through a questionnaire and the method will be correlational since we will seek to understand the relationship between variables. The statistical population of this study consists of 22 insurance companies in Iran that are active in providing electronic insurance services. The statistical sample of this research consists of 45 managers of these companies. The criteria for selecting these managers are having sufficient experience and specialized knowledge about electronic insurance services. Due to the small size of the statistical population studied and the small number of managers selected, which was qualified as a statistical sample of the study, the census sampling method was used, census method is the method

of statistical enumeration where all members of the population are studied. To collect data, library studies were carried out for collecting information about the theoretical basis of research, and questionnaires were used for collecting field information. Considering that the population of the statistical population was 45, the same number of questionnaires were distributed among them. of these, 32 questionnaires (71% return rate) were obtained. The present research questionnaire consisted of 61 questions. The questionnaire consisted of a combination of three questionnaires: The IT Questionnaire for Leavitt and Whisler (1958), the knowledge Management Questionnaire for Nonaka and Takeuchi (1995), and the Sustainable Competitive Advantage Questionnaire for Hill and Jones (2010). A questionnaire containing 61 questions was distributed among the statistical sample members. In this questionnaire, a five-point Likert scale was used. Cronbach's alpha coefficient was used to calculate the reliability of the questionnaires. The results of this test are shown in Table 1.

Table 1. Results of Cronbach's Alpha Test

Components	Items	Cronbach's alpha coefficients
Information Technology	22	0.84
knowledge management	16	0.81
Sustainable competitive advantage	23	0.89

Source: Output from SPSS

The results show that the value of Cronbach's alpha coefficients of all components is more than 0.7 and considering that the criterion value of this coefficient (Cronbach's alpha) is 0.7, it can be said that the reliability of the research components is confirmed. In this research, structural equation modeling method in Smart PLS.3 software has been used to analyze the data and test the research hypotheses.

4. DATA ANALYSIS

4.1 The Normality of Data

It is necessary to first determine the normality of the distribution of variables. The Kolmogorov-Smirnov test (K-S) is used to test the normality of the distribution of variables. When checking that the data is normal, the zero hypothesis that the data distribution is normal is tested at the error level of 5%. If a significant value greater than or equal to the error level (5%) is obtained, then there is no reason to reject the zero hypotheses. In other words, data distribution will be normal. The results of this test are shown in Table 2.

Table 2. Results of Significant Coefficients of K-S

	Information Technology	knowledge management	Sustainable competitive advantage
Sig	0.081	0.075	0.080

Source: Output from SPSS

Since the significance level of the test of each of the studied variables is more than 50%, it can be said with 95% confidence that all the variables under study are normal.

We used the partial least squares structural equation modeling (PLS-SEM) method in this study for analysis of the data, fitting the conceptual model of the research, and testing

the hypotheses. PLS is a variance-based approach, which needs fewer conditions compared to similar structural equation techniques such as Lisrel and Amos (Liljander et al., 2009). For example, unlike Lisrel, PLS path modeling is more suitable for actual applications. In cases where the study aims to analyze causal relationships and prediction, the PLS path modeling method is preferred to covariance-based techniques such as Lisrel (Hair et al., 2014). PLS modeling is performed in two steps. In the first step, the measurement model is examined through validation and reliability analyzes and confirmatory factor loadings analysis. In the second stage, the structural model is evaluated by estimating the path between the variables and determining the fit indices of the model.

4.2 Evaluation of the Measurement Model

In this process, the composite reliability (CR) and average variance extracted (AVE) were performed and examined aimed at achieving the convergent validation and correlation rate. Reliability above 0.7 associated with an average variance of at least 0.5 is the two conditions required for the convergent Validation (Ching Lin & Chih Huang, 2009). factor loadings greater than 0.5 also indicate good reliability for the studied constructs (Fornell & Larker, 1981). Cronbach's alpha shows the level of reliability (reliability of internal consistency) of the construct. The values higher than 0.7 are considered desirable for the Cronbach's alpha, while values lower than 0.6 are considered undesirable. The divergent validation is also measured by the interaction factor loadings method and the Fornell-Larcker method. The first method includes examining the interaction factor loadings, in which, the correlation of the indices of a construct is compared with that structure and the correlation of that index with other constructs; if the correlation of the indices of a construct with the construct other than itself is greater, the divergent validation is questioned (Ringle & Sarstedt, 2011). The second method is the one presented by Fornell and Larker in 1981. According to this method, the divergent validation is confirmed if the squared average variance extracted of each construct would be more than the correlation between the constructs. The results of this test are shown in Table 3 and Table 4.

Table 3. Results of Evaluation of Measurement Model

Construct	Item	Factor loadings	Cronbach's alpha	Composite reliability	Convergent validation
Information Technology	IT1	0.631	0.861	0.830	0.551
	IT2	0.618			
	IT3	0.669			
	IT4	0.701			
	IT5	0.667			
	IT6	0.725			
	IT7	0.639			
	IT8	0.842			
	IT9	0.730			
	IT10	0.729			
	IT11	0.620			
	IT12	0.650			
	IT13	0.881			
	IT14	0.680			
	IT15	0.679			
	IT16	0.830			
	IT17	0.777			
	IT18	0.699			
	IT19	0.590			
	IT20	0.600			
	IT21	0.701			
	IT22	0.849			
Knowledge management	KM1	0.611	0.839	0.793	0.591
	KM2	0.618			
	KM3	0.658			
	KM4	0.619			
	KM5	0.779			
	KM6	0.806			
	KM7	0.684			
	KM8	0.793			
	KM9	0.729			
	KM10	0.638			
	KM11	0.716			
	KM12	0.597			
	KM13	0.628			
	KM14	0.634			
	KM15	0.681			
	KM16	0.677			

Sustainable competitive advantage	SCA1	0.672	0.798	0.818	0.549
	SCA2	0.778			
	SCA3	0.710			
	SCA4	0.796			
	SCA5	0.758			
	SCA6	0.912			
	SCA7	0.886			
	SCA8	0.842			
	SCA9	0.839			
	SCA10	0.920			
	SCA11	0.795			
	SCA12	0.740			
	SCA13	0.39			
	SCA14	0.768			
	SCA15	0.694			
	SCA16	0.703			
	SCA17	0.897			
	SCA18	0.835			
	SCA19	0.827			
	SCA20	0.681			
	SCA21	0.774			
	SCA22	0.731			
	SCA23	0.857			

Source: Output from PLS-SEM

Table 4. The Results of Evaluating the Divergent Validation of Constructs

	Information Technology	Knowledge management	Sustainable competitive advantage
Information Technology	0.742		
Knowledge management	0.684	0.768	
Sustainable competitive advantage	0.629	0.679	0.740

Source: Output from PLS-SEM

These results indicate a good internal consistency for the measurement model and reports the fit of the model. As a result, the measurement model is confirmed.

4.3 Structural Model Evaluation and Hypotheses Testing

The path coefficients are the most basic criteria to measure the relationship between constructs in the model. The paths in which the Significance coefficients are opposite to the direction claimed in the hypothesis will lead to the non-confirmation of the hypothesis. Some researchers including Chin (1998) suggest that the value of 0.2 is a basis for showing the accuracy of the relationship between the constructs, and thus, confirming the research hypotheses at the confidence level of 95% (Hair et al., 2010). The t-value also indicates the accuracy rate of the relationship and is used to test the hypotheses in the PLS-SEM algorithm. In the structural equations modeling method, after fitting the measurement models, the fitting of the structural model of the research is investigated. In analyzing the structural model, the relationships between latent variables (constructs) with each other are analyzed and the criteria of significance coefficients t-value and the coefficient of determination or the same, R^2, are used to fit the model. The significance *t*-values are used to evaluate

the fitting of the research structural model by several criteria that the first and most basic criteria are significance coefficients *t*, or the same *t*-values. The values of *t* greater than 1.96 indicate the accuracy of relationships between the constructs, and as a result, the research hypotheses are confirmed at 95% confidence level. According to the results, all the numbers on the paths are higher than 1.96 This indicates that the paths are significant, the structural model is fit, and the research hypotheses are validated. These results are reported in Table 5. The second criterion necessary for measuring the structural model fit is to determine the coefficients of determination, or the same R^2 related to the endogenous latent variables (dependent variable) of the model. This criterion is used to connect the measurement and structural components of the structural equations modeling and represents the effect of an exogenous (independent) variable on an endogenous (dependent) variable. It should be noted that the R^2 values of the model are calculated only for the endogenous constructs of the model the value of this criterion is zero for the exogenous constructs of the model. Chin (2010) introduced three values of 0.19, 0.33, and 0.67 as weak, moderate, and strong criteria of R^2 criterion. Given that the value of R^2 for the knowledge management variable 0.454 and Sustainable competitive advantage variable 0.523 was calculated, considering the three values of the criterion, the suitability of the structural model fit is confirmed.

Table 5. The Structural Model Evaluation Results and Hypotheses Testing

Hypothesis	Path	Path coefficient	t-value	p-value	Test result
Direct Effect					
H1	IT →SCA	0.657	2.451	0.002	supported
H2	IT →KM	0.728	2.848	0.000	supported
H3	KM →SCA	0.619	3.911	0.001	supported
Mediator effect					
H4	IT →KM →SCA	0.450	2.887	0.003	supported

Source: Output from PLS-SEM

The results of testing the two hypotheses showed that IT has a positive and significant association with Sustainable competitive advantage and knowledge management of the studied companies. Hence, IT with path coefficients of 0.657 and 0.728 directly explain the changes related to the Sustainable competitive advantage and knowledge management. The results of the third hypothesis test show that knowledge management directly explains 0.619 of the changes related to sustainable competitive advantage. Also, the result of the fourth hypothesis test showed that the mediating role of knowledge management variable in the relationship between IT and sustainable competitive advantage is confirmed and the IT variable through knowledge management has a positive and significant effect on the sustainable competitive advantage of companies.

5. CONCLUSION

The purpose of this research was to investigate the role of IT in creating and developing a sustainable competitive advantage for organizations through the implementation of knowledge management. The mediating role of knowledge management on the relationship between IT and sustainable competitive advantage has been evaluated in this research. The results of the structural equation test confirmed all four research hypotheses. Based on the first hypothesis, it can be concluded that the implementation of IT positively and

significantly affects the development of sustainable competitive advantage for organizations. The results are consistent with the results of Mao et al. (2016), Lohrke et al. (2016), Gupta et al. (2018). For the second hypothesis, we investigated the relationship between knowledge management and IT. The results of the hypothesis test showed that the t-value is 2.848 Because this value is greater than 1.96, there is a significant relationship between the organization's IT and knowledge management. The results of this hypothesis are consistent with the results of Masadeh et al. (2017) and Kasemsap (2015). In the third hypothesis, the relationship between knowledge management and the competitive advantage of the organization was tested. The value obtained for the t-value was 3.911, and since this was more than 1.96, we concluded that there is a positive and significant relationship between knowledge management and the creation and development of competitive advantage in the organization. The results of the third hypothesis of the research were consistent with the results of Torres et al. (2018), Guimaraes et al. (2018), and Yassen et al. (2016). for the fourth hypothesis of the research, we sought to test the mediating role of knowledge management on the relationship between IT and sustainable competitive advantage. Considering the value of the path coefficient of 0.450 and the value of t-value 2.887, the mediating role of knowledge management was confirmed. The results obtained for this hypothesis test are consistent with Mao et al. (2016). According to the literature, IT has the potential to create and develop a sustainable competitive advantage for organizations. Moreover, in addition to IT, implementation of the principles of knowledge management in the organization leads to increased efficiency, effectiveness, and capabilities and reduced costs and improved services which in turn increase the competitive advantage of the organization. As the findings of the research showed, IT has a significant relationship with knowledge management. The results of testing the two hypotheses showed that IT has a positive and significant association with sustainable competitive advantage and knowledge management of the studied companies. knowledge management and this increases the organization's attention to the customer, financial issues, human resources, and productivity. The results show that the use of IT affects the sustainable competitive advantage and knowledge management of companies operating in Iran's electronic insurance industry. Based on this, it can be said that IT can provide effective and efficient tools for all aspects of knowledge management, including sharing, storage, and application of knowledge, and put the organization on the path to achieving sustainable competitive advantage. Based on the research findings, it is suggested that a combination of existing IT technologies be used to improve the flow of knowledge management in companies operating in the e-insurance industry to gain a competitive advantage. It is also suggested that special attention be paid to the next capacity of IT innovation to access optimal knowledge and the need for proper planning in this field. Accordingly, it is recommended to the managers of these companies to have appropriate knowledge planning to realize knowledge management, in this planning they should have knowledge perspective, partial goals, operational goals, and finally mechanisms to evaluate the improvement of knowledge management in operate to increase sustainable competitive advantage. Managers can inform their employees of the important consequences of knowledge management and teach them how to use IT and knowledge management tools to improve service innovation and improve sustainable competitive advantage.

5.1 The Research Limitations and Suggestions for Future Research

Since it was an exploratory study, the research findings are limited to the sample size and the results may change if the sample size changes. Also, different views on the research subject among members of the statistical population can somehow affect the results. The studied population in this research included companies operating in the electronic insurance services industry in Iran. Accordingly, the results obtained are specific to these companies and cannot

be generalized to all organizations and companies. It is recommended that researchers will conduct future research on this topic in other organizations and manufacturing and service companies in the electronics insurance services industry worldwide and other industries, and compare the results with the results of the present study. Given that the present study examines the relationship between IT and sustainable competitive advantage concerning the mediating role of knowledge management, it is recommended that researchers are advised in future research to examine the relationship between other variables such as innovation and individual knowledge management with a sustainable competitive advantage, addressing these issues can have effective results for production and service organizations.

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THE RELATIONSHIP BETWEEN THE FACTORS OF RISK IN ASSET EVALUATION MODELS AND FUTURE ECONOMIC GROWTH: EVIDENCE FROM THREE REGIONAL MARKETS

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ABSTRACT

This study seeks to ascertain whether the risk factors in the asset evaluation models proposed by Fama and French (1993, 2015) contain information that help in forecasting regional economic growth. To this end, based upon samples of Gross Domestic Product for three regions, North America, Asia Pacific and Europe, covering the period between 1991 and 2018, we applied the quantile regression analysis technique. The empirical results suggest that the performance of regional risk factors contains information that helps in forecasting the regional level of economic growth. This furthermore concludes that the regional risk factors help in forecasting the economic growth of countries with developed and large-scale share markets.

Keywords: Fama-French Three and Five Factor Model, Economic Growth, Regional Risk Factors, Investment, Profitability.

JEL Classification: G11, G12, C13

1. INTRODUCTION

The financial economics literature details how analysing the economic growth forecasts may apply to the profitability of share markets. Indeed, various studies, with greater consistency from the 1980s onwards (Fama, 1981, 1990; Fischer & Merton, 1984; Kaul, 1987; Schwert, 1990; Aylward & Glen, 2000; Mauro, 2003; Panopoulou, 2009), have demonstrated how variations in the rate of return of shares perform a relevant role in forecasting economic growth. In practice, this attribute's relevance to share markets as an indicator of economic growth is in keeping with their capacities to provide services for the efficient allocation of resources to the productive sector, encouraging entrepreneurship and technological innovation, qualifying the transaction costs and information at the corporate level (Levine, 1991; Bencivenga, Smith, & Starr, 1996; Greenwood & Smith, 1997).

After formulating their multi-factor asset evaluation models (Fama & French, 1993, 2015) as an alternative to the Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner 1965), Liew and Vassalou (2000) observe how the scale effect and the book-to-market index risk factors for share markets capture information that assists in predicting the economic growth of developed countries. These findings suggest that the asset evaluation models designed to estimate the cost of company capital and the portfolio of investments (e.g., Fama & French, 2004) may serve as indicators of domestic economic development.

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Technological developments focused on the new information and communication technologies have gained a growing role as a factor of innovation in share markets with information having now become globally available stipulating both a new business paradigm that affirms the internationalisation of businesses as well as economic, financial, and monetary harmonisation that have themselves contributed towards accelerating the process of financial market integration across both the regional and global levels (Fratzscher, 2002; Billio & Pelizzon, 2003; Baele, 2005). In effect, this reality drives the formation of risk factors both at the regional and global levels that enable the estimation of the profitability ratios for large-scale domestic share markets (Moer, 2005). Fama and French (2012, 2017) struck out in this direction when, in 2015, they put forward an asset evaluation model made up of five risk factors - market (MKT), size (SMB), book-to-market index (HML), operating profits (RMW), and investment (CMA).

There are few studies analysing the relationship between future economic growth and the regional-level risk factors and their impact on operating profits and investment according to the five-factor asset evaluation model proposed by Fama and French (2015). Hence, the objective of this study consists of applying the quantile regression technique to the 0.05; 0.25; 0.50; 0.75 and 0.95 quantiles to ascertain whether the risk factors for regional share markets in the asset evaluation proposed by Fama and French (1993, 2015) do capture information able to assist in forecasting future economic growth as encapsulated by Gross Domestic Product (GDP hereafter) for the regions of North America, Asia Pacific, and Europe as well as for countries with large-scale, developed share markets.

The motivation for applying the quantile regression analysis technique stems from the nature of asymmetric distribution of the GDP growth rate that may emerge from the different conditional distribution quantiles for risk factor performance. The results returned indicate that the asset evaluation models developed to estimate the cost of capital and investment portfolios may serve as economic indicators as they report information that may assist in forecasting regional and domestic economic growth.

The structure of this study spans five sections. After this introduction, the following section sets out the theoretical framework that details the empirical theoretical developments produced in recent years. Section three describes the methodology, the criteria, and the analytical methods applied in this empirical study. There then follows the analysis and discussion of the results before closing with the conclusion.

2. THEORETICAL FRAMEWORK

The relevance of share markets as an indicator for long-term economic growth stems from the endogenous growth theory formulated by Levine (1991); Bencivenga et al. (1996); and Greenwood and Smith (1997), according to which, share markets act efficiently to reduce liquidity risks, sharing, and diversification of other risks through the dissemination of information about both companies and their management while actively promoting negotiations over their ownership without interrupting their respective productive processes (Levine, 1991). In the context of asset evaluation models, Chen, Roll and Ross (1986) demonstrate that the systematic risk deriving from the development of share markets is not susceptible to representation through means of variables for macroeconomic factors, such as indexes of industrial production, inflation and interest rates, and credit risks. Fama and French (1993) add further factors of risk to CAPM: dimension and the book-to-market index that imitate variables of an unidentified state. Liew and Vassalou (2000) note that the factors of risk proposed by Fama and French (1993) and developments in the share market are interrelated with respect to the future economic growth of ten countries

(Australia, Canada, France, Germany, Italy, Japan, the Netherlands, the United Kingdom, the United States, and Switzerland) over the period from 1978 to 1996. Neves and Leal (2003) observe a positive relationship between the future economic growth of Brazil and the SMB risk factor over the period from 1986 to 2001. Hanhardt and Ansotegui Olcoz (2008) deploy the risk factors of market, size, the book-to-market index, and the positions of share portfolios for five industry types for twelve countries (Austria, Belgium, Finland, France, Greece, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain) in the Eurozone for the period between 1995 and 2003, and the authors concluded that the SMB risk factor contains robust information that assists in predicting economic growth in this region. Liu and Di Iorio (2013) report that the SMB and HML risk factors aid in predicting the economic growth rate of Australia for the period between 1993 and 2010.

Fama and French (2015) present a model with five risk factors spanning the market risks (MKT) that derive from CAPM, size (SMB), the book-to-market index (HML), operating profitability, and CMA investment, as depicted in the equation below (Eq. 1)

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{ir}RMW_t + \beta_{ic}CMA_t + \varepsilon_{it} \quad [1]$$

Where $R_{it} - R_{ft}$, stands for the excess profitability of asset or portfolio i in the period t; R_{mt} represents the market risk; R_{ft} accounts for the free rate risk over the period t; R_{mt}–R_{ft} provides the risk premium that corresponds to the average excess profitability of the market portfolio; SMB_t (Small minus Big) provides for the difference in profitability of diversified share portfolios in small companies in contrast with large companies; HML_t (High minus Low) conveys the difference between the profitability rates of diversified share portfolios in high and low book-to-market ratio, $RMW_{t,}$ (Robust Minus Weak) is the operating profit factor that stems from the difference between the profitability rates of diversified share portfolios in high operating profit companies against those turning in low operating profits; and the CMA_t (Conservative Minus Aggressive) investment factor results from the difference between the profitability of diversified share portfolios in companies with low and high levels of investment, with ε_{it} as the residual.

3. METHODOLOGY

The objective of this research is to analyse the risk factors in the three- and five-factor asset evaluation models proposed by Fama and French (1993, 2015) for the regions of North America, Asia Pacific, and Europe to ascertain whether they assist in predicting the future economic growth of these regions as well as countries with developed and large-scale share markets. To this end, we apply the quantile regression technique to the diverse, conditioned distribution quantiles for GDP growth, represented by the intervals, 0.05, 0.25, 0.50, 0.75, and 0.95, in which the quantiles 0.05 and 0.25 represent low growth rates, 0.50 accounts for moderate growth, and quantiles equal to or above 0.75 depict high growth. For the purposes of comparing the meaning and the magnitude of the coefficients, this also applies the ordinary least squares (OLS) regression method.

The regression quantiles (RQ) put forward by Koenker and Bassett (1978) feature the minimisation of the weighted sum for the absolute residuals, and the model estimates the parameters for the regression across different quantiles (between 0 and 1) of the conditional dependent variable for the vector of explanatory variables through the median. In turn, the median describes the best measurement of the central trend given that this is not subject to the impact of extreme values, unlike the average (Fávero & Belfiore, 2017). Hence, in accordance with Koenker and Bassett (1978) and Buchinsky (1998), quantile regression (i)

represents a robust regression technique with its parameter estimators not influenced by extreme data; (ii) does not follow the assumption of normality among the residuals; and (iii) provides more complete information that enables the explanation and prediction of the behaviour of the dependent variable given the variations taking place in the independent variables.

In accordance with Fávero and Belfiore (2017), the general quantile regression model is as follows:

$$Y_i = a + b_{\emptyset 1}X_{1i} + b_{\emptyset 2}X_{2i} + \cdots + b_{\emptyset k}X_{ki} + u_{\emptyset i} = X_i' b_{\emptyset} + u_{\emptyset i} \quad [2]$$

with:

$$Perc_{\emptyset}(Y_i|X_i) = X_i' b_{\emptyset} \quad [3]$$

Where $Perc_{\emptyset}(Y_i|X_i)$ represents the percentile Ø ($0 < Ø < 1$) of the dependent variable Y, conditional on the vector of the independent variables X'.

Reflecting the vector of the explanatory variable in the equations (Eq. 2 and 3) by F (Factor), we thus define the quantile regression model applied in this study as the following:

$$GDP_i = F_i' \beta_{\emptyset} + u_{\emptyset i}, \quad Quant_{\emptyset}(GDP_i|XF_i) = F_i' \beta_{\emptyset} \quad [4]$$

Where $Quant_{\emptyset}(GDP_i|F_i)$ represents the quantile Ø ($0 < Ø < 1$) of the dependent variable GDP, conditional on the vector of the independent variable F'.

For this empirical study, the analysis of the relationship between future economic growth and the regional factors of risk incorporates the application of eight regression models, with six univariate regression models to verify whether each risk factor individually captures information on economic growth and two multivariate regression models with three and five risk factors, respectively. The first six models depicted in the equation (Eq. 5) estimate the relationship between the regional GDP growth rate and each of the six factors of regional risk, MKT, SMB, HML, RMW, and CMA. Liew and Vassalou (2000) observe how the MKT, SMB, and HML risk factors independently help in predicting the economic growth of developed countries. This empirical study extends the analysis to the RMW and CMA regional risk factors. Equation 5 is given by:

$$GDP_t = \alpha + \beta Fator_{t-1} + \varepsilon_t \quad [5]$$

Where GDP_t denotes the GDP growth rate for the period t calculated logarithmically; $Factor_{t-1}$, accounts for the profitability of the regional factors of risk MKT, SMB, HML, RMW, and CMA in the preceding period; and ε_t is the residual of the regression equation.

The MKT risk factor derives from the difference in the weighted average of the listed capitalisation of each share and the monthly America treasury bond rate. The SMB risk factor corresponds to the stock market capitalisation of each company and results from the multiplication of each share price with the number of shares in circulation. The HML risk factor results from the division of the accountancy value of each company and its listed share value. The RMW risk factor stems from dividing the pre-tax result for the period t by the value of net assets of the company for the same period. The calculation of the CMA risk factor, in turn, divides the difference in the total value of the assets over the period t-1 and t-2 by the total asset value for period t-2.

The calculation of the SMB, HML, RMW, and CMA risk factors dates to the end of June of each year based on six weighted portfolios formed by the intersection (2x3) of two SMB groups and three HML, RMW, and CMA groups. The separation of the two SMB group takes place at the 90 and 10 percentile points. The 90 percentile depicts the group of large-scale shares, and the 10 percentile represents the share group classified as small scale. The three groups for each of the HML, RMW, and CMA risk factors divide at the 30 and 70 percentile points. Hence, in accordance with the risk factor, the group of shares returning values below the 30 percentile point rank as Low – L, Weak – W, and Conservative – C; while the percentiles between 30 and 70 classify as Neutral – N and those above the 70 percentile corresponding to High – H, Robust – R, and Aggressive – A. Therefore, these classifications enable the establishing of six portfolios, 2x3 (Small, S; Big, B; Low, L; Neutral, N; and High, H) for each group, SMB and HML, SMB and RMW, and CMA, through the intersection of the two asset groups (Small – S and Big – B) formed out of the size of the company and the three share groups (Low, L; Neutral, N and High, H), classified according to book-to-market, operating profit, and investment.

Hence, for the three-factor model, SMB (hereafter designated as SMB3F) emerges from the difference between the weighted average and the profitability of the three small-scale share portfolios and the three large-scale share portfolios as set out in the following equation (Eq. 6).

$$SMB = 1/3(SL + SN + SH) - 1/3(BL + BN + BH) \quad [6]$$

In turn, the five-factor SMB model stems from the average differences in profitability of the nine small-scale share portfolios and the nine large-scale share portfolios in terms of SMB book-to-market, SMB operating profit (OP), and SMB investment (INV), as conveyed by the following equations (Eq. 7, 8, 9, 10).

$$SMB_{B/M} = 1/3(SL + SN + SH) - 1/3(BL + BN + BH) \quad [7]$$

$$SMB_{OP} = 1/3(SW + SN + SR) - 1/3(BW + BN + BR) \quad [8]$$

$$SMB_{INV} = 1/3(SC + SN + SA) - 1/3(BC + BN + BA) \quad [9]$$

$$SMB = 1/3(SMB_{B/M} + SMB_{OP} + SMB_{INV}) \quad [10]$$

The HML, RMW, and CMA risk factors arise out of the difference between the weighted average of the profitability of the two high (H) and low (L) share portfolios across the factors of book- to-market, robust (R) and weak (W) operating profit, and conservative (C) and aggressive (A) investment, as portrayed by the following equations (Eq. 11, 12, 13).

$$HML = 1/2(SH + BH) - 1/2(SL + BL) \quad [11]$$

$$RMW = 1/2(SR + BR) - 1/2(SW + BL) \quad [12]$$

$$CMA = 1/2(SA + BA) - 1/2(SC + BC) \quad [13]$$

The estimating of models seven and eight formed by a set of three and five independent variables—established by the risk factors in the asset evaluation models incorporating three and five risk factors (Fama and French, 1993; 2015), as represented by the equations (Eq. 14, 15)—seeks to analyse the relationship between the regional GDP growth rate and that of countries with developed and large-scale share markets.

$$GDP_t = \alpha + \beta_1 MKT_{t-1} + \beta_2 SMB_{t-1} + \beta_3 HML_{t-1} + \varepsilon_t \quad [14]$$

$$GDP_t = \alpha + \beta_1 MKT_{t-1} + \beta_2 SMB_{t-1} + \beta_3 HML_{t-1} + \beta_4 RMW_{t-1} + \beta_5 CMA_{t-1} + \varepsilon_t \quad [15]$$

3.1 Description of the Data

3.1.1 Sample

For this empirical study, we applied the historical annual series of data on GDP, calculated in American dollars, for the period between January 1991 to 2018 and the profitability rates of the risk factors in the asset evaluation models for the regions of North America (Canada and the United States), Asia Pacific (Australia, Hong Kong, New Zealand, and Singapore) and Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom). We sourced the profitability and GDP data from the databases of Kenneth French and the World Bank, respectively.

The calculation of GDP for each of the three regions adopted the classification provided by Fama and French (2012, 2017) for establishing the regional risk factors based on the profitability of the developed stock markets of North America, Asia Pacific, and Europe. Correspondingly, the GDP for the North America region incorporates the sum of the GDP of Canada and the United States; while the Asia Pacific region features the GDP of Australia, Hong Kong, New Zealand, and Singapore; and in the case of the GDP for the Europe region, it consists of seventeen European Union member states: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Analysis of the relationship between the regional risk factors and the GDP of countries with developed and large-scale stock markets includes a total of five countries - Canada, France, Germany, Singapore, the United States of America - plus the Administrative Region of Hong Kong, a selection of two for each region.

4. RESULTS

4.1 Descriptive Statistics and the Adherence Tests

Table 1 presents a summary of the descriptive statistics and the adherence tests for the normality (Jaque-Bera, JB) and stationarity (Augmented Dickey-Fuller, ADF) of the profitability of the risk factors for regional stock markets and regional GDP growth rates and for countries with developed and large-scale share markets over the period from January 1991 to December 2018. We started out calculating the ADF with a maximum lag of 8, the Akaike (1974) information criteria (AIC) and t statistical method for ascertaining the absence of a unit root.

This details how the risk factors returned by the regional Asia Pacific model, MKT (11.92%) and SMB3F (-1.03%), respectively, report the highest and lowest average risk premiums. The median varies between -0.3.45% (SMB3F, Asia Pacific) and 11.86% (MKT, North America). The total range of the set of observations of profitability varied from 28.38% (RMW, Europe) and 133.89% (MKT, Asia Pacific). The standard deviation in the risk premiums varied from 0.07 (RMW, Europe) to 0.30 (MKT, Asia Pacific). The asymmetry and Kurtosis measurements emerge as heterogeneous. The Asia Pacific regional market returned the strongest trend for positive asymmetry, with the North American regional market providing the best trend in the distribution of the frequency of leptokurtic type profitability. The coefficients estimated for the normality test indicate that the regional risk factors for the North America and Europe regions follow a normal distribution pattern, with the exception being the CMA (8.67) factor associated with North America.

Table 1. Descriptive statistics and the adherence test for the annual GDP growth rates and the profitability of the regional risk factors in the three-and five-factor asset evaluation models

Region	Variable	$\bar{X}$	Md	Min	Max	S	A	K	JB	ADF
		%	%	%	%					
North America										
	MKT	9.53	11.86	-39.54	32.47	0.18	-0.92	0.63	4.27	-1.00***
	SMB3F	0.95	-0.63	-25.62	22.61	0.10	-0.13	0.43	0.27	-4.61***
	SMB	2.03	2.55	-26.87	22.24	0.10	-0.42	0.66	1.28	-0.74***
	HML	3.10	1.91	-33.41	50.03	0.17	0.35	1.04	1.76	-1.12***
	RMW	4.14	7.54	-18.35	25.50	0.10	-0.40	0.37	0.88	-1.21***
	CMA	3.14	3.98	-20.04	46.56	0.14	0.84	2.20	8.67**	-1.08***
	GDP	2.53	2.65	-2.61	4.68	0.01	-1.48	3.46	23.30***	-0.52**
Canada	GDP	2.41	2.63	-2.99	5.05	0.02	-1.15	3.17	17.27***	-0.77***
USA	GDP	2.54	2.72	-2.57	4.64	0.02	-1.43	3.04	11.98***	-0.51*
Asia Pacific										
	MKT	11.92	9.58	-52.97	80.92	0.30	0.38	0.20	0.68	-3.04**
	SMB3F	-1.03	-3.45	-18.30	31.99	0.12	1.09	0.82	6.11**	-1.69***
	SMB	0.64	-1.44	-15.27	29.48	0.11	1.01	0.40	4.78*	-5.52***
	HML	8.08	6.47	-7.90	26.65	0.09	0.07	-0.54	0.35	-0.92***
	RMW	2.15	2.02	-20.11	20.28	0.09	0.18	0.14	0.17	-0.83***
	CMA	3.08	4.83	-45.64	23.67	0.13	-2.09	5.48	53.55 ***	-1.38***
	GDP	3.45	3.49	0.94	5.09	0.01	-0.37	-0.65	1.10	-0.99***
Hong Kong										
	GDP	3.58	3.05	-6.06	8.34	0.03	-1.08	1.77	8.78**	-0.91***
Singapore	GDP	5.55	5.57	-2.22	13.56	0.04	-0.07	-0.24	0.09	-0.92***
Europe										
	MKT	7.74	9.69	-47.52	41.66	0.20	-0.65	0.28	1.99	-4.00***
	SMB3F	1.23	3.44	-15.51	15.67	0.09	-0.22	-1.21	1.86	-0.89***
	SMB	1.99	4.85	-15.02	16.73	0.09	-0.29	-1.16	1.89	-0.80***
	HML	4.18	2.28	-23.55	27.54	0.13	0.00	-0.48	0.25	-0.76**
	RMW	5.00	3.74	-10.16	18.22	0.07	0.00	-0.33	0.12	-1.11**
	CMA	1.94	-0.36	-20.42	18.89	0.09	-0.01	-0.19	0.04	-0.81**
	GDP	1.65	1.94	-4.37	3.73	0.02	-2.15	5.96	60.79***	-0.75***
Germany	GDP	1.40	1.72	-5.78	4.00	0.02	-2.02	5.92	57.70***	-1.52***
France	GDP	1.57	1.71	-2.92	3.85	0.01	-1.19	2.64	14.25***	-0.72**

Notes: $\bar{X}$, average; Md, median; Min, minimum; Max, maximum; S, standard deviation; A, asymmetry; K, Kurtosis; JB, Jaque-Bera test; ADF, Augmented Dickey-Fuller test.

Source: Own Elaboration

This details how the risk factors returned by the regional Asia Pacific model, MKT (11.92%) and SMB3F (-1.03%), respectively, report the highest and lowest average risk premiums. The median varies between -0.3.45% (SMB3F, Asia Pacific) and 11.86% (MKT, North America). The total range of the set of observations of profitability varied from 28.38% (RMW, Europe) to 133.89% (MKT, Asia Pacific). The standard deviation in the risk premiums varied from 0.07 (RMW, Europe) to 0.30 (MKT, Asia Pacific). The asymmetry and Kurtosis measurements emerge as heterogeneous. The Asia Pacific regional market returned the strongest trend for positive asymmetry, with the North American regional market providing the best trend in the distribution of the frequency of leptokurtic type profitability. The coefficients estimated for the normality test indicate that the regional risk factors for the North America and Europe regions follow a normal distribution pattern, with the exception being the CMA (8.67) factor associated with North America.

The asymmetric negative association of the GDP growth rates receives confirmation from the asymmetry coefficients. The ADF test results set out in Table 1 report the absence of any unit root with a statistical significance of between 1% and 10%.

4.2 Empirical Results

4.2.1 Evaluating the relationship between the risk factors and economic growth –the univariate model

Table 2 details the estimates for the six univariate models resulting from equation (Eq. 5) according to the regression quantile (RQ) method applied to the quantiles 0.05, 0.25, 0.50, 0.75, and 0.95 and the ordinary least squares (OLS) method for the purposes of comparison. For the models estimated by the OLS method that report self-correlation and heteroscedasticity in their residuals, we applied the Newey and West (1987) and White (1980) robust estimators in order to correct the standard error.

The results presented by this empirical study, through recourse to the Gretl econometric software, omit the estimates in the diagnostic test for the presence of multicollinearity, which did not register any presence, and omit the adjustment coefficients (R^2); nevertheless, these results are available on request.

Table 2 details how the MKT risk factor, as expected, returned a positive and statistically significant relationship with the future regional economic growth rates. This finding further strengthens the centrality of the MKT risk factor as already observed by Levy and Roll (2010). The SMB3F, SMB, and HML risk factors return positive coefficients for the Asia Pacific and Europe regions. The SMB3F and SMB risk factors attained statistical significance at 5% in the case of the Asia Pacific market. These results thus align with those of Liew and Vassalou (2000), Neves and Leal (2013), and de Liu and Di Iorio (2013).

The magnitude of the positive coefficients reflects most clearly in the estimates produced by quantile regression. In effect, this demonstrates how the lowest quantiles (0.05, 0.25) for the conditional distribution of the GDP growth rates generate the highest coefficients. With the exception of CMA, all of the other risk factors return at least a positive coefficient, thus countering the estimates returned by the OLS method. The MKT risk factor displayed a positive and stable relationship with the regional economic growth rates across all of the quantiles subject to analysis. All of the quantiles obtained statistical significance at 5% apart from the 0.95 quantile for the Asia Pacific market. The confirmation of the asymmetry in the economic growth rates resulting from the MKT effect is verifiable in the estimated coefficients. In the case of North America, the MKT risk factor produced a positive effect in the order of 3.3% (quantile 0.25) and 7% (quantile 0.05), against a constant value of 5.5% estimated by the OLS method. This observation extends to the economic growth rates for the Asia Pacific and Europe regions where the MKT risk factor for each region returns a positive effect in the order of 1.7% (quantile 0.75) to 2.3% (quantile 0.50) and 1.9% (quantile 0.50) to 7.6% (quantile 0.05), respectively, against an average value of 1.9% (Asia Pacific) and 5% (Europe), and statistically significant at 5% in the OLS estimates.

Table 2. OLS and RQ results for the model GDP = $\alpha + \beta_1 Fator_{t-1} + \varepsilon_t$, for each of the MKT, SMB3F, SMB, HML, RMW and CMA risk factors

Region	Model	OLS	RQ	RQ	RQ	RQ	RQ
			0.05	0.25	0.5	0.75	0.95
North America							
	MKT	0.055***	0.070***	0.033***	0.043***	0.049***	0.041***
		(0.017)	(0.013)	(0.009)	(0.015)	(0.016)	(0.005)
	SMB3F	-0.002	0.073**	-0.002	0.004	-0.025	-0.014
		(0.030)	(0.033)	(0.037)	(0.013)	(0.048)	(0.010)
	SMB	-0.009	0.072***	-0.002	-0.005	-0.036	-0.026
		(0.031)	(0.005)	(0.027)	(0.012)	(0.039)	(0.011)
	HML	-0.009	0.017***	-0.020**	-0.019	-0.020	-0.011**
		(0.017)	(0.004)	(0.009)	(0.012)	(0.020)	(0.006)
	RMW	-0.042**	-0.142***	-0.043	-0.046**	-0.034	0.007
		(0.017)	(0.009)	(0.034)	(0.018)	(0.027)	(0.006)
	CMA	-0.024**	-0.144***	-0.025*	-0.032**	-0.037	-0.039
		(0.012)	(0.009)	(0.014)	(0.012)	(0.026)	(0.024)
Asia Pacific							
	MKT	0.019***	0.019***	0.020***	0.023**	0.017***	0.005
		(0.006)	(0.006)	(0.005)	(0.009)	(0.005)	(0.007)
	SMB3F	0.040**	0.068**	0.043**	0.057*	0.022	0.011
		(0.018)	(0.026)	(0.016)	(0.031)	(0.015)	(0.006)
	SMB	0.041**	0.078**	0.049**	0.056	0.034	0.010
		(0.015)	(0.021)	(0.018)	(0.035)	(0.021)	(0.007)
	HML	0.007	-0.028	-0.002	0.011	0.029	0.023
		(0.025)	(0.020)	(0.034)	(0.044)	(0.025)	(0.026)
	RMW	-0.025	-0.091***	-0.004	-0.033*	-0.030*	0.008
		(0.023)	(0.015)	(0.032)	(0.017)	(0.017)	(0.016)
	CMA	-0.028	-0.049***	-0.026***	-0.015	-0.018	-0.020
		(0.016)	(0.004)	(0.008)	(0.025)	(0.020)	(0.013)
Europe							
	MKT	0.050**	0.076***	0.049**	0.019**	0.030**	0.038***
		(0.018)	(0.006)	(0.020)	(0.011)	(0.011)	(0.013)
	SMB3F	0.055	0.308***	0.087***	0.026	-0.019	0.025*
		(0.036)	(0.035)	(0.015)	(0.023)	(0.019)	(0.013)
	SMB	0.053	0.302***	0.084***	0.027	-0.018	0.029*
		(0.036)	(0.051)	(0.009)	(0.028)	(0.029)	(0.016)
	HML	0.018	0.050***	0.034	0.009	-0.009	-0.021**
		(0.024)	(0.007)	(0.037)	(0.017)	(0.016)	(0.009)
	RMW	-0.041	-0.028	-0.070**	-0.052**	-0.030	0.070***
		(0.046)	(0.062)	(0.031)	(0.027)	(0.039)	(0.005)
	CMA	-0.055*	-0.255***	-0.057*	-0.025	-0.042***	-0.029***
		(0.032)	(0.046)	(0.033)	(0.026)	(0.009)	(0.005)

Notes: OLS, ordinary least squared; RQ, regression quantile; Standard error in parentheses; ***, **, *, statistically significant at 1%, 5% and 10%.

Source: Own Elaboration

The SMB3F, SMB, HML, and RMW risk factors act in different ways across each of the three regional markets under analysis. As Table 2 sets out, in the case of regional GDP for North America, the coefficients estimated for the risk factors of SMB3F, SMB, HML, and RMW report a positive effect of 1.7% (HML), 7.3% (SMB3F), 7.2% (SMB) (quantile 0.05), and 7% (RMW) (quantile 0.95) in contrast with the negative estimates obtained by OLS.

In relationship to the Asia Pacific region, the SMB3F and SMB risk factors generate positive coefficients across every quantile under analysis with statistical significance at 5% for the lower and median quantiles (6.8%, 4.3%, and 5.7%, SMB3F; 7.8% and 4.9%, SMB),

thereby higher than the coefficients estimated by the OLS method (4%, SMB3F and 4.1%, SMB). The HML risk factor provided positive coefficients from the 0.50 quantile upwards while not obtaining statistical significance, with the RMW risk factor presenting a positive coefficient in the 0.95 quantile without achieving statistical significance alongside the value returned by the OLS method.

In the case of the Europe region, the SMB3F and SMB risk factors reported positive and significant coefficients between 5% and 10% between the first and third quantiles. The magnitude of the coefficients was in the order of 2.5% and 2.9% (quantile 0.95, SMB3F and SMB) rising to 30.8% and 30.2% (quantile 0.05, SMB3F & SMB), against the average values of 5.5% and 5.3% without achieving statistical significance estimated by OLS. The HML risk factor returned a positive relationship (5%), statistically significant at 5%, in the 0.05 quantile, contrary to the average value returned by calculating OLS. In the case of the RMW risk factor, there was a positive and statistically significant relationship in the 0.95 quantile with a 7% effect, different to the negative average value estimated by the OLS method. The negative relationship of the CMA risk factor, in keeping with the results for the North America and Asia Pacific regions, received confirmation through the regression quantile method.

4.2.2 Evaluating the relationship between the three-risk factor model and economic growth

Table 3 presents the estimates obtained by the OLS and regression quantile methods that adopt as their independent variables the MKT, SMB, and HML risk factors proposed by Fama and French (1993) as set out in equation (Eq. 14).

For the three- and five-factor models, the analysis of the relationship between GDP and the regional risk factors extends to the six countries with developed stock markets. Moerman (2005) concluded that the regional risk factors turn in a better performance in large-scale share markets in terms of their calculating expected profitability when compared with the domestic risk factors.

The results detailed in Table 3 align with the observation of Fama and French (2017) as regards how the regional risk factors operate differently in each of the markets.

In relationship to the regional GDP of North America, as well as for the GDP of Canada and the United States, the positive performance and statistical significance at 5% of the MKT and HML risk factors took place in two of the five quantiles. With the exception of the MKT risk factor, the average values estimated by OLS do not obtain significance. The MKT performance in terms of regional and domestic GDP stood at 1.4% (quantile 0.95, North America) and 9% (quantile 25, North America and the United States). The positive effect of the SMB risk factor on the GDP of Canada emerged in two quantiles with a range of coefficients ranging from 2.6% (quantile 0.05) to 3.9% (quantile 0.50). In the case of the HML factor of risk, the positive effect on regional and domestic GDP came in between 2.4 (quantile 0.25, United States) and 6.1% (quantile 0.05, Canada).

Table 3. Multiple regression estimates for the model GDP = $\alpha + \beta_1 MKT_{t-1} + \beta_2 SMB_{t-1} + \beta_3 HML_{t-1} + \varepsilon_t$

Region	Model	OLS	RQ	RQ	RQ	RQ	RQ
			0.05	**0.25**	**0.5**	**0.75**	**0.95**
North America							
	MKT	0.063***	0.071***	0.087***	0.042***	0.043***	0.043***
		(0.020)	(0.006)	(0.005)	(0.008)	(0.012)	(0.012)
	SMB	-0.023	-0.010	-0.037***	0.000	-0.030	-0.014
		(0.019)	(0.009)	(0.008)	(0.013	(0.019)	(0.020)
	HML	0.014	0.037***	0.027***	0.011	-0.009	0.004
		(0.019)	(0.006)	(0.005)	(0.008)	(0.012)	(0.013)
Canada							
	MKT	0.057**	0.070***	0.049***	0.022***	0.037***	0.060***
		(0.021)	(0.009)	(0.013)	(0.006)	(0.006)	(0.010)
	SMB3F	-0.008	0.026*	0.006	0.039***	-0.019*	-0.002
		(0.034)	(0.014)	(0.021)	(0.009)	(0.010)	(0.016)
	HML	0.033	0.061***	0.025*	0.019***	-0.008	-0.001
		(0.021)	(0.009)	(0.014)	(0.006)	(0.006)	(0.011)
USA							
	MKT	0.063***	0.070***	0.088***	0.048***	0.047**	0.039***
		(0.020)	(0.005)	(0.007)	(0.012)	(0.023)	(0.009)
	SMB	-0.024	0.003	-0.051***	-0.005	-0.029	-0.015
		(0.019)	(0.008)	(0.012)	(0.019)	(0.037)	(0.015)
	HML	0.013	0.036***	0.024***	0.011	-0.007	0.004
		(0.019)	(0.005)	(0.008)	(0.012)	(0.024)	(0.009)
Asia Pacific							
	MKT	0.016*	-0.009	0.020***	0.013	0.012	0.022***
		(0.008)	(0.006)	(0.003)	(0.008)	(0.009)	(0.008)
	SMB	0.014	0.122***	0.024***	0.038*	0.022	-0.042*
		(0.023)	(0.015)	(0.008)	(0.021)	(0.024)	(0.022)
	HML	-0.002	0.083***	0.010	0.040*	-0.008	0.021
		(0.025)	(0.016)	(0.009)	(0.024)	(0.027)	(0.024)
Hong Kong							
	MKT	0.072***	0.031	0.045***	0.095***	0.081***	0.120***
		(0.019)	(0.032)	(0.004)	(0.011)	(0.015)	(0.001)
	SMB	0.014	0.287***	0.029***	0.006	0.015	-0.106***
		(0.050)	(0.082)	(0.010)	(0.029)	0.039	(0.001)
	HML	0.020	0.224**	0.005	0.014	-0.003	-0.015***
		(0.055)	(0.091)	(0.011)	(0.032)	(0.043)	(0.001)
Singapore							
	MKT	0.081***	0.016	0.086***	0.087***	0.081***	0.056***
		(0.023)	(0.011)	(0.026)	(0.026)	(0.002)	(0.014)
	SMB	0.041	0.232***	0.077	0.025	-0.004	0.001
		(0.060)	(0.028)	(0.068)	(0.068)	(0.004)	(0.036)
	HML	-0.056	0.209***	-0.002	-0.074	-0.098***	-0.092**
		(0.066)	(0.030)	(0.076)	(0.075)	(0.005)	(0.040)

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Table 3 (continue)

Region	Model	OLS	RQ	RQ	RQ	RQ	RQ
			0.05	**0.25**	**0.5**	**0.75**	**0.95**
Europe							
	MKT	0.047**	0.071***	0.025***	0.032**	0.021	0.024***
		(0.018)	(0.003)	(0.005)	(0.015)	(0.015)	(0.005)
	SMB	0.016	-0.107***	0.040***	0.000	-0.017	0.011
		(0.020)	(0.007)	(0.012)	(0.033)	(0.033)	(0.009)
	HML	0.014	0.107***	0.025***	0.016	0.004	-0.012*
		(0.014)	(0.005)	(0.008)	(0.022)	(0.022)	(0.007)
Germany							
	MKT	0.057**	0.103***	0.028	0.046***	0.028***	0.021***
		(0.023)	(0.001)	(0.018)	(0.009)	(0.005)	(0.005)
	SMB	0.031	-0.085***	0.045	0.045**	0.036***	0.081***
		(0.019)	(0.002)	(0.039)	(0.019)	(0.010)	(0.012)
	HML	-0.012***	-0.020**	-0.054	-0.009	0.003	0.019**
		(0.019)	(0.001)	(0.027)	(0.013)	(0.007)	(0.008)
France							
	MKT	0.041***	0.052***	0.031***	0.027**	0.025**	0.022***
		(0.013)	0.012	0.005	0.012	0.004	0.003
	SMB	0.005	-0.031	0.033***	0.000	-0.034***	-0.037***
		(0.023)	(0.027)	(0.012)	(0.026)	(0.009)	(0.006)
	HML	0.010	0.029	0.037***	0.016	-0.005	-0.039***
		(0.012)	(0.018)	(0.008)	(0.018)	(0.006)	(0.004)

Notes: USA, United States of America; OLS, ordinary least squared; RQ, regression quantile; Standard error in parentheses; ***, **, *, statistically significant at 1% and 5%.

Source: Own Elaboration

Liew and Vassalou (2000) encounter a positive relationship between the GDP of the United States and the three-factor local risk model for the periods between 1957 and 1998 and between 1978 and 1996. In the case of Canada, these authors observe a positive relationship in the MKT and SMB risk factors over the period from 1978 to 1996.

In terms of the GDP of the Asia Pacific region, as well as the domestic figures for Hong Kong and Singapore, the MKT, SMB, and HML risk factors report positive and statistically significant performances at 5% across the four quantiles. With the exception of the MKT risk factor, the OLS-measured values do not obtain statistical significance. In the case of the MKT risk factor, the variation in the coefficients ranged from 2% (quantile 0.25, Asia Pacific) to 12% (quantile 0.95, Hong Kong). The participation of the SMB risk factor varied between 2.9% (quantile 0.25, Asia Pacific) and 28.7% (quantile 0.05). The HML risk factor generated a positive effect rising from 4% (quantile 0.50, Asia Pacific) to 22.4% (quantile 0.05, Hong Kong).

In relation to the regional GDP figures for Europe as well as the national economies of Germany and France, the three regional risk factors are statistically significant at 5% and have positive performances between one and five quantiles. For the MKT factor, the variation in the coefficients ranged from 2.1% (quantile 0.95; Germany) to 10.3% (quantile 0.05, Germany). The performance of the SMB risk factor rose from 3.3% (quantile 0.25, France) to 8.1% (quantile 0.95). In turn, the HML risk factor generated a positive effect, ranging from 1.9% (quantile 0.9, Germany) to 10.7% (quantile 0.05, Europe).

Liew and Vassalou (2000) return a positive relationship between the MKT and SMB risk factors and German GDP for the period from 1987 to 1996. Following analysis of France, the authors identified positive coefficients for the SMB and HML risk factors for the period between 1983 and 1996. Hanhardt and Ansotegui Olcoz (2008) encounter a positive relationship between the SMB factor and economic growth in the Eurozone.

4.2.3 Evaluating the relationship between the five-risk factor model and economic growth

Table 4 provides the estimates returned by the OLS method and the regression quantile with five independent variables incorporated into the five-risk factor asset evaluation model demonstrated in equation (Eq. 15).

Liew and Vassalou (2000) argue that the presence of a positive relationship between the SMB and HML risk factors conveys how a period of economic growth is possible when small-scale shares and high B/M indexes achieve better levels of performance than large-scale shares and low B/M indexes, which motivates investors to hold shares that generate high profitability rates, and, when observing an eventual change in the economic cycle, this analysis extends to the RMW and CMA risk factors.

The estimates returned by the OLS method indicate how the regional MKT and HML risk factors maintain a positive relationship with the GDP for the North America region as well as for the United States. Analysis of the results for Canada demonstrates how the MKT, HML, and CMA risk factors return positive coefficients.

The results deriving from the Asia Pacific region, as well as those for Singapore at the national level, report the existence of positive coefficients for the MKT, SMB, RMW, and CMA risk factors, while only the MKT risk factor obtains statistical significance at 5%. For Hong Kong GDP, the positive relationship only arises with the MKT, SMB, and CMA risk factors, with the MKT risk factor attaining statistical significance at the 1% level.

For the region of Europe and France's national level, the MKT, SMB, and HML risk factors produce positive coefficients, with the HML factor obtaining statistical significance at 1%. The results for Germany were different, however. The MKT, SMB, HML, and RMW risk factors generate positive relationships even while statistical significance at 10% was the case only for the HML risk factor.

The results returned by the regression quantile method provide a complete vision on the conditional GDP movements in accordance with the five risk factors. In relation to the regional GDP of North America, the MKT and HML risk factors return statistically significant at 5% and positive effects in the extreme quantiles. The centrality of the MKT risk factor emerges both in terms of its statistical significance at 5% and also in the magnitude of coefficients that range from between 1.4% (quantile 0.95) to 9% (quantile 0.25). In terms of the HML risk factor, the variation in the coefficients ranged from 3.4% (quantile 0.95) to 6.4% (quantile 0.05). The RMW risk factor presented positive effects, obtaining a magnitude of 3.1% (quantile 0.25), against the negative average value (-0.9%) returned by the OLS method. The absence of any positive effect from the SMB and CMA risk factors according to the OLS method received confirmation across every quantile.

Table 4. Multiple regression estimates for the model GDP = $\alpha + \beta_1 MKT_{t-1} + \beta_2 SMB_{t-1} + \beta_3 HML_{t-1} + \beta_4 RMW_{t-1} + \beta_5 CMA_{t-1} + \varepsilon_t$

Region	Model	OLS	RQ	RQ	RQ	RQ	RQ
			0.05	**0.25**	**0.50**	**0.75**	**0.95**
North America							
	MKT	0.058***	0.068***	0.090***	0.055**	0.019	0.014**
		(0.021)	(0.015)	(0.027)	(0.026)	(0.035)	(0.006)
	SMB	-0.027	-0.004	-0.026	-0.011	-0.044	-0.041***
		(0.023)	(0.023)	(0.041)	(0.039)	(0.052)	(0.010)
	HML	0.030	0.064**	0.039	0.049	0.026	0.034**
		(0.028)	(0.031)	(0.055)	(0.053)	(0.070)	(0.013)
	RMW	-0.009	-0.004	0.031	-0.014	-0.035	-0.022**
		(0.023)	(0.026)	(0.046)	(0.045)	(0.059)	(0.011)
	CMA	-0.014	-0.031	-0.024	-0.044	-0.031	-0.043**
		(0.027)	(0.038)	(0.068)	(0.065)	(0.086)	(0.016)
Canada							
	MKT	0.051**	0.063***	0.074***	0.033*	0.006	-0.033***
		(0.020)	(0.002)	(0.000)	(0.017)	(0.036)	(0.010)
	SMB	-0.020	0.001	-0.032***	0.023	-0.039	-0.058***
		(0.030)	(0.003)	(0.000)	(0.026)	(0.053)	(0.015)
	HML	0.029	0.122***	0.090***	0.036	0.038	0.034*
		0.041	(0.003)	(0.000)	(0.035)	(0.072)	(0.020)
	RMW	-0.032	-0.016***	-0.025***	0.018	-0.077	-0.053***
		0.035	(0.004)	(0.000)	(0.029)	(0.060)	(0.017)
	CMA	0.004	-0.071***	-0.033***	-0.008	-0.031	-0.062**
		(0.050)	(0.006)	(0.000)	(0.043)	(0.088)	(0.024)
USA							
	MKT	0.059***	0.067***	0.090***	0.052**	0.028	0.017
		(0.020)	(0.017)	(0.021)	(0.029)	(0.027)	(0.011)
	SMB	-0.027	0.008	-0.044	-0.010	-0.039	-0.036**
		(0.023)	(0.025)	(0.031)	(0.043)	(0.041)	(0.016)
	HML	0.030	0.055	0.038	0.031	0.024	0.030
		(0.027)	(0.033)	(0.042)	(0.059)	(0.055)	(0.022)
	RMW	-0.007	-0.004	0.025	-0.008	-0.027	-0.015
		(0.023)	(0.028)	(0.035)	(0.049)	(0.046)	(0.018)
	CMA	-0.016	-0.023	-0.020	-0.030	-0.031	-0.036
		(0.027)	(0.041)	(0.051)	(0.071)	(0.067)	(0.027)
Asia Pacific							
	MKT	0.033**	0.009***	0.026***	0.054**	0.043***	0.021**
		(0.015)	(0.003)	(0.000)	(0.022)	(0.002)	(0.009)
	SMB	0.011	0.097***	0.045***	0.008	-0.016***	-0.056***
		(0.023)	(0.004)	(0.000)	(0.034)	(0.003)	(0.015)
	HML	-0.016	-0.005	0.013***	-0.041	-0.014***	0.038**
		(0.026)	(0.005)	(0.000)	(0.038)	(0.003)	(0.016)
	RMW	0.029	0.047***	0.041***	0.051	0.009**	-0.007
		(0.028)	(0.005)	(0.000)	(0.041)	(0.003)	(0.018)
	CMA	0.027	0.028***	0.026***	0.074***	0.053***	-0.013
		(0.025)	(0.005)	(0.000)	(0.038)	(0.003)	(0.016)
Hong Kong							
	MKT	0.098***	0.102***	0.087***	0.106***	0.100***	0.109***
		(0.032)	(0.011)	(0.016)	(0.019)	(0.000)	(0.001)
	SMB	0.013	0.129***	0.078***	0.021	0.015***	-0.118***
		(0.050)	(0.017)	(0.025)	(0.030)	(0.000)	(0.002)
	HML	-0.007	0.176***	-0.016	-0.005	-0.020***	0.043***
		(0.056)	(0.019)	(0.028)	(0.033)	(0.000)	(0.003)
	RMW	-0.017	-0.138***	0.007	0.018	0.030***	-0.033***
		(0.061)	(0.020)	(0.031)	(0.036)	(0.000)	(0.003)
	CMA	0.080	0.274***	0.089***	0.078**	0.046***	-0.024***
		(0.056)	(0.019)	(0.028)	(0.033)	(0.000)	(0.003)

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Table 4 (continue)

Region	Model	OLS	RQ	RQ	RQ	RQ	RQ
			0.05	0.25	0.50	0.75	0.95
Singapore							
	MKT	0.091**	0.002	0.114**	0.097***	0.119***	-0.044***
		0.041	(0.004)	(0.050)	(0.011)	(0.008)	(0.027)
	SMB	0.033	0.273***	0.063	0.015	-0.024**	-0.057
		(0.063)	(0.007)	(0.077)	(0.017)	(0.012)	(0.042)
	HML	-0.071	0.183***	-0.044	-0.065***	-0.114***	0.169***
		(0.070)	(0.008)	(0.086)	(0.019)	(0.013)	(0.047)
	RMW	0.010	-0.109***	0.029	0.043**	0.044***	-0.214***
		(0.076)	(0.008)	(0.094)	(0.021)	(0.014)	(0.052)
	CMA	0.014	0.176***	0.010	0.002	0.042***	-0.202***
		(0.070)	(0.008)	(0.086)	(0.019)	(0.013)	(0.047)
Europe							
	MKT	0.011	0.047***	0.013	-0.005	0.003	0.014*
		(0.014)	(0.000)	(0.022)	(0.021)	(0.017)	(0.008)
	SMB	0.015	-0.068***	-0.034	0.017	0.028	0.022*
		(0.016)	(0.000)	(0.035)	(0.033)	(0.027)	(0.013)
	HML	0.122***	0.190***	0.138**	0.114	0.134***	0.042**
		(0.025)	(0.000)	(0.052)	(0.049)	(0.040)	(0.019)
	RMW	-0.004	0.046***	-0.031	-0.002	-0.019	-0.014
		(0.033)	(0.000)	(0.056)	(0.054)	(0.043	(0.021)
	CMA	-0.185***	-0.114***	-0.153*	-0.179	-0.216***	-0.085***
		(0.036)	(0.001)	(0.079)	(0.075)	(0.061)	(0.029)
Germany							
	MKT	0.029	0.099***	0.015	0.025***	0.007	0.001
		(0.021)	(0.001)	(0.029)	(0.002)	(0.019)	(0.011)
	SMB	0.034	-0.078***	0.003	0.028***	0.049	0.082***
		(0.032)	(0.002)	(0.046)	(0.002)	(0.030)	(0.017)
	HML	0.084*	0.061***	0.192**	0.029***	0.058	0.031
		(0.048)	(0.003)	(0.068)	(0.003)	(0.045)	(0.025)
	RMW	0.028	0.124***	0.050	-0.030***	-0.021	0.001
		(0.052)	(0.004)	(0.074)	(0.004)	(0.049)	(0.028)
	CMA	-0.152**	0.020***	-0.261**	-0.076***	-0.113	-0.103**
		(0.073)	(0.005)	(0.103)	(0.005)	(0.068)	(0.038)
France							
	MKT	0.009	0.036***	0.027***	0.015	0.002	-0.005
		(0.014)	(0.004)	(0.000)	(0.027)	(0.025)	(0.005)
	SMB	0.002	-0.016	-0.033	0.008	-0.013	-0.011
		(0.022)	(0.006)	(0.000)	(0.042)	(0.039)	(0.008)
	HML	0.010***	0.096***	0.138***	0.097	0.067	0.035**
		(0.034)	(0.009)	(0.000)	(0.063)	(0.059)	(0.013)
	RMW	-0.023	-0.0007	0.004***	0.003	-0.061	-0.074***
		(0.036)	(0.019)	(0.000)	(0.069)	(0.064)	(0.014)
	CMA	-0.163***	-0.082***	-0.105***	-0.137	-0.161*	-0.113***
		(0.051)	(0.013)	(0.000)	(0.096)	(0.089)	(0.019)

Notes: USA, United States; OLS, ordinary least squared; RQ, regression quantile; Standard error in parentheses; ***, **, *, statistically significant at 1% and 5%.

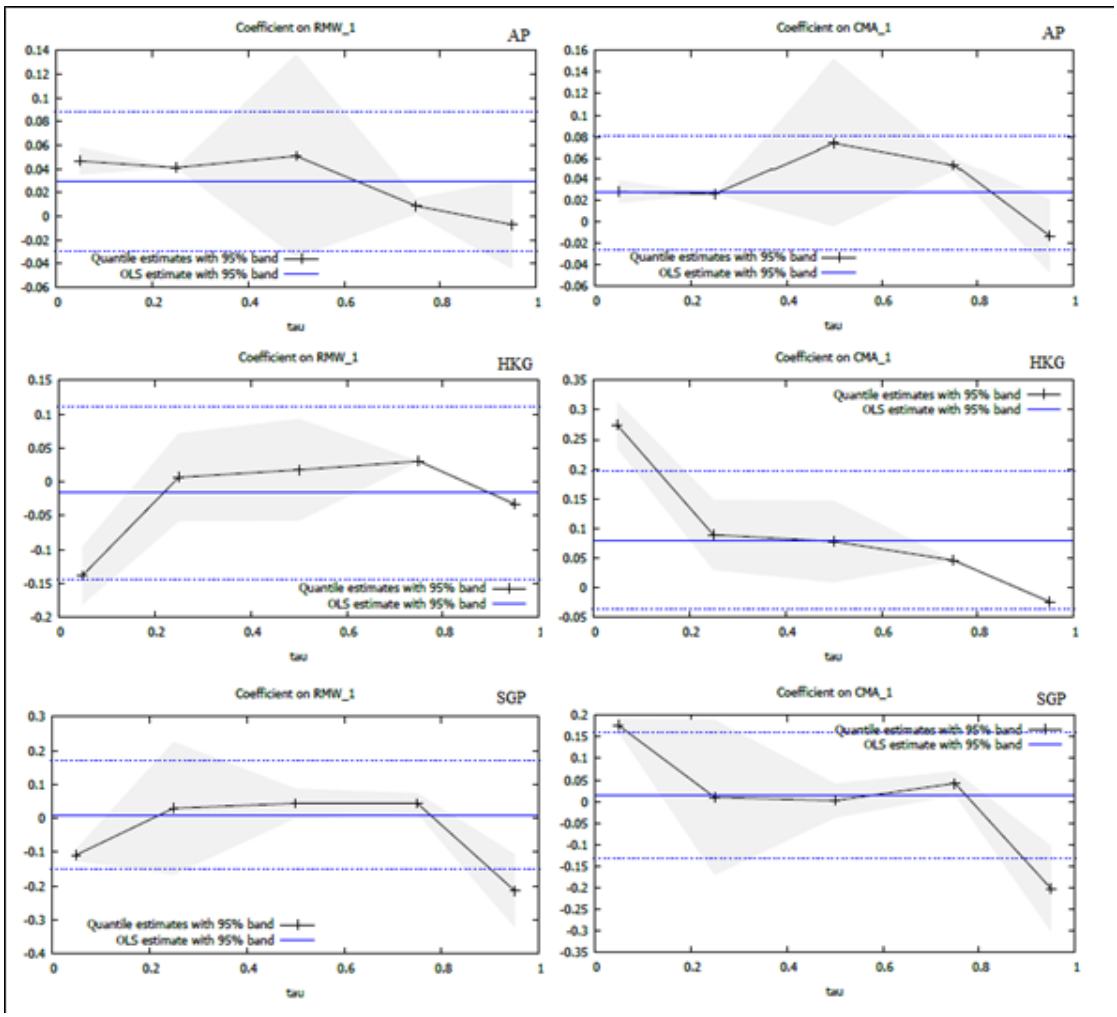
Source: Own Elaboration

In the cases of Canada and the United States, the MKT and HML risk factors contributed positively to forecasting local GDP. The SMB and RMW risk factors return positive effects in the 0.05 and 0.25 quantile, while the negative effect of the CMA risk factor spanned every quantile. The magnitude of the positive coefficients generated by the MKT risk factor for forecasting the GDP of Canada ranged from 0.6% (quantile 0.75) to 7.4% (quantile 0.25). Applied to the United States, the coefficients vary between 2.8% (quantile 0.75) and 9% (quantile 0.25). The positive and statistically significant effect of HML on the GDP

of Canada emerged in three quantiles, with the variation in the coefficient ranging from 3.4% (quantile 0.95) to 12.2% (quantile 0.05). In terms of the GDP for the United States, the positive effect lacks statistical significance but did appear in every quantile, with the variation in the coefficients stretching from 2.4% (quantile 0.75) to 5.5% (quantile 0.05).

For the Asia Pacific region, the positive effects of the five risk factors on both regional GDP and the domestic GDPs of Hong Kong and Singapore emerged in quintiles one to five. The RMW risk factor returned positive coefficients that rose from 0.09% (quantile 0.75, Asia Pacific) to 4.7% (quantile 0.05; Asia Pacific), against average values lacking in statistical significance returned by the OLS calculations. The CMA risk factor generated positive coefficients varying from 2.6% (quantile 0.05, Asia Pacific) to 27.4% (quantile 0.50, Hong Kong). Figure 1 illustrates the effects of the regional RMW and CMA risk factors on conditional quantile GDP behaviour and the OLS returned for Asia Pacific (AP), Hong Kong (HKG), and Singapore (SGP).

Figure 1. Effects of the RMW and CMA risk factors on the regional Asia Pacific market in terms of the quantiles and conditional average of the GDP for the region Asia Pacific (AP), Hong Kong (HKG) and Singapore (SGP)



Source: Own Elaboration

The vertical and horizontal lines respectively represent the risk factor coefficients (independent variables) and the quantiles from 0 to 1. The continuous blue line depicts the OLS estimated coefficient and the respective confidence interval of 95% represented by the

dotted parallel lines. The shaded area identifies the confidence interval for the regression quantile while the vertical, broken black coloured line identifies the coefficients estimated by the regression quantile method. As Table 4 displays, the performance of the RMW and CMA risk factors on regional GDP was positive across the quantiles from 0.05 to 0.75, as was the CMA risk factor for the GDP of both Hong Kong and Singapore. In relation to the RMW risk factor, the positive effect on the GDP of Hong Kong and Singapore emerged in the quantiles from 0.25 to 0.75.

In the case of Europe, the positive and statistically significant effect between 5% and 10% for the regional MKT, SMB, HML, and RMW risk factors on regional GDP ranged across quantiles one to five. The estimates of OLS for the HML risk factor returned positively and statistically significant between 1% and 5% effects for regional and domestic GDP. In the case of regional GDP, the MKT risk factor produced coefficients varying from 1.4% (quantile 0.95) to 4.7% (quantile 0.05). The HML risk factor generated coefficients spanning from 4.2% (quantile 0.95) to 19% (quantile 0.05). Furthermore, the positive performance of the risk factors, SMB and RMW, respectively, on the regional GDP of Europe, stood at 4.6% (quantile 0.05).

In relation to the German GDP, the five regional risk factors returned a positive and statistically significant relationship at 5% for quantiles one to three, contrary to the statistically insignificant measurements (except for HML) returned by the OLS method. The statistically significant and positive performance of the RMW (12.4%) and CMA (2%) risk factors took place in the lowest quantile 0.05.

In the results for the French GDP, the MKT, HML, and RMW risk factors generated positive and statistically significant coefficients at 5% for quantiles one to three. In terms of the MKT risk factor, the magnitude of the coefficients ranged from 2.7% (quantile 0.75) to 3.6% (quantile 0.05). As regards the HML risk factor, the variation in the coefficients varied from 3.5% (quantile 0.95) to 13.8% (quantile 0.25). In turn, the RMW regional risk factor turned in a positive and statistically significant performance at 5% for the 0.25 quantile (0.4%).

5. CONCLUSION

The objective of this paper involved studying whether the MKT, SMB, HML, RMW, and CMA risk factors in the regional asset evaluation models proposed by Fama and French (1993, 2015) capture information that assists in forecasting future economic growth as encapsulated by GDP in the regions of North America, Asia Pacific, and Europe, as well as countries hosting developed and large-scale stock markets for the period between 1991 and 2018. Through the regression quantile technique, we were able to verify that the behaviour of GDP in the low (5%, 25%), median (50%), and high (75% and 95%) percentiles is conditional on the profitability of regional risk factors. The quantile regression empirical results obtained underpin the conclusion that the regional risk factors do contain information able to help in predicting both regional economic growth and that of countries hosting developed and large-scale stock markets even while, as also observed by Fama and French (2017), the regional risk factors act differently in each region. The MKT risk factor is the core component here and impacts positively on every conditional distribution quantile, with the information contained in the SMB and HML risk factors reflected with greater frequency in the lower percentiles of the asymmetric distribution of GDP, while the RMW risk factor impacts on the higher percentiles.

The positive relationship between future economic growth and the three regional risk factors of MKT, SMB, and HML in the model of Fama and French (1993) received further

confirmation in the regions of North America, Asia Pacific, and Europe, as well as at the national level for Canada, the United States of America, Hong Kong, Singapore, France, and Germany. The positive estimates obtained by the multiple regression estimates adopting the five regional risk factors of MKT, SMB, HML, RMW, and CMA in the Fama and French model (2015) received verification by the GDP growth rates for the Asia Pacific region and for the economies of Hong Kong and Singapore. The MKT, HML, and RMW risk factors return a positive relationship favouring economic growth in the region of North America, and nationally for the United States, across at least two distribution quantiles. For Europe, the MKT, SMB, HML, and RMW risk factors generated a positive relationship with regional economic growth as well as national-level growth for both France and Germany.

The results of this study suggest that the profitability returns on the regional risk factors proposed by Fama and French (1993, 1996, 2015) reflect unidentified variables that describe a set of investment opportunities and fall beyond the scope of capture by CAPM.

This empirical study thus contributes to the literature on validating the regional-level asset evaluation models within the context of the relationship between economic growth and the risk factors. The central role played by the MKT risk factor in the regional markets partially reflects the trend towards the integration of stock markets. The profitability rates of regional risk factors for Europe and Asia Pacific stem from twenty countries with developed stock markets. However, this empirical study only approached two countries per region, and there is thus the recommendation for future research to extend this analysis to other countries.

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NAUTICAL TOURISM: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

Nautical tourism revolves around alternative aspects such as leisure activities related to water, sports, and navigation. In recent decades, it has positioned itself as one of the most developed segments within the global tourism market. This article analyses the main contributions in this area, understanding the complexity of finding an approximate definition of its concept. The objective is to analyse from 1989 to 2019 the scientific production of the term "nautical tourism" in addition to identifying which keywords and trends related to nautical tourism are currently being developed through the VOSviewer programme. For this, a bibliometric study of the documents inscribed in the WoS and Scopus databases has been carried out. Future trends in research include terms such as security, management risk, and Mediterranean.

Keywords: Nautical Tourism, Bibliometric Indicators, WoS, Scopus.

JEL Classification: L83, Z32, O30

1. INTRODUCTION

In recent years, nautical tourism has shown its capacity for recovery and survival among the different sectors of the world economy. There are many factors that influence its development such as its location, hydrographic resources, transport, accessibility, as well as cultural and social factors in the area.

The success of this kind of tourism depends on the wide range of activities it offers and on the possibility of integrating it with active tourism, sports, and contact with nature (Perelló, 2013). Likewise, Peláez (2003) places it within the framework of a set of relationships between people who come together when they travel for less than a year and whose main motivation is to carry out nautical activities.

Nautical tourism is a highly dynamic product of the coastal tourist space with great potential to develop consolidated destinations and can serve destinations that are not attractive for development (Gómez, 2012). The coast has great possibilities that go beyond the offer of sun and beach tourism, being able to develop nautical activities and of course the marinas. Marinas, apart from being a support infrastructure for nautical activities, are an additional complement to the local tourist offering for services that support the development of recreational boating and nautical tourism (Rivera, 2010), hence the importance of including within the field of study of tourism marinas and those support infrastructures that are located in the surroundings of the sea or riverside since in addition to offering moorings for recreational boats (sailing or motor), they generate services of tourist interest such as leisure, sports activities, and restaurants.

Despite the importance of nautical tourism and marinas at an international level, production in the academic and research fields has not been positioned with the same intensity. Tourism has been stimulated in scientific production on account of the interest it

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arouses in the research community. On the other hand, nautical tourism has lacked interest for researchers when compared to other areas of research (Forteza et al., 2017). The first article published on nautical tourism dates to 1989 and is entitled "Development of the Marinas in Yugoslavia", in which Deskovic dealt with the development of this tourism and its viability. Even though 30 years have passed since the first publication, the exact definition of nautical tourism is still a complex issue due to the multifunctional nature of nautical activities.

This circumstance has provided an opportunity to explore the interesting field of bibliometric analysis, which is based on two elements: scientific publication, as an indicator of research results (Moed, 2005), and the citations that have been made to measure its scientific impact (Merton, 1977).

The aim of this paper is to analyse from 1989 to 2019 the scientific production of the term "nautical tourism" through two databases (Web of Science and Scopus) as well as to identify, by means of keyword analysis, which are the most-used terms and which trends related to nautical tourism are currently developing through the trend graphs produced by VOSviewer.

2. LITERATURE OVERVIEW

Despite the limited literature on the term under study, in relation to the differences that may exist between nautical, maritime, and marine tourism (Forteza et al., 2017), there is no unanimity or clarity among the authors. In general terms, the differentiating element attributed to nautical tourism is the practice of sporting activities at sea (Ferradás, 2001; Luković, 2013) which can also be carried out in aquatic environments (Jovanovic et al., 2013). To continue with this point, there is no precise definition of the concept of nautical tourism as the authors point out that the definition has a certain complexity due to the links that it has with maritime and navigation activities; therefore, if all the elements that make it up are considered, a more complete definition of nautical tourism can be obtained (Luković, 2007). Other definitions of nautical tourism start from the perspective of the tourist product itself related to the practice of leisure activities in direct contact with the sea (Ayala, 2007).

For the study, firstly, a review of the concept has been carried out. Table 1 shows the different definitions of nautical tourism for the period 2000–2019 by various authors:

Table 1. Nautical Tourism Definitions by Author

Author	Definitions
Cardona (2000)	Defines it as an active holiday in contact with the sea that allows all kinds of nautical activities to be carried out in leisure time.
Ferradás (2001)	Defined as segment of coastal tourism independent of the weather conditions related to leisure and sports activities developed at sea.
Yepes & Amor (2001)	The term nautical station appears. It is a project which aims to direct a coastal tourist destination towards the practice of water sports, sharing water activities with the enjoyment of nature and the recreational tourist offerings of the coastal regions.
Kovačić, Bošković & Favro (2006)	It is considered a recent commercial activity that has developed between ordinary tourism and maritime activity, comprising characteristics that make it a special type of tourism.
Luković (2007)	Definition and classification: marinas, charter, and cruise ports. This classification is common in developed European countries and is conditioned by the basic macro-strategic development model according to the natural factors of development.
Favro, Kovačić, & Gržetić (2008)	It is a complex system that requires the use of all the patterns and regularities of the general system theory for its management.

Kasum, Žani & Boži (2011)	It points out and highlights the importance of developing a relatively new nautical market, defining it as a system that is divided into technological subsystems at sea and on land.
Kovačić & Favro (2012)	Nautical tourism is a diversified branch of general tourism that has significantly changed the structure and peculiarities of the tourism industry.
Benevolo & Spinelli (2018)	They point out that nautical tourism is a variety of tourism with the sea as a distinctive element where the marinas are considered central actors of nautical tourism, dedicated to satisfying the complex and growing demand of the nautical tourist.
Kasum, Mikuličić & Kolić (2018)	It is a complex system that uses various forms of technical and technological processes and as such is exposed to certain risks.
Bal & Czalczynska-Podolska (2019)	It is a category of maritime tourism that generates direct impacts on coastal development and promotion and which, due to its importance, has become one of the most important areas of research.

Source: Own Elaboration

Once the definitions provided by the authors have been reviewed, nautical tourism is understood to be those vacation activities or events that involve traveling for pleasure combined with sailing in a water environment: mainly fresh water, salt water, seas, oceans, rivers and lakes. For coastal areas with marinas, nautical tourism provides a further complement to the tourist and holiday offer of the area. The authors reveal that it is still a variant of tourism with the sea as the protagonist and at the same time a differentiating element where the marinas are considered as central actors of nautical tourism dedicated to satisfying the complex and growing demand of the nautical tourist (Benevolo & Spinelli, 2018).

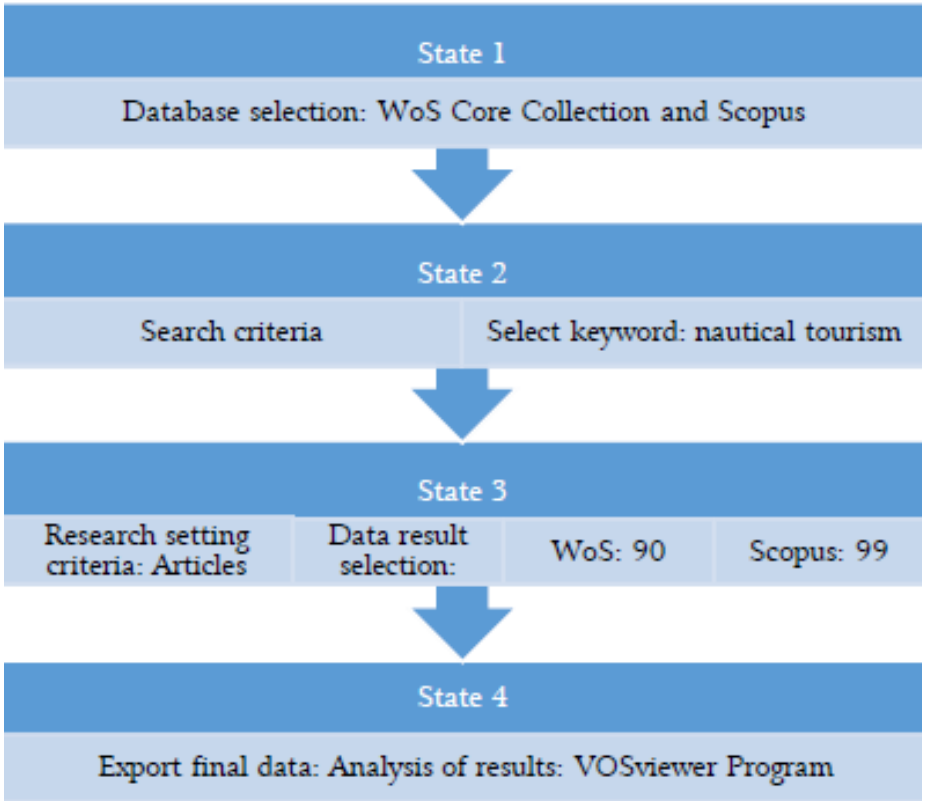
3. METHODOLOGY

To carry out the research in this article, bibliometric analysis has been used to study the scientific production of the authors and has been used in various areas (Junquera & Mitre, 2007).

Bibliometrics is designed by an interpretative profile of the researchers whose main emphasis is based on the selection of the database, the choice of keywords, the title of the abstract, and the content of the article (Meiras & Rojas, 2014). This study is based on the identification of a bibliographic portfolio based on an initial selection procedure comprised of four stages (Figure 1):

1. Selection of the databases available in the electronic journal portal, with Web of Science (WoS) and Scopus having been chosen.
2. Search of the documents directly in the databases by means of the electronic search systems via keywords. The term “nautical tourism” was chosen for the research.
3. Use of arbitrarily defined research filters to select articles according to the scope of the investigation and the decisions of the researcher. In this case, articles published in journals of impact were selected.
4. Pre-analysis of the articles with the intention of filtering and selecting those articles that best match the study with a qualitative approach through the analysis of empirical content which can be explored and applied to all forms of communication and sectors of the human sciences (Bardin, 2011).

Figure 1. Stages of Bibliometric Analysis



Source: Own Elaboration

The preliminary results of the search in the WoS database without applying any filters were a total of 121 documents. These results were refined according to the search criteria of this research, selecting only the main collection of Web of Science, thereby obtaining 90 documents. This was in turn adjusted to include only the articles published in scientific journals in order to guarantee the quality of the research.

In the case of the search in the Scopus database, a total of 180 documents were selected by article, title, and keywords and then refined by scientific articles, thereby obtaining 99 articles.

Once the results were obtained, we exported the results to be processed through the VOSviewer programme and subsequently analysed them.

4. RESULTS

4.1 Evolution in the Number of Publications Per Year

Table 2 provides information on the evolution during the study period of the number of articles cited, citations per article (average), and the h-index.

The evolution of the number of published articles had an increasing trend in both databases, with WoS being above Scopus in 2013 and 2017; in 2018 Scopus exceeded WoS. During the years 1989 to 2002, there were hardly any publications; it is from 2007 onwards that a significant growth can be observed in both databases, especially in Scopus.

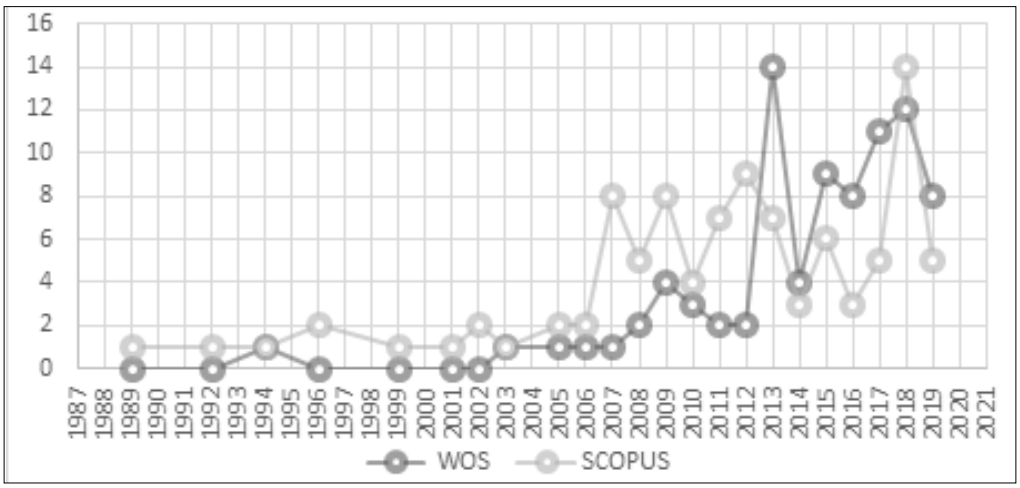
Table 2. Evolution in the Publication of Articles, Citations, Citation per Article, and H-index

WoS					SCOPUS				
Year	**Article**	**Citation**	**Citation per article**	**h-index**	**Year**	**Article**	**Citation**	**Citation per article**	**h-index**
1989	-	-	-	-	1989	1	0	0.00	0
1992	-	-	-	-	1992	1	2	2.00	1
1994	1	0	0.00	0	1994	1	0	0.00	0
1996	-	-	-	-	1996	2	4	2.00	1
1999	-	-	-	-	1999	1	0	0.00	0
2001	-	-	-	-	2001	1	1	1.00	1
2002	-	-	-	-	2002	2	1	0.50	1
2003	1	31	31.00	1	2003	1	6	6.00	1
2005	1	6	6.00	1	2005	2	0	0.00	0
2006	1	0	0.00	1	2006	2	10	5.00	2
2007	1	1	1.00	1	2007	8	24	3.00	3
2008	2	9	4.50	1	2008	5	8	1.60	2
2009	4	14	3.50	2	2009	8	10	1.25	2
2010	3	16	5.33	2	2010	4	21	5.25	3
2011	2	13	6.50	2	2011	7	16	2.29	2
2012	2	40	20.00	2	2012	9	37	4.11	2
2013	14	38	2.71	4	2013	7	22	3.14	2
2014	4	15	3.75	2	2014	3	4	1.33	1
2015	9	52	5.78	4	2015	6	54	9.00	4
2016	8	10	1.25	3	2016	3	9	3.00	2
2017	11	16	1.45	2	2017	5	3	0.60	1
2018	12	2	0.17	2	2018	14	3	0.21	1
2019	8	0	0.00	0	2019	5	5	1.00	0

Source: Own Elaboration

The evolution of the number of articles published in the Web of Science has seen a growing trend since 2007, with the year 2013 being highlighted with 14 articles. On the other hand, in the Scopus database, the first article was published in 1989 and has seen an increasing trend as of 2007, with 14 articles being highlighted for 2018 (Figure 2).

Figure 2. Evolution of Articles in WoS and Scopus

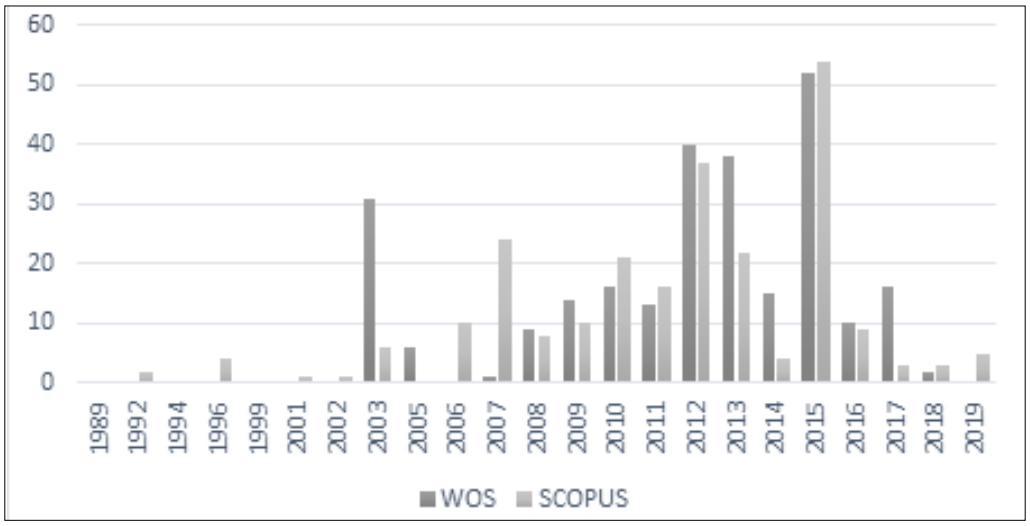


Source: Own Elaboration

Figure 3 shows the development of the total number of citations. In 2015, WoS had the highest number of citations for this database with 52 citations, but this number as exceeded by Scopus with 54. In the same year, Scopus has the highest h rating, while for WoS, the highest values were reached in 2013 and 2015.

According to the classification by category in WoS, the areas that have the most weight in research are social sciences (52%), engineering (25%), and sports sciences (18%), and the rest is made up of other areas such as transport, the environment, public administration, etc. In the case of Scopus, the result is similar, with social sciences (28%), engineering (22%), and the environment (20.1%) as the main areas, and the rest is made up of other areas such as chemical engineering, management, and business.

Figure 3. Evolution of Citations in WoS and Scopus



Source: Own Elaboration

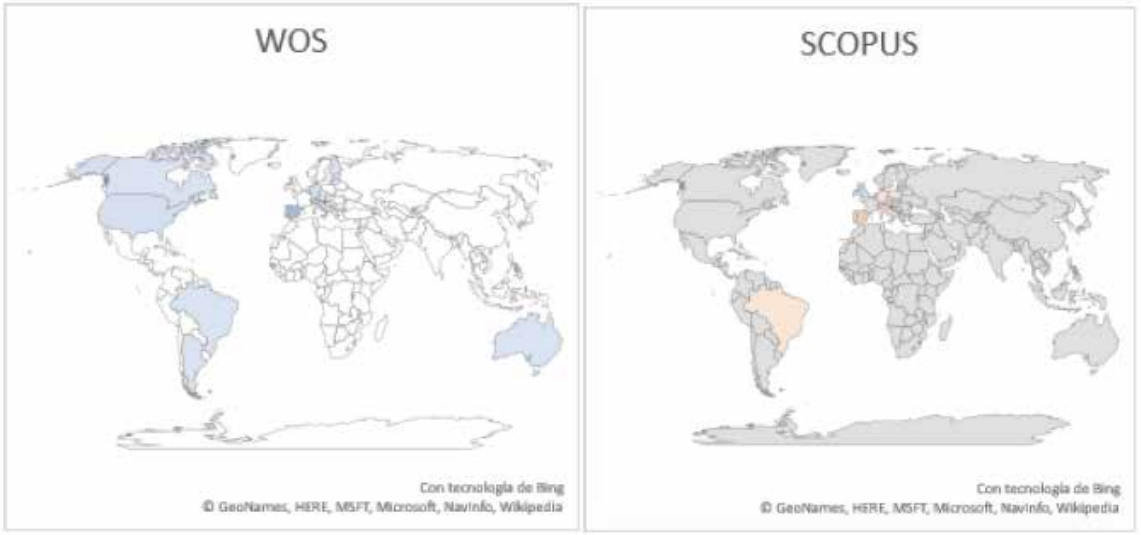
If the scientific production of articles is considered for period of the economic and financial crisis 2008–2014, we can see a rebound a year before the financial recovery during which time its evolution was growing, reaching its maximum in 2013, during which year the subject dealt with was related to case studies of the development of nautical tourism in

Croatia, the Baltic and Arctic regions, the Black Sea, and the Atlantic and Mediterranean coasts.

4.2 Analysis of Authors, Research Centres, and Countries

In analysing the origin of the articles (Figure 4) according to the WoS database by the countries that are most representative, the first position is occupied by Croatia, followed by Spain, Italy, and Portugal, adding up to 76.5% of the total.

Figure 4. Density Map of Scientific Production



Source: Web of Science and Scopus. Own Elaboration.

Table 3 contains the six authors with the highest number of citations and the most articles published in the WoS and Scopus databases.

In the WoS database, the most significant author is Mirjana Kovačić with 13 articles, 52 citations and an h-index of 4. With an h-index of 2 and 17 articles published is Tihomir Luković; both authors are affiliated with Rijeka University, Rijeka, Croatia. Srećko Favro has 5 articles, 16 citations, and an h-index of 3. The remaining authors—Gržetić, Z. and Gračan, D.—have between 5–8 articles, with few citations, and indexes varying between 1 and 2.

Table 3. Most Relevant Authors

Author	Affiliation	Articles	Citation	h
Luković, T.	Rijeka University, Rijeka, Croatia	17	29	2
Kovačić, M.	Rijeka University, Rijeka, Croatia	13	52	4
Gržetić, Z.	Hydrographic Institute of the Republic of Croatia, Split, Croatia	8	9	2
Favro, S.	Sveučilište u Splitu, Split, Croatia	5	16	3
Gračan, D.	Rijeka University, Rijeka, Croatia	4	1	1
Kovačić, M.	Rijeka University, Rijeka, Croatia	15	41	3
Luković, T.	Rijeka University, Rijeka, Croatia	11	21	3
Favro, S.	Sveučilište u Splitu, Split, Croatia	9	19	3
Gračan, D.	Rijeka University, Rijeka, Croatia	6	6	2
Gržetić, Z.	Hydrographic Institute of the Republic of Croatia, Split, Croatia	5	18	2

Source: Web of Science and Scopus. Own Elaboration.

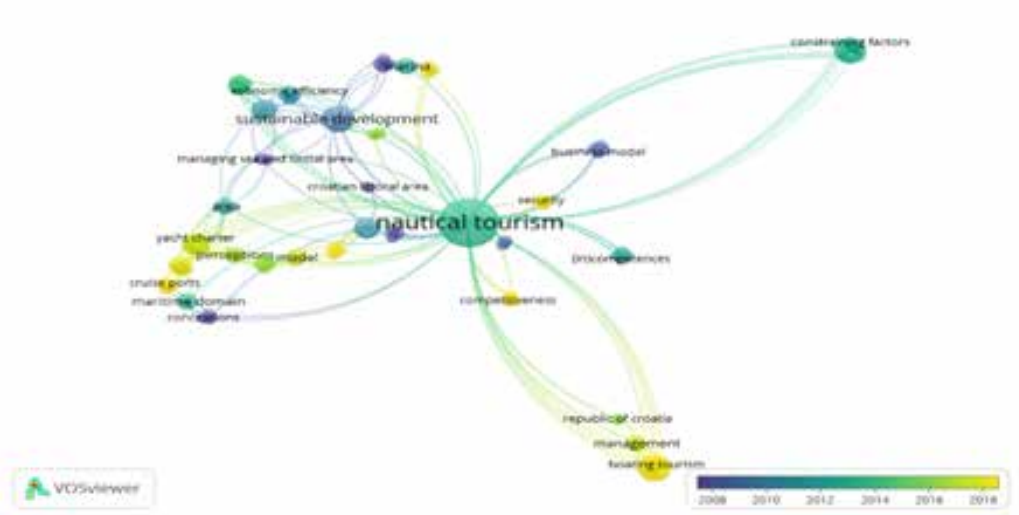
On the other hand, in the Scopus database we have Mirjana Kovačić with 15 articles, 41 citations with an h-index of 3, followed by Tihomir Luković with 11 published articles, 21 citations, and an h-index of 3. In third position is Srećko Favro with 9 articles, 19 citations, and the same h-index as the previous two. The authors Gračan, D., Dominis, Z., and Gržetić, Z. have an h-index between 1 and 2, but the difference is that Gržetić has 5 publications, 18 citations with almost the same number of articles, but the average is 3.6% higher than that of the others.

4.3 Trend Analysis

Through an analysis carried out on the keywords, the most-used terms and the current trend in relation to new aspects of nautical tourism are identified. To do this, VOSviewer was used to obtain trend graphs, in which a scale of colours ranging from blue to yellow indicates the novelty of the terms in the study period.

In Figure 5, with respect to WOS, the trends concern concepts related to competitiveness, the Mediterranean, development strategy, risk management, and economic and ecological impact.

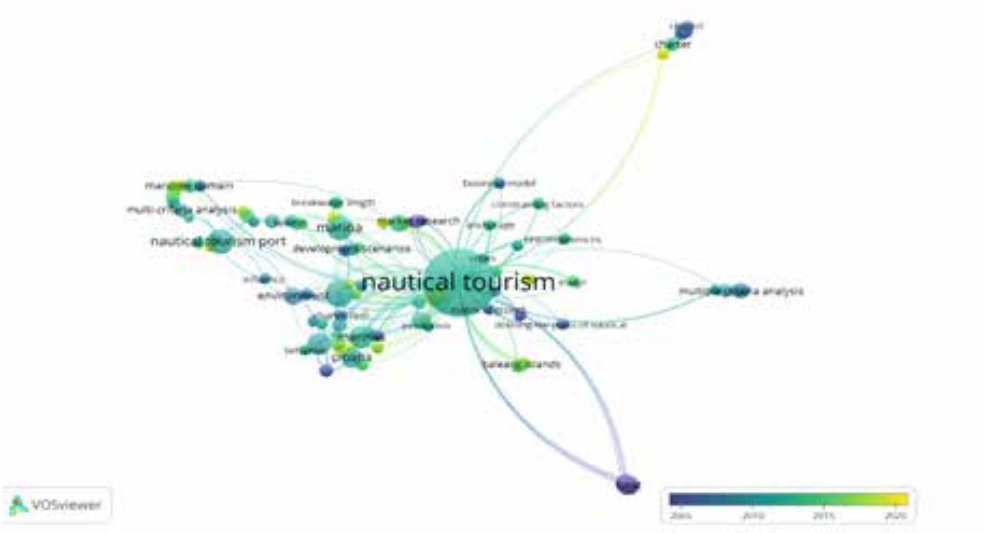
Figure 5. Trends in Keywords According to WoS



Source: Own Elaboration

In Scopus (Figure 6) the trends are focused on concepts related to blue growth, marine ecosystems, tourist ports, risk management, security, the Mediterranean, pleasure boating, web communication, website quality, and website evaluation.

Figure 6. Trends in Keywords According to Scopus



Source: Own Elaboration

If the trends of the keywords in both databases are grouped together, they coincide in the terms management risk and security and Mediterranean. These are terms that refer to risks in the management of tourism, which for some countries has become mass tourism that has been chosen as an economic activity. Due to its peculiarities, nautical tourism is a complex system with various technical and technological processes, hence the need to propose measures to guarantee its safety, especially in the regions of the Mediterranean Sea which are highly attractive to tourists for sailing due to their similar geographical and climatic conditions.

5. CONCLUSION

Nautical tourism is made up of those vacation activities or events that involve traveling for pleasure combined with sailing in an aquatic environment. For coastal areas that have marinas, nautical tourism is an element that differentiates an area from other localities, improves the tourist offering of the place, has a decisive role in the economy, and highlights the importance of good territorial planning, safety, and the environment for its sustainability.

Finding a definition for the concept of nautical tourism remains a complex issue as there are various factors and elements involved. It is a definition that is continually evolving due to the activities that are emerging and being incorporated into the term nautical tourism.

The authors with the largest number of citations and most published articles are Luković from the University of Dubrovnik, Kovačić from Rijeka University, Favro from Sveučilište Splitu, and Gržetić from Zvonko Hydrographic Institute of the Republic of Croatia Split; all these authors are from Croatia, a country with great potential for the development of nautical tourism, due to its roots in traditional seafaring and its great tourist attractions.

The main thematic areas of research in the Scopus database are focused on social sciences, engineering, and environmental sciences, while for the WoS database, the areas are overlapping with the exception of the environmental aspect which is in fourth position after sport. From the graphics produced by VOSviewer, the map of keywords generated around the concept of "nautical tourism" and those that are most repeated shows that they are related to the environment, marinas, sports, ports, legislation, management, safety, risk, competitiveness, sustainable development, fishing, nautical charter, etc....

According to the analysis of trends, concepts such as blue growth, marine ecosystems, tourist ports, risk management, and security emerge, terms which indicate the concern for environmental conservation and future lines of research in this field.

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PRODUCTIVITY MEASUREMENT: THE CASE OF NATURE TOURISM FIRMS IN PORTUGAL

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ABSTRACT

Productivity measurement in the tourism sector has been raising increasing interest among researchers and is recognised as an important indicator for understanding the strengths and weaknesses of the sector and for enhancing its spillover effects on the economy. However, studies for Portugal and the particular activities included in the set of nature tourism activities are scarce. To overcome this research gap, this paper calculates the labour productivity and total factor productivity (TFP) measures of nature tourism firms to compare firms' productivity performance across NUTS II regions in mainland Portugal during 2014–2017. Using data from SABI, *Quadros do Pessoal*, INE and the National Tourism Registry, the sample consists of 369 firms, representing 55% of firms operating in nature tourism in the mainland. Results show that the levels of TFP, unlike to labour productivity, are uneven over time and space. In 2015, a year of change in the business cycle, all regions experienced a negative increase in TFP except the Metropolitan Region of Lisbon, which seems to indicate that nature tourism in most of the country is less resilient to external economic shocks, performing better in periods of prosperity. Labour productivity growth does not present, in general, consistently positive results.

Keywords: Labour Productivity, Total Factor Productivity, Tourism Sector, Nature Tourism, Regional Analysis, Portugal.

JEL Classification: L83, O10, O47, R11

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1. INTRODUCTION

The tourism sector involves an increasingly wide range of stakeholders and different activities and types of enterprises, which include multinationals and small and medium-sized businesses (which constitute most of the companies in the sector). It accounts for an important share of economic activity in most countries (UNWTO, 2014; Tourism of Portugal, 2018) being an essential source of revenue and positively impacting the balance of payment and the living standard of the populations (Nunkoo et al., 2020). In 2018, for example, with nearly 25 million guests, Portugal presented historical results for national tourism in the following indicators: overnight stays, revenues, guests, employment and exports; and tourism was considered the largest export economic activity in the country, with an 8.2% contribution to GDP (Tourism of Portugal, 2018). Based on the Travel & Tourism Competitiveness Index 2017 and World Tourism Barometer, Portugal is considered the 14th most competitive destination in the world (Tourism of Portugal, 2018). Considering the importance of tourism for the world economy and for economic growth, several studies have been published regarding productivity measurement. Such measurement has been raising increasing interest in academia and is recognised as critically important, since it is an essential indicator for understanding the strengths and weaknesses of the tourism sector.

According to Schreyer (2001: 11), productivity is commonly defined as a 'ratio of a volume measure of output to a volume measure of input use'. In tourism, productivity measures how efficiently and effectively specific production inputs are used in an economy to produce a given level of output, by relating the number of inputs, notably employment of labour and capital, to outputs (Blake et al., 2006). However, measuring productivity in tourism, a service-based sector where in many cases personal contact is required, is complex, given the different tools and measures of inputs and outputs. Because increased productivity can lead to economic growth without any additional inputs, tourism firms aim at increasing their productivity to earn higher income through the generation of greater outputs. At the same time, governments are interested in improving the productivity of their tourism markets to achieve higher levels of economic growth. Finally, scholars are interested in how tourism productivity affects economic growth. Thus, the research agenda of the United Nations World Tourism Organization has paid particular attention to tourism productivity (Assaf & Dwyer, 2013). However, Milio (2014) observed that, after the international financial crisis started in 2007, regions highly specialised in tourism have shown a lack of resilience difficulties, and an ability to recover their trajectories of economic growth. Furthermore, European regions with high specialisation in tourism (measured by the share of the employment in this sector in the regional labour force) tend to exhibit lower levels of gross value added, along with lower levels of education (Romão & Neuts, 2017).

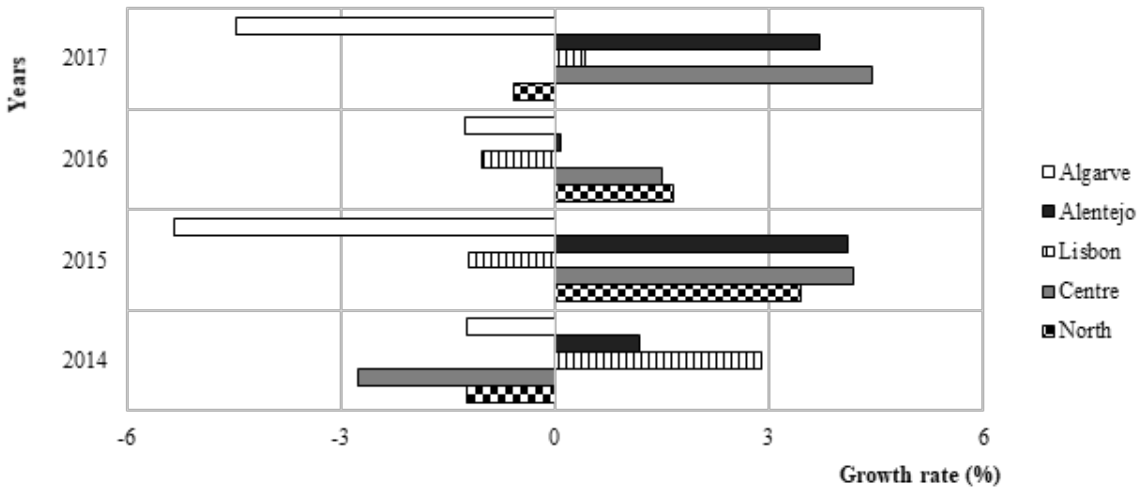
Tourism in Portugal has been critical for the national economy, and the results obtained in the last year confirm the growth trend, reinforcing the importance of the sector (Tourism of Portugal, 2018). Given the focus on the quality of the tourist experience and given Amusement and Recreation Activities' contribution to the establishment of visitors/tourists relations, job creation and destination development (National Observatory of Tourist Animation, 2013, cited in Leite, 2018). Furthermore, Amusement and Recreation Activities play a decisive role in projecting local identities, underpinning the economic development of the regions (Leite, 2018). Amusement and Recreation Activities refers to a set of activities aimed at transforming leisure into dynamic, participatory and creative activities, making it possible to reconcile tourism, sports and nature, and allowing tourists to enjoy activities amid the richness of the environment (Leite, 2018). According to the legislation in force (Decree-Law No. 186/2015 of 3 September), Amusement and Recreation Activities include recreational activities, sports or cultural activities, which are configured as outdoor tourism

activities or cultural tourism and are of interest to tourism for the region in which they occur (Ministério da Economia, 2015).

As described in *Ministério da Economia* (2015), 'open-air tourism activities', are also known as 'outdoor activities', 'active tourism' and 'adventure tourism', and they refer to activities that cumulatively: (i) predominantly take place in natural spaces, resulting in diversified experiences of enjoyment, experimentation and discovery of nature and landscape, whether or not in physically equipped facilities; (ii) assume logistical organisation and/or supervision by the provider; and (iii) imply a physical interaction of the participants with the surroundings. In turn, 'cultural tourism activities' refers to pedestrian and transport activities, which promote contact with the cultural and natural heritage through mediation between the recipient of the service and the cultural good enjoyed, for the purpose knowledge sharing. The before-mentioned activities imply physical effort to a greater or lesser extent, and range from passive (e.g. sitting, relaxing, enjoying a view) to active, (e.g. skiing, mountain biking, horse riding). They can be undertaken by individuals alone or in groups of family and friends (Bell et al., 2007). When the focus is on the adventure, it also involves challenge and risk-taking (Houge & Kerr, 2016). Based on Beedie and Hudson (2003), these activities can be distinguished between 'hard' and 'soft'. Activities like rafting, scuba diving, mountain biking, rappelling, cliff jumping, river crossing, paragliding, rock climbing, and bouldering can be considered 'hard', whereas 'soft' outdoor activities include walking, cycling, camping, hiking, biking, animal watching, horseback riding, canoeing, and water skiing. In recent years, these activities have become increasingly important for visited regions, given their economic implications. Therefore, different forms of tourism have grown in popularity and have captured practitioners' interest (Bell et al., 2007). This recognition creates opportunities to extend the existing knowledge about the impacts of outdoor tourism activities by approaching these activities from a supply perspective.

The potential effect of tourism on productivity growth, particularly of nature tourism activities, is yet to be uncovered. Given that in 2015 and 2016 the North of Portugal contained the two regions in Portugal's mainland that grew the most in terms of number of guests (see Figure 1), the goal of this paper is to assess how this translates into increases in productivity.

Figure 1. Annual Increase in Tourism Demand (guests) Across NUTS II Regions, 2014–2017



Source: Own elaboration based on Estatísticas do Turismo 2013–2017, INE

Assuming underemployment, if firms' turnover increases due to increased demand and it is not necessary to increase the production factors in the short run, then total factor productivity will increase. Thus, using two productivity measures, this study examines the relative position of the NUTS II regions of mainland Portugal, in 2014–2017. Thus, this study contributes to an in-depth understanding of tourism firms' contribution to regional productivity in mainland Portugal, which has not been fully revealed in the previous literature.

Following the introduction, a literature review on the tourism firms' productivity is performed. In section 3, information on the data source and methodology is provided. Section 4 presents and discusses the results, and section 5 concludes.

2. LITERATURE REVIEW

Tourism is a component of aggregate demand that generates domestic output (Lin et al., 2018) and it is regarded as a form of export that can inject cash-flow into the economy (Chou, 2013). Accordingly, a considerable amount of literature on tourism has been focused on macroeconomic-level issues. Early studies that aimed to calculate the total economic impact of tourism focused on estimating tourism's income or the expenditure multiplier effect (Archer, 1984) through cost-benefit analysis (Dwyer & Forsyth, 1998) and input-output analysis (Frechtling & Horváth, 2016). Subsequently, targeting more accurate measurements, authors used computable general equilibrium models (Inchausti-Sintes, 2015; Njoya & Seetaram, 2018). More recently, most empirical studies have tested the tourism-led growth hypothesis (Carmignani & Moyle, 2018; Zuo & Huang, 2018). Although tourism development is positively related to economic growth (Pablo-Romero & Molina, 2013; Brida et al., 2016), few studies have examined how tourism productivity affects the whole economy.

In tourism, the areas in which productivity has been studied are hotels (e.g. Barros & Alves, 2004; Cordero & Tzeremes, 2018; Liu & Tsai, 2018; Chatzimichael & Liasidou, 2019; Tzeremes, 2019), restaurants (Reynolds & Biel, 2007; Kukanja & Planinc, 2018; Kim & Jang, 2019) and travel agencies (Botti et al., 2010; Fuentes & Alvarez-Suarez, 2012; Díaz-Chao et al., 2016; Zuo & Li, 2018). However, to our knowledge, only one study (Kinfemichael & Morshed, 2019) included Amusement and Recreation Activities in the analysis.

For example, Barros and Alves (2004) analysed the efficiency of a Portuguese public-owned hotel chain, based on a sample of 126 observations, for the period 1999–2000. They used an output-oriented Malmquist-productivity index and Data Envelopment Analysis (DEA), a nonparametric technique, to estimate the total factor productivity (TFP) change. This index made it possible to break down TFP into a pure-efficient change index and scale-efficient change index. Barros and Alves (2004) found mixed results, that is, some hotels obtained gains in both areas and others obtained gains in one area while experiencing losses in the other. Only a small number of hotels achieved TFP improvements, with a more significant fraction achieving improvements in technical efficiency and only a small fraction achieving improvements in technological change.

Using a sample of 820 Spanish hotels from Balearic and Canary Islands, Cordero and Tzeremes (2018) analyse hotels' labour productivity growth in 2007–2012. They decompose labour productivity into technological change, technological catch-up (efficiency improvement/convergence), and capital deepening. Their results suggest that hotels' labour productivity is resilient in terms of facing the financial crisis. Using a Hicks–Moorsteen index approach, Liu and Tsai (2018) investigate TFP growth, technological progress, pure technical efficiency change, scale efficiency change, and mix efficiency change of star-rated

hotels in China, in 2001–2015. Their results show that the annual average growth rate of TFP was 13.11%, mainly attributed to an average yearly growth rate of operational efficiency of 21.85% and a mix efficiency growth rate of 13.52%.

Chatzimichael and Liasidou (2019) decompose hotel-sector TFP growth into components attributable to changes in technical efficiency, scale effect, and technological change. The hotel-sector production Frontier is approximated parametrically using an approach that does not requires data on prices. The study uses a translog production function to estimate productivity growth and its components in a sample of 25 European countries, in 2008–2015. In turn, Tzeremes (2019) applied the robust Luenberger productivity index (LPIs) alongside their main components to a sample of 176 hotels in the Canary Islands, Spain, from 2004 to 2013. The analysis was performed over several sub-periods during the Global Financial Crisis (GFC). The results indicated that hotels increased their productivity levels during the period and, also, that they have demonstrated strong resilience during the global financial crisis. In Tzeremes (2019) research, they obtained a contradiction when comparing the robust and original LPIs. Their findings suggest that the original LPIs underestimate hotel productivity levels due to the presence of outliers in the sample.

Reynolds and Biel (2007) suggest that productivity analysis through maximising operational outcomes, in addition to minimising expenses, might be possible through the application of a holistic productivity metric that includes traditional operational variables (revenue, profit, food cost, and labour cost) and new variables such as guest and employee satisfaction and retention equity. Through data from a chain's 36 corporate-owned restaurants located in the United States, they found that factors leading to maximum outputs, such as controllable profit and retention equity, include employee satisfaction in addition to expected variables such as cost of goods sold and the number of seats.

Kukanja and Planinc (2018) used DEA, based on secondary-financial data provided by the national tax authorities, to analyse the efficiency of 142 small and medium-sized Slovenian restaurants in 2017. Results showed that the average efficiency score is 85%, which indicates that, on average, restaurants have to increase their efficiency level by 15% in order to improve their efficiency according to the most efficient (best-performing) units under comparison.

Based on the equity theory and the fair-wage hypothesis, Kim and Jang (2019) investigate the relationship between the minimum wage and restaurant productivity in the US, for 1980–2014. The sample of 1,926 firm-year panel data for 242 restaurants comes from the Department of Labour website and the COMPUSTAT annual database for the federal minimum wage rate and company financials, respectively. The results revealed that increasing the minimum wage enhances restaurant productivity for up to two years. The results further indicated that both full-service restaurants and low-wage restaurants benefit from the positive effect, while there is no significant effect on limited-service restaurants and high-wage restaurants.

Botti et al. (2010) use a procedure based on the Luenberger productivity indicator for estimating and decomposing productivity change into efficiency change and technological change in the Portuguese travel agency sector for 2000–2004. They use sales and profits as proxies of output; and wages, capital, total operational cost, excluding wages and book value of premises, as proxies of inputs. Nominal variables are deflated using the GDP deflator. Data are obtained from reports published annually by the newspaper *Diário de Notícias* on the 1,000 largest firms in Portugal; the results show that productivity has increased for most of the travel agencies, almost always explained by an improvement in technological change. Fuentes and Alvarez-Suarez (2012) analyse the productivity of 22 travel agencies located in Alicante (Spain), in 2004–2007, to obtain results on efficiency. They use Malmquist indices and the smoothed bootstrap method; and the Mann-Whitney U test is adopted to study the

relationships between levels of productivity, ownership type, location, and experience. The results do not present an optimistic view regarding the evolution of the economic activity of the agencies.

Using survey data for 120 small and medium-sized travel agencies based in Catalonia (Spain) and partial least square–structural equation modelling (PLS–SEM) estimation techniques, Díaz-Chao et al. (2016) examine new co-innovative sources of firm labour productivity. They find that labour productivity is directly explained by those agencies' capacity to exploit their assets, use local networks, and make international transactions.

Co-innovation practices have a negative impact that may be related to difficulties in terms of securing productivity improvements in the short term. Based on cross-sector, cross-regional panel data collected from 2001 to 2014, Zuo and Li (2018) focus on accommodations, travel agencies, and tourist attractions to study the relationship between resource reallocation and changes in sectoral productivity. They use a sequential Data Envelope Analysis model to measure the heterogeneous productivity changes. They find deterioration of the allocative efficiency in China. Kinfemichael and Morshed (2019) use disaggregated data for the period 1987–2015 from the US Bureau of Economic Analysis to examine sectoral unconditional convergence in labour productivity in the United States. Their results show a general slowing down in the rate of convergence of labour productivity in recent years. The authors uncovered a new catching-up process for some subsectors, such as accommodations, amusement, gambling, and recreation services.

For the tourism industry, Pham (2019) developed a framework that integrates the principles of the growth accounting framework and the tourism satellite account (TSA) to provide a holistic approach to calculate the three largest productivity measures: capital productivity, labour productivity and multifactor productivity, for the Australian tourism industry. Using two sources of information, one of which provides three series: hours worked, capital services and real GVA indices for all conventional industries. Three tourism indexes are calculated as the weighted sum of these series using the corresponding shares. The series of hours worked is aggregated using the compensation of employees (COE) shares; capital services are aggregated using the gross operating surplus (GOS) shares and the gross value added (GVA) is aggregated by using the GVA shares. The shares were calculated based on nominal values to reflect the Laspeyres chain volume index closely; and the productivity measures capture around 80% of the entire tourism industry. The conclusion is that, in Australia, tourism is a reservoir designed to accommodate fluctuations in demand for labour in the economy.

From the studies mentioned above, among all possible types of productivity measures, the most used are labour productivity (LP), which measures the growth in value-added output per unit of labour used, and multifactor productivity (MFP), calculated through a growth accounting framework. The inputs used are usually labour, raw materials, capital, or a combination of all three. At the same time, the output is often either turnover, gross value added (GVA), or gross domestic product (GDP). The components of tourism productivity may be the number of jobs directly attributable to tourism (direct tourism jobs), as the input; and the gross value added (GVA) directly due to tourism (tourism direct GVA (TDGVA)), as the output. The approaches to measuring tourism productivity are the Data Envelopment Analysis, the Stochastic Frontier Analysis (SFA), and occasionally the Malmquist index and Luenberger productivity indicators (LPIs). The LPI takes the value of 0 if there is not any productivity change among periods t and t + 1. However, positive values mean progress of productivity levels, whereas negative values suggest a decline of productivity levels. These indicators can be estimated either by parametric or nonparametric methods. Also, growth regressions and Growth Accounting Frameworks are used.

Despite the recognised importance and the number of existing papers that provide an overview of productivity, its measurement, and the tourism-specific challenges (Joppe & Li, 2016), productivity is still under-researched with regard to tourism firms (Blake et al., 2006; Joppe & Li, 2016). Especially underresearched is the attempt to address productivity within one of tourism's sub-sectors, such as Amusement and Recreation Activities (code 93.2 NACE revision 2) in Portugal.

3. METHODOLOGY

3.1 Data Sources

This paper constructs two measures of productivity of nature tourism firms, namely, labour productivity and total factor productivity, and compares firms' performance across NUTS II regions in mainland Portugal during 2014–2017. The identification of firms operating exclusively in nature tourism was obtained from the National Tourism Registry (RNAAT). The database from RNAAT showed 1,023 tourist agents. Subsequently, there was a need to collect financial data from the SABI database financial reports. Bureau van Dijk (BvD) collects and harmonises the data from the mandated firm reports. In particular, for the Portuguese case, financial data come from *Informação Empresarial Simplificada* (IES).

This information is collected massively by Coface, BvD's partner for Portugal, which sends it to BvD for consequent upload in the SABI database. However, since SABI does not provide financial reports of entrepreneurs, 343 tourism agents were withdrawn, and 428 firm reports have been obtained via the SABI database. Afterwards, 14 firms that were located in the Islands (Madeira and Azores) were removed because the published statistics of *Quadros do Pessoal* only provide information on employees, according to qualification level, for mainland Portugal. After cleaning data regarding firms with missing values for all years, the sample is comprised of 369 nature-based Amusement and Recreation Activities firms (code 93.2 NACE revision 2). Thus, the sample represents 55% of total firms operating in nature tourism in the mainland from 2014 to 2017 (Table 1), and grants the reliability of conclusions at a 95% level of confidence.

Table 1. Percentual Representation of the Sample, by NUTS II

NUTS II	RNAAT	Sample	Representation of the sample (%)
North	135	79	59
Centre	116	64	55
Lisbon	200	101	51
Alentejo	70	45	64
Algarve	145	80	55
Total	**666**	**369**	**55**

Source: Own Elaboration

To calculate the variable human capital (w) for the estimation of TFP, the number of employees of each firm was multiplied by the regional coefficient (Table 2). This coefficient is the share of employees with at least a degree in total, by NUTS II regions, obtained from *Quadros do Pessoal* for the period 2014–2017. Subsequently, the missing values in the sample were attempted to be filled through multiple imputation, an iterative method of addressing missing data and fittingly reproducing the variance/covariance matrix one would

have observed. In this process, the distribution of the observed data is used to estimate multiple values that reflect the uncertainty around the true value. These values are then used in an ordinary least squares (OLS) model, and the results are combined.

Table 2. Regional Coefficients for the Calculation of Human Capital (variable)

NUTS II region	2014	2015	2016	2017
North	13.47	14.05	14.69	15.07
Centre	13.33	14.00	14.53	14.95
Lisbon	23.43	24.14	24.33	24.97
Alentejo	11.69	12.36	12.51	12.72
Algarve	11.20	11.61	11.69	11.99

Source: Own Elaboration

3.2 Empirical Strategy

In the empirical research two measures of productivity have been used—labour productivity and total factor productivity—to assess the relative performance of nature tourism firms across NUTS II regions in mainland Portugal, from 2014 to 2017. For this purpose, labour productivity is calculated as the ratio between turnover and number of employees. The level of TFP, rather than the output per capita, has been estimated using an augmented Solow Model type of equation. According to Griliches and Mairesse (1995), estimating growth equations with firm-level panel data can lead to specification problems as well as to the invalidity of instruments for capital and employment at the firm level. A way of addressing the issue of endogeneity in capital and the possibility of productivity shocks is to use a two-step approach and estimate TFP using the Wooldridge (2009) modifications to the original Levinsohn-Petrin (LP) (2003) value-added approach, according to equation (1):

$$\mathbf{Y_{It} = A_{It} K_{It}^{\beta^k} L_{It}^{\beta^l} M_{It}^{\beta^m}} \quad (1)$$

In this equation, Y_{it} represents the physical output of firm i at period t, and K_{it}, L_{it} and M_{it} are the inputs of capital, labour, and materials, respectively. A_{it} is the Hicksian neutral efficiency level (the proxy to the total factor productivity—TFP) of firm i in period t. For a given level of A, higher output levels demand higher inputs (K, L, and M) levels.

It is assumed that $L = L^P + L^{NP}$, where L^P stands for production worker (unskilled) labour and L^{NP} stands for non-production worker (skilled) labour. L^{NP} is constructed as explained in section 3.1, since there is no information for individual firms.

Although it is possible to observe Y_{it}, K_{it}, L_{it}, and M_{it}, A_{it} is not observable and therefore needs to be estimated. The estimation of $A_{it,}$ depends on several different components such as skills, knowledge and firm-level capabilities, including managerial and organisational competences. We assume that A_{it} or TFP in logs is given by equation (2), where β_0 measures the mean efficiency level across firms over time, and ε_{it} is the time- and producer-specific deviation from that mean:

$$\mathbf{\ln(A_{It}) = \beta_0 + \varepsilon_{It}} \quad (2)$$

Taking the natural logs of equation (1) and inserting equation (2) obtains a linear production function, presented in equation (3):

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_{lP} l^P_{it} + \beta_{lNP} l^{NP}_{it} + \beta_m m_{it} + \varepsilon_{it} \quad (3)$$

In equation 3, lower-case letters refer to natural logarithms. The error term ε_{it} can be further decomposed into an observable (or at least predictable) and an unobservable i.i.d. component, representing unexpected deviations from the mean due to measurement error, unexpected delays or other external circumstances, i.e, $\varepsilon_{it} = v_i + u^q_{it}$. Hence, equation (3) becomes equation (4):

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_{lP} l^P_{it} + \beta_{lNP} l^{NP}_{it} + \beta_m m_{it} + v_{it} + u^q_{it} \quad (4)$$

Since the firm-level productivity[11] is $tfp_{it} = \beta_0 + v_{it}$, rearranging the terms of equation (2) obtains equation (5):

$$tfp_{it} = y_{it} - (\beta_k k_{it} + \beta_{lP} l^P_{it} + \beta_{lNP} l^{NP}_{it} + \beta_m m_{it}) - u^q_{it} \quad (5)$$

And the estimated productivity is given by equation (6):

$$\widehat{tfp} = tfp_{it} + u^q_{it} \quad (6)$$

This empirical model makes it possible to address the simultaneity bias in traditional OLS regression techniques to estimate TFP when unobserved productivity or TFP shocks, *i* and *t*, are correlated to the choice of inputs. Since the Olley-Pakes (1996) and Levinsohn-Petrin (LP) (2003) techniques, while controlling for the simultaneity bias, suffer from collinearity problems (Ackerberg et al., 2007), Wooldridge (2009) suggested modifications to the original LP approach aiming to correct the collinearity issue. Defining the value added as $va_{it} = y_{it} - \beta_m m_{it}$, it can then be estimated through equation (4) as a residual

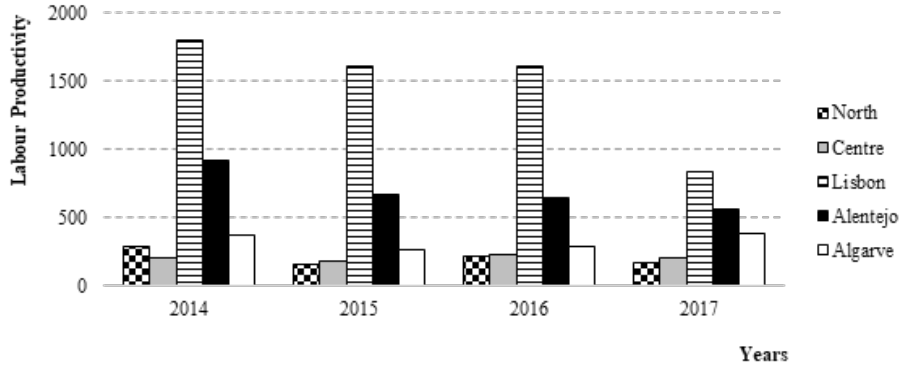
$$\widehat{tfp_{it}} = va_{it} - \left(\widehat{\varepsilon^v_p} l^P_{it} + \widehat{\varepsilon^v_{NP}} l^{NP}_{it} + \widehat{\varepsilon^v_K} K_{it}\right) \quad (7)$$

4. RESULTS

Results, shown in Figure 2, reveal that the labour productivity of firms operating nature-based activities in the Metropolitan region of Lisbon is highest, followed by the labour productivity of firms in Alentejo and Algarve. The northern region ranked in the fourth position in 2014 but dropped to the last position in the following two years.

[11] The productivity term is identified assuming that tfp_{it} is a state variable in the firm's decision problem (i.e. it is a determinant of both firm selection and input demand decisions), although u^q_{it} is either the measurement error or a non-predictable productivity shock (Olley & Pakes, 1996).

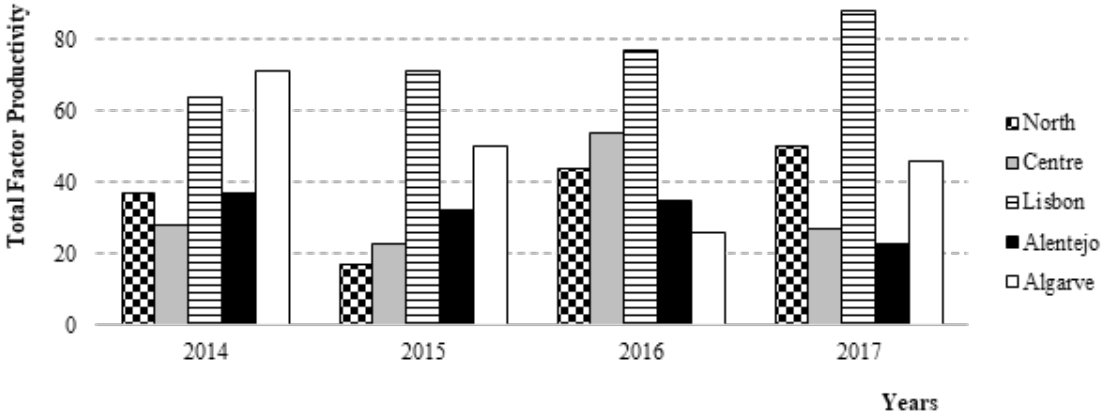
Figure 2. Labour Productivity Across NUTS II Regions, 2014–2017



Source: Own Elaboration

Regarding TFP, according to Figure 3, the higher level was recorded in firms operating in Algarve in 2014 and in the Metropolitan region of Lisbon in the following years. Firms in the northern region and Alentejo ranked in the third position in 2014. In 2015, the northern region ranked in the last position but in 2016 ranked in the third position. This may be explained by the annual increases in tourism demand (guests) in 2015 and 2016 (see Figure 1). Surprisingly, firms in Algarve show the worst position regarding TFP in 2016, although they recovered in 2017, rising to the third position. Although the central region shows the worst performance regarding TFP, in 2016, firms ranked second. Once again, this can be explained by the annual increases in tourism demand (guests) in 2015 and 2016. However, in the following year, those firms recorded levels of TFP in line with those recorded in 2014–2015.

Figure 3. Total Factor Productivity Across NUTS II Regions, 2014–2017

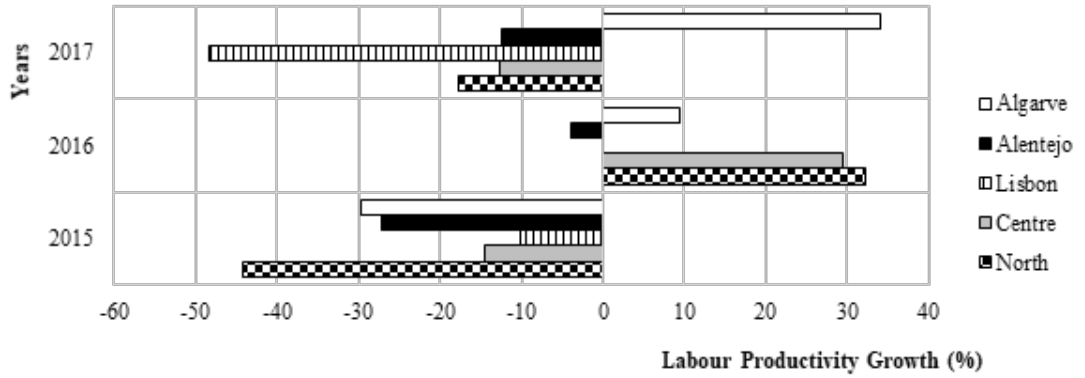


Source: Own Elaboration

These results seem to indicate that the levels of TFP, unlike labour productivity, are very uneven over time and space. The exception is the metropolitan region of Lisbon. This can be explained by the fact that the calculation of TFP requires a higher number of production factors than labour, which can suffer impacts from various factors both internal and external to the firms. However, these results should be read with caution, since the calculation of TFP did not accounted not for the real human capital in each firm but for an estimate of the amount of *w*, considering that firms operating in amusement and recreation activities hire the same amount of skilled labour (measured as employees with at least a degree) as the

mean for the whole region. Next, the labour productivity and TFP growth is analysed (see Figures 4 and 5, respectively).

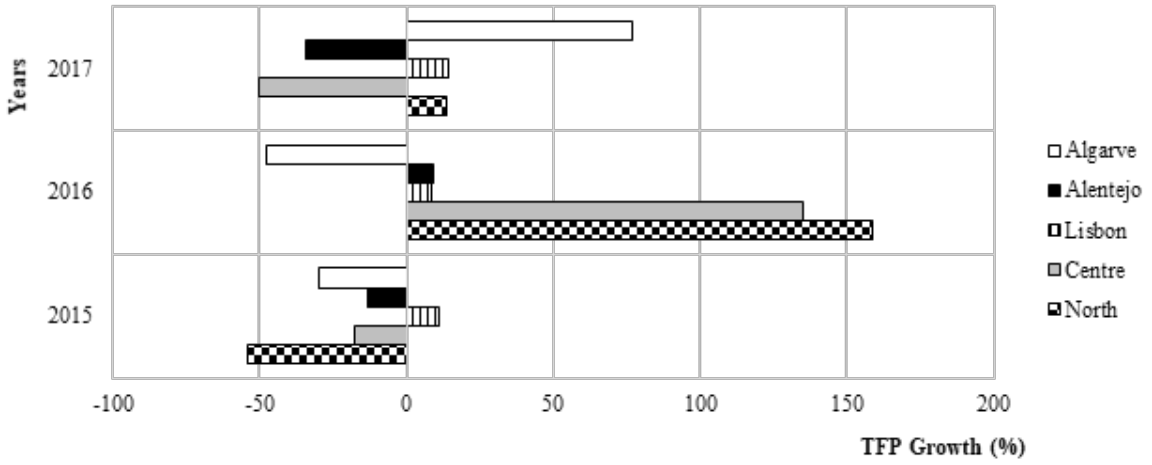
Figure 4. Growth of Labour Productivity Across NUTS II Regions, 2015–2017



Source: Own Elaboration

Results in terms of labour productivity growth (Figure 4) show that labour productivity increases in 2015–2017 were generally negative, except in 2016 for the northern and central regions (which grew 32% and 29% respectively) and in 2016 and 2017 for the Algarve region (10% and 34%, respectively).

Figure 5. Growth of TFP Across NUTS II Regions, 2015–2017



Source: Own Elaboration

The results on TFP growth (Figure 5) show, once again, that 2016 was favourable for the productivity of nature tourism firms operating in northern and central Portugal, with TFP increases of 159% and 135% respectively. The Metropolitan Region of Lisbon recorded increases in TFP during the whole period, although these were not uniform. Indeed, TFP grew more in 2015 and 2017. Firms in Alentejo only experienced positive TFP growth in 2016 (9%), while firms in Algarve only recorded positive TFP growth in 2017, albeit of great magnitude (77%). It should be noted that in 2015, all regions experienced a negative increase in TFP, except the Metropolitan Region of Lisbon, which seems to indicate that nature tourism firms in this region are more productive and resilient to external shocks.

5. CONCLUSION

Tourism is characterised by including intangibility, simultaneous production and consumption, perishability, and heterogeneity, which compound the complexity of capturing productivity in services (Joppe & Li, 2016). Also, and apart from the specific features of the sector, the combination of other measures, considered as inputs and outputs, than expected ones (e.g. costs) has already been highlighted. These measures include for example, the involvement of consumers in the value creation process, service quality, value-added to services through experiences, innovation, human capital (Joppe & Li, 2016), employee satisfaction, and controllable profit and retention equity (Reynolds & Biel, 2007). Adding to the complexity of measuring productivity in tourism is the recognition that the volume and structure of the tourism sector are defined on the basis of consumption generated by tourists rather than residents. Isolating and distinguishing consumption by tourists from that by non-tourists (e.g. residents) or by those who are not final consumers (e.g. tour operators), is not an easy task (Joppe & Li, 2016).

Productivity improvement in the tourism industry is related to service innovations that improve the experiences of tourists, unlike the manufacturing industry, which can improve productivity by introducing new technology into the production process (Chen & Soo, 2007). In addition, because productivity is not exogenous, new growth theory suggests that it can be assisted by knowledge spillover effects in human capital and public investment (Romer, 1986), which is more consistent with the more labour-intensive, less physical capital-intensive features of the tourism sector. Tourism can absorb underemployed labour to increase overall economic productivity due to its strong forward and backward sectorial linkages (Blake et al., 2006). When labour and other production factors move from a less productive sector such as agriculture to a more productive service sector like tourism, this structural change process with productivity growth may represent a mechanism through which tourism, can generate domestic output and contribute to economic growth.

In Portugal, more and more tourism entertainment/animation companies are emerging and organising recreational, recreational, sports, and/or cultural activities, which are directed at visitors/tourists (Tourism of Portugal, 2013). These activities are becoming increasingly important in meeting the needs of people looking for participatory and active tourism, with various emotions, experiences, and fun. Thus, these tourist activities contribute to increasing visitors' satisfaction level. In 2018, Portugal reached created a record 2,107 new tourist animation/entertainment companies. In total, during the last ten years a total of 8,952 new businesses were registered in Portugal (Tourism of Portugal, 2019).

Empirically, the overall results confirm that the levels of TFP of nature-based firms, contrary to labour productivity, are very uneven over time and space. The exception is the metropolitan region of Lisbon. Besides, labour productivity analysis reveals that Lisbon companies have higher productivity rates. Furthermore, firms' performance in this region in 2015, in terms of TFP growth, seems to indicate that nature tourism firms are more productive and resilient to external shocks.

The results from crossing the data on changes in tourism demand (number of guests) with firms' performance regarding productivity, especially for the northern and central regions, seem to indicate that increased tourism demand is immediately and directly reflected in the levels of labour productivity. This relationship is consistent with the levels of TFP growth with a one-year lag.

In terms of regional development, these results imply that policy measures to increase tourism and the productivity of tourism firms in the northern region as well as in other regions, excepting the Metropolitan region of Lisbon, are required. How well firms react to challenges in their operating environments depends on the capability of their employees

and of the systems that support them. Thus, investment in human capital development is vital to innovation and the productivity increases associated therewith. The demands of the 'information age' require higher-level skills gained through formal education and training. However, the innovation that is likely to increase firms' productivity commonly arises from the absorption and application of knowledge generated externally (Santos & Khan, 2019). Hence, policy measures aimed at improving firms' productivity may include supporting partnerships between firms. Several measures can be taken to achieve this end, for instance, (i) providing linkage information in seminars, exhibitions, and missions, and sponsoring fairs and conferences; (ii) organising meetings; (iii) promoting associations; and (iv) providing advice regarding deals. Other measures include regulatory regimes for business and foreign investment as vehicles of knowledge transfer.

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