Journal of Posthumanism
2025
Volume: 5, No: 1, pp. 1475–1495
ISSN: 2634-3576 (Print) | ISSN 2634-3584 (Online)
posthumanism.co.uk

DOI: https://doi.org/10.63332/joph.v5i1.698

Political Uncertainty in the Behavior of Rental Housing Prices in Spain. Time Trends and Persistence Analysis

Manuel Monge[1], Rafael Hurtado[2], Juan Infante[3]

Abstract

Over time, Spain has implemented various legislative measures to address the imbalance between homeownership and rental housing in a real estate market closely linked to the country's economic conditions. Changes in governance have introduced different regulatory approaches that may have influenced rental prices. This study examines the relationship between political uncertainty and rental housing prices in Spain from 1997 to 2024, using fractional integration, fractional cointegration, and wavelet analysis. The results indicate that exogenous shocks, such as uncertainty, temporarily affect rental prices. Additionally, a one-point increase in the Economic Policy Uncertainty index correlates with a 16.4-point rise in rental prices.

Keywords: *Political Uncertainty, Legal Uncertainty, Rental Housing Prices, Spain, ARFIMA (p,d,q) model, FCVAR model, Causality test, Wavelet Analysis.*

JEL Classification: *R30, C22, C32*

Introduction

In the twenty-first century, one of the biggest issues facing European policymakers is housing affordability. Affordability is becoming a crucial objective in housing provision policies, going beyond the long-standing concern for housing access for vulnerable collectives. The challenges with housing access are more widespread than ever, endangering many nations' adherence to the right to housing promoted by international organizations, national laws, and a variety of platforms (see United Nations Economic Commission & Housing Europe, 2021).

Various housing policy approaches exist in Europe, as noted by Maldonado and Martínez del Olmo (2017). The southern nations of Europe are more likely than the others to have a high percentage of secondary houses, vacant homes, and a severe lack of rental social housing. The owner invests and saves against uncertain periods under the so-called "Culture of ownership" of Spanish society (see Echaves García, 2017). In that sense, one of the primary tools of housing policy to which a bigger budget has been allocated is the tax deduction for purchasing (see Maldonado and Martínez del Olmo, 2017).

According to Pareja and Sánchez-Martínez (2012), Spain's housing market differs greatly from that of other European nations. The primary political and economic differences are shown in two ways: (1) imbalances between owning and renting a home; and (2) a dearth of public housing and a real estate industry linked to the nation's economic expansion.

[1] Universidad Francisco de Vitoria, Madrid, Spain. Email: manuel.monge@ufv.es. (Corresponding Author)
[2] CUNEF Universidad, Madrid, Spain
[3] Universidad Villanueva, Madrid, Spain.

The degree to which the housing sector is associated with and participates in economic development in southern European countries relative to other European countries, particularly in Spain, could distort state intervention in housing and the objectives it sets itself. This is because the alternation of political parties has given rise to different ideologies. The legislative and regulatory instrumentalization of policies may have had unfavorable effects on housing rental prices.

The social democratic approach to housing includes tenant protection policies and support for social and social housing, regulation of rental prices to prevent speculation and abuse in high-demand areas, and protection against evictions. A more conservative approach promotes the liberalization of land, the promotion of home ownership through home purchase policies, more flexible rental markets and less state intervention.

The research conducted by Gonzalez-Perez (2007, 2010), Pareja and Sanchez-Martinez (2012), or Maldonado and Martinez del Olmo (2017) provide a remarkable overview of the evolution of housing policy in Spain.

As was already established, ownership is linked to a significant percentage of secondary and vacant property in Spain's housing market. Certain authors, as Maldonado and Martinez del Olmo (2017), suggests that regulations (laws and decrees) constitute one of the State's instruments or measures of market intervention.

In accordance with these authors, additional tools pertain to the creation of land for development, the spatial demarcation of areas designated for special intervention (such as rehabilitation), the availability of mortgage loans and regulation through housing finance, suitable fiscal policy, taxes and allowances (for either property or rental housing), the encouragement of new housing developments in the public and private sectors, and state action plans (three-year plans) that are linked to budgets.

De Jorge-Huertas and De Jorge-Moreno (2020) state that three laws (1975, 1990, and 2007) and a decree (1997/1998) concerning the regulatory procedures pertaining to home ownership in Spain were focused on controlling speculation or land values. Four laws (1994, 2000, 2009, and 2013) and two decrees (1980 and 1985) pertaining to rental housing are displayed, all of which have as their main goals the promotion of the use of rent rather than property.

They suggest that these laws have had varying effects. Attempts to slow the rate at which house costs are rising, such as varying the amount of land cession or charging town governments for services rendered without charging, have not produced the desired outcome. The price increases that have occurred for over ten years, starting in 1998 or the late 1980s, serve as evidence of this. Nonetheless, considering the declining trend in prices, the new 2007 law pertaining to the regulation of public land patrimony might have had a favorable effect.

In relation to the effects on the prices of rented housing, the authors of the paper mentioned before suggesting that the "Boyer" Decree 1985 or the urban leasing law of 1994, which attempts to liberalize rents, does not seem to be reflected in decreasing trends in prices.

In various contexts, government policies have sought to mitigate fluctuations in housing prices through tools such as price controls or fiscal incentives (Su et al., 2019). However, prior research suggests that these policies may, in some cases, generate perceived uncertainty among market participants due to their implementation and potential future changes (El-Montasser et al., 2016).

There are many studies that examine how economic uncertainty shocks affect the macroeconomy, stock markets, and commodity markets (see, Bloom, 2009; Caggioano et al., 2014; Jurado et al., 2015; Baker et al., 2016; Caldara and Iacoviello, 2022; Kozeniauskas et al., 2018; Christidou and Fountas, 2018; Christou et al., 2019; among others). And many studies support that an increase in economic uncertainty, as measured by different proxies, leads to a negative impact on investment, production and employment (see Colombo, 2013; Caldara et al., 2016; Henzel and Rengel, 2017; Meinen and Röhe, 2017; among others).

The relationship between economic policy uncertainty and asset prices has been a central theme of economic research. During some episodes of stress in the economy, asset prices tend to become more volatile. This volatility is not only a direct consequence of market conditions, but is often exacerbated by increased economic policy uncertainty, as governments and policymakers often adjust their strategies in response to changes in the economic outlook.

During periods of economic stress, governments may introduce policy changes to stabilize markets or stimulate economic recovery. These changes can increase uncertainty as market participants try to anticipate policy impacts and shifts. As a result, the uncertainty itself becomes an influential factor, intensifying asset price volatility and potentially leading to a feedback loop: economic volatility raises policy uncertainty, which in turn influences asset prices, further affecting the economy.

In that sense, if the price of an asset (in our case, real estate) is the sum of the discounted value of the expected future cash flows (hence, rents from a rental), it is interesting to investigate how policy uncertainty in Spain affects rent prices, if standard economic theory is to be followed.

Uncertainty itself has a contagious nature (see Bernanke, 1983; Rodrik, 1991; Aizenman and Marion, 1993; Baker et al., 2016; Brogaard and Detzel, 2015). With uncertainty in economic policy, investors and homeowners face greater difficulty in making long-term decisions, which can lead to reduced investment, heightened risk aversion, or rapid shifts in housing demand and supply. Consequently, understanding this interaction is crucial for policymakers aiming to mitigate excessive volatility in asset markets, especially since housing stability often has far-reaching effects on overall economic stability. Uncertainty shocks are said to have been a major factor in the global changes in home prices (Hirata et al., 2013). Gilchrist et al. (2014) also discussed how the influence of political uncertainty on housing prices raises default risk and is transmitted to the market.

In line with this, Pástor and Veronesi (2012, 2013) demonstrated through their theoretical contributions that policy uncertainty carries a risk premium and affects the pricing of various asset classes in domestic environments (see also Brogaard and Detzel 2015; Gao et al., 2019; Kelly et al., 2016; Liu et al., 2017; Brogaard et al., 2020; Wang et al., 2020; Huang et al., 2020; Xia et al., 2020; Choudhry, 2020; Chien and Setyowati, 2021; Li et al. 2024).

According to the above, we see that there is a scarce literature focused on analyzing the effect of political uncertainty on housing prices using time series methodologies, including for the case of Spain, as is the focus of this paper.

Gimeno and Martínez-Carrascal (2010), Rodriguez and Bustillo (2010), Gonzalez and Ortega (2013), Arrazola et al. (2015), and many other works concentrate on particular aspects of the price bubble that characterized Spain up until 2007. The majority of the literature on Spanish housing prices focuses on the time leading up to the Great Recession.

On the other hand, the most current research on housing costs in Spain, as reported by Alves and Urtasun (2019) and López-Rodríguez and de los Llanos Matea (2019), essentially outlines how prices have changed since the recovery in 2014.

So, to our knowledge, there is no other research work that attempts to study the statistical properties of how political uncertainty affects rental housing prices since January 1997 to January 2024 in Spain, using methodologies based on fractional integration, fractional cointegration and Wavelet Analysis.

To carry out this analysis, first it applies long memory techniques to provide evidence on the statistical properties (more specifically, mean reversion and persistence) of the policy uncertainty and housing rental prices. To rule out possible spurious relationships, we have calculated to types of tests: the VAR-based Granger-causality Test based on time domain, and Breitung and Candelon (2006) test based on the frequency domain. To understand the relationship that exists in the long term between both variables, we perform a fractional cointegrating test. Finally, to understand the long-term relationship of the time series and their behavior during the structural changes, we use Continuous Wavelet Transform (CWT).

The structure of this paper is as follows. Section 2 describes the data used for our study. Section 3 explains the methodologies used to carry out the research. The results are discussed in Section 4. Finally, the conclusions are found in Section 5.

Data

For rental housing prices in Spain, information was acquired from the Eikon Reuters database, that is a privately accessible economic and financial database that provides industry-leading data, insights and exclusive, reliable news. The data are in year-on-year rate of change and are from the ECOICOP (European Classification of Individual Consumption by Purpose) groups of the CPI.

The variable related to policy uncertainty in Spain was developed by Ghirelli et al. (2019)[4], where the construction of this index follows closely the procedure proposed by Baker et al. (2016) in their Economic Policy Uncertainty (EPU index). This index is based on newspaper coverage frequency and considers three fundamental aspects: 1) Economy (E); Policy (P) related to the taxes, regulation, expenditure, deficit, among others words; 3) Uncertainty (U).

We decide to employ the EPU Index in considering Aye's (2018) research, which indicates that EPU contributes to actual housing return. Additionally, Choudhry (2020) discusses how crucial EPU is in determining housing demand and prices.

The period analyzed is from January 1997 to January 2024 in monthly frequency.

Figure 1 attempts to graphically represent both variables in the period analyzed. The values that appear on the left axis of the graph are those corresponding to the EPU index and the values that appear on the right axis of the graph are those corresponding to housing rental prices in year-on-year rate of change.

[4] https://www.policyuncertainty.com/spain_GPU.html

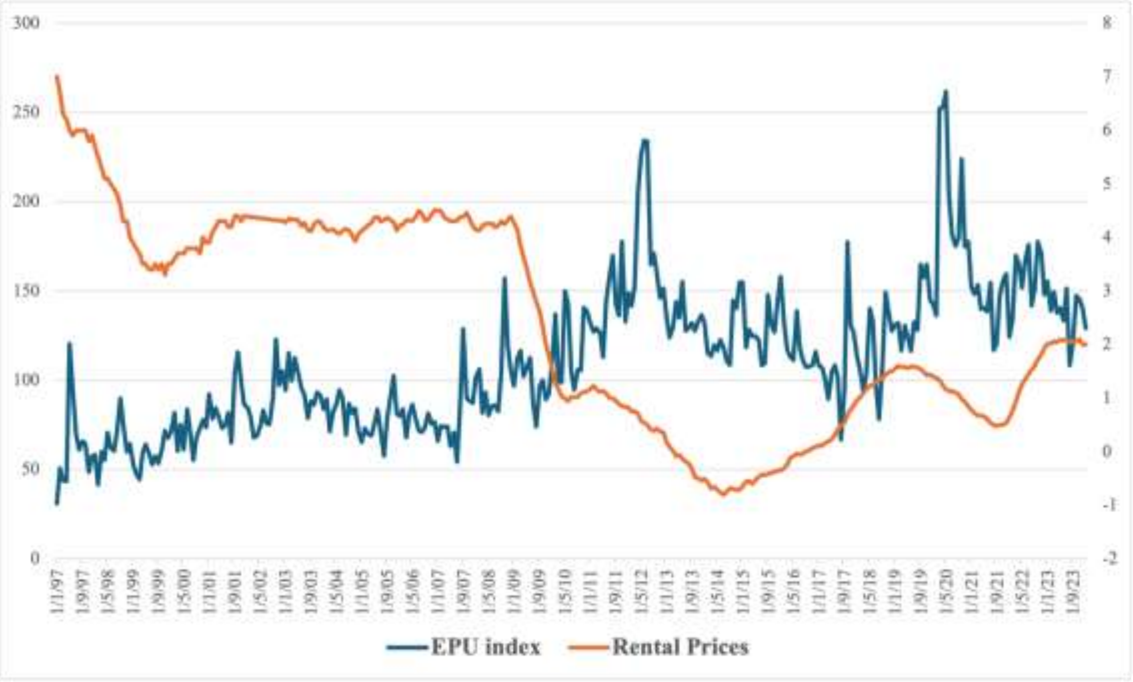

Figure 1. Political Uncertainty vs Rental prices in Spain

Methodology

Unit Roots

Statistics and econometrics use single or multi-equation regression models of time series with the objective to model variables and to understand the interrelations (Box and Jenkings, 1970).

But before to use these types of models, it is important to understand the behavior of these time series. To be able to work with the series, the fundamental assumption is to conclude if the process follows a non-stationary I(1) behavior when it contains a unit root or if it is stationary I(0) when it does not (see Nelson and Plosser, 1982).

So, to determine the integration order of each time series we use standard unit root test. The best known and most widely used unit root test is the Dickey-Fuller test (see Dickey and Fuller, 1979). If a non-systematic component in Dickey-Fuller models is autocorrelated, the Augmented Dickey-Fuller test is constructed (Dickey and Fuller, 1981). Many other tests have been considered due to the greater power, such as Phillips (1987) and Phillips and Perron (1988) in which a non-parametric estimate of spectral density u_t of at the zero frequency has been used. The methodology based on Kwiatkowski et al. (1992) has been used to analyze the deterministic trend.

Arfima (P, D, Q) Model

Once we have tested the integration order of each time series by using standard unit root tests, we employ a more advanced methodology. Following the idea that was introduced by Adenstedt (1974), Granger and Joyeux (1980), Granger (1980, 1981) and Hosking (1981), to achieve stationarity I(0), the number of differences does not necessarily have to be an integer value, since it can be any point on the real line and therefore fractional I(d).

So, in order to make the time series stationary I(0), we differentiate the time series with a fractional number. This is an advanced procedure over unit root tests due to the lower power under fractional alternatives (see Dieblod and Rudebusch, 1991; Hassler and Wolters, 1994; Lee and Schmidt, 1996).

Another feature of the I(d) models is to determine and capture the persistence of the observations. This is when observations are far apart in time but highly correlated.

The fractional integrated method that we use in this research paper is the ARFIMA (p, d, q) model where the mathematical notation is:

$$(1-L)^{d}x_{t}=u_{t}, t=1,2, \qquad (1)$$

In equation (1), x_t refers to the time series that has an integrated process of order d ($x_t \approx I(d)$), d refers to any real value, L is the lag-operator ($Lx_t = x_{t-1}$) and $u_t$refers to I(0) which is the covariance stationary process where the spectral density function is positive and finite at the zero frequency and it displays a type of time dependence in the weak form. Therefore, we can state that if u_t is $ARMA\ (p,q)$, x_t is $ARMA(p,d,q)$.

From equation (1), the polynomial $(1-L)^d$ is expressed in terms of binomial expansion where for all real d, x_t depends not only on a finite number of past observations but also on the whole of its history. So a higher value of d implies a higher level of association between the observations of the series.

Depending on the value of the parameter d, we can differentiate between various cases.

Table 1 summarizes the different results of d:

$d = 0$	x_t process is short memory
$d > 0$	x_t process is long memory
$d < 0.5$	x_t is covariance stationary
$d \geq 0.5$	x_t is nonstationary
$d < 1$	x_t is mean reverting
$d \geq 1$	x_t is not mean reverting

Table 1. Interpretation of the results of d for the ARFIMA model

Although there are several procedures for estimating the degree of long-memory and fractional integration (Geweke and Porter-Hudak, 1983; Phillips, 1999, 2007; Sowell, 1992; Robinson, 1994, 1995a,b; etc.), we follow Sowell (1992) maximum likelihood approach and use the Akaike information criterion (AIC) (Akaike, 1973) and the Bayesian information criterion (BIC) (Akaike, 1979) to select the most appropriate ARFIMA model.

Breitung–Candelon Test

The causality test proposed by Breitung and Candelon (2006) contributes to providing an idea about whether the relationship between both time series is temporary or permanent (see Tastan, 2015; Ciner, 2011; Kirca et al., 2020). Because it interprets Granger causality across several frequency domains, this test has an advantage over other frequently used causality tests. To this end, two-time series—one based on coherence and the other on the bivariate spectral-density matrix—are categorized according to their spectral associations. An overall count of immediate forward and backward causality mechanisms is then obtained from the categorization.

According to Breitung and Candelon (2006), the VAR(p) model below can be used to specify the interdependence between two variables, x and y:

$$x_t = \alpha_1 x_{t-1} + \alpha_p x_{t-p} + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \beta_{1t} \qquad (2)$$

The null hypothesis, $H_0: M_{y \to x}(w) = 0$, as tested by Geweke (1982), matches the null hypothesis of linear restriction given as:

$$R(w)\beta = 0 \qquad (3)$$

Where β denotes the coefficient vector of y. $R(w)$ is defined as:

$$R(w) = \left[\frac{\cos(w)\cos(2w)\ldots\cos(pw)}{\sin(w)\ \sin(2w)\ldots\sin(pw)}\right] \qquad (4)$$

The F-statistics for the null hypothesis in Eq. (5) has an approximated distribution of $F(2, T - 2P)$ for $Fw \in (0, \pi)$. Furthermore, co-integration is frequently used as a framework for examining the frequency-based Granger causality test. Therefore, Breitung and Candelon (2006) substitute x_t in Eq. 2 for Δx_t. As a result, the existence of cointegration between the series suggests that the primary long-term causation and zero-frequency causality share conceptual similarities. However, if there is no long-term link in the stationary case, the evidence of a causal association at a low frequency implies that the variable under consideration's frequency element can be predicted by a different variable.

FCVAR Model

Following Johansen and Nielsen (2012), we use their multivariate Fractional Cointegrated VAR (FCVAR) model to check the relationship of the variables in the long term. The FCVAR model is notated in the next equation:

$$\Delta^d X_t = \alpha\beta' L_b \Delta^{d-b} X_t + \sum_{i=1}^{k} \Gamma_i \Delta^b L_b^i Y_t + \varepsilon_t \qquad (5)$$

Where ε_t is a term with mean zero and variance-covariance matrix Ω that is p-dimensional independent and identically distributed; α and β are $p \times r$ matrices where $0 \leq r \leq p$. The relationship in the long-term equilibria in terms of cointegration in the system is due to the matrix β. Controlling the short-term behavior of the variables is due to parameter Γ_i. Finally, the deviations from the equilibria and their speed in the adjustment is due to parameter α.

Wavelet Analysis

Wavelet methodology allows time series to be analysed in the time-frequency domain. Thus, for this research article we use two tools named wavelet coherency and wavelet phase difference, because the requirement of stationarity is not necessary and studying the interaction in time and frequency domain of the time series reveals evidence of potential changes (structural changes).

Furthermore, the most important information is hidden in the frequency content of the signal. So, as we know, we can define the time series as an aggregation of components operating on different frequencies.

Finally, if we follow the research carried out by Zhou (2008), Podobnik and Stanley (2008), Gu and Zhou (2010) and Jiang and Zhou (2011) we can conclude that misleading results will be found if we apply a typical cross-correlation to study statistical relationships between two multifractal time series.

The wavelet coherency plot represents the correlation of time series and helps us to identify hidden patterns and/or information in the time-frequency domain. The wavelet transform, represented by $WT_x(a,\tau)$, of a time series $x(t)$ obtained by projecting a mother wavelet ψ, is defined as:

$$WT_x(a,\tau) = \int_{-\infty}^{+\infty} x(t)\frac{1}{\sqrt{a}}\psi^*\left(\frac{t-\tau}{a}\right)dt, \quad (7)$$

where the wavelet coefficients of $x(t)$ are represented by $WT_x(a,\tau)$ and provide information on time and frequency by mapping the original time series onto a function of τ and a. Following Aguiar-Conraria and Soares (2014) we choose the Morlet wavelet as the mother wavelet because it is a complex sine wave within a Gaussian envelope, so we will be able to measure the synchronism between time series.

Wavelet coherence helps us understand how one time series interacts with another. We can define this term as:

$$WCO_{xy} = \frac{SO\left(WT_x(a,\tau)WT_y(a,\tau)^*\right)}{\sqrt{SO(|WT_x(a,\tau)|^2)SO\left(\left|WT_y(a,\tau)\right|^2\right)}}, \quad (8)$$

Where the smoothing operator in time and scale is represented with the parameter SO. This operator is important because without it, the wavelet coherency is always one for all times and scales (Aguiar-Conraria et al., 2008). In Aguiar-Conraria's website[5] we can find the Matlab codes for the CWT resolution.

Empirical Results

The first analysis that we carry out in this research paper is the unit root/stationarity test to analyze the political uncertainty and the rental prices in Spain from January 1997 to January 2024. To do this analysis we perform the Augmented Dickey-Fuller (ADF) test, the Phillips Perron (PP) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test to determine whether the time series are stationary I(0) or non-stationary I(1). In data analysis this is very important as it allows a more consistent interpretation of the model parameters. A trend or seasonal variation can distort the results and lead to erroneous conclusions about the underlying relationships in the data.

Table 2 displays the results that we obtained using the unit roots that we have mentioned before. We observe that the EPU index presents a stationary I(0) behaviour. On the other hand, the Rental Housing Prices presents a different behaviour, nonstationary I(1). In this case, Rental Housing Prices present a trend that is not deterministic but stochastic. This means that deviations from the mean in the prices are not automatically corrected over time. So, each future value depends on the previous value plus an error term, thus accumulating the impact of all past error. To correct this, we perform the analysis on the first differences for this last time series and we observe an I(0) behaviour. This is something to be expected noting that the above methods only consider integer degrees of differentiation, i.e., 0 for stationary series and 1 for nonstationary ones. Thus, in what

[5] https://sites.google.com/site/aguiarconraria/joanasoares-wavelets

follows, we permit more flexibility in the dynamic specification of the model by allowing fractional differentiation throughout the previously described ARFIMA approach.

	ADF			PP		KPSS	
	(i)	(ii)	(iii)	(ii)	(iii)	(ii)	(iii)
Original Data							
EPU index	–1.0861	–4.2156*	–6.4514*	–4.2028*	–6.9503*	3.7168*	0.15
Rental Housing Prices	–2.5894*	–2.2191	–0.7148	–2.5591	–1.0474	3.9339	0.6161

Table 2. Unit root tests for Housing Rentals in Spain (YoY%)

Due to the lower power of the unit root methods under fractional alternatives, we also employ fractionally integrated methods, and use ARFIMA (p, d, q) models to study the persistence of the political uncertainty and the rental prices behaviour for the case of Spain.

The Akaike information criterion (AIC; Akaike, 1973) and the Bayesian information criterion (BIC; Akaike, 1979) are used to select the appropriate AR and MA orders in the models. A point of caution should be adopted here since the AIC and BIC may not necessarily be the best criteria for applications involving fractional models (Hosking, 1981; Beran et al., 1998).

The advantages of using the ARFIMA (p, d, q) model over any Unit Root tests are several: 1) They allow fractional values for d providing greater flexibility in how the series is modeled; 2) They capture long-term dependence; 3) They offer a complete framework for modeling and predicting time series.

Table 3 displays the estimates of the fractional differencing parameter d and the AR and MA terms, using Sowell's (1992) maximum likelihood estimator of various ARFIMA (p, d, q) specifications with all combinations of p, q ≤ 2, for each time series.

Data analyzed	**Sample size (days)**	**Model Selected**	**d**	**Std. Error**	**Interval**	**I(d)**
Original Data						
EPU index	325	ARFIMA (0, d, 0)	0.60	0.051	[0.52, 0.69]	I(d)
Rental Housing Prices	325	ARFIMA (2, d, 0)	0.61	0.081	[0.47, 0.74]	I(d)

Table 3. Results Of Long Memory Tests.

We observe from Table 3 that the estimates of what we get focusing on the political uncertainty (EPUC index) and rental housing prices is lower than 1 ($d < 1$) in both cases, showing fractional behaviour I(d).

We observe for EPU Index that the parameter d is 0.60 ($d = 0.60$) and for Rental Housing Prices the parameter d is 0.61 ($d = 0.61$). Like d is higher than 0.5 ($d \geq 0.5$), this implies nonstationary and with long memory behaviour.

So, both results imply that the shocks have or will have temporary effects and will disappear by themselves in the long-run.

After completing the univariate analysis, the next step is to determine whether the two time series are related or if one affects the other. To explore this, we perform a bivariate causality analysis, which helps us understand how one variable or time series influences the other. This method allows us to identify whether changes in one series can explain or predict changes in the other. Specifically, it examines whether past values of the causal variable contain valuable information that can be used to forecast future values of the dependent variable. So, in Table 4 we display the results that we get using Granger causality using VAR model test to examine the interactions between EPU index and rental housing prices.

The Granger causality test consist of a vector autoregressive representation (VAR) consisting of the two series:

$$EPU_t = \alpha_1 + \sum_{i=1}^{n} \beta_i RHP_{t-i} + \sum_{j=1}^{m} \delta_j EPU_{t-j} + \epsilon_{EPU_t} \quad (5)$$

$$RHP_t = \alpha_2 + \sum_{i=1}^{n} \theta_i RHP_{t-i} + \sum_{j=1}^{m} \psi_j EPU_{t-j} + \epsilon_{RHP_t} \quad (6)$$

Where *EPU* represents the political uncertainty and *RHP* represents the rental housing prices. It is assumed that both ϵ_{EPU_t} and ϵ_{RHP_t} are uncorrelated white noise error terms (see Asteriou and Hall, 2015). The letters m and n in equation (2) and (3) represent the maximum number of lags for each of the variables.

The application of the VAR methodology is based on the following validations. First, VAR can only be applied when all the variables are either integrated of order zero or one. In this case, we have proved that both variables have the same behavior I(d). Second, one can estimate the level and the first difference relationship between variables using the ordinary least squares method. Third, variables are not expected to have long run relationships since they are integrated of order zero.

The two Granger causality hypotheses that are tested in this study are as follows. The first hypothesis is $H_0: \sum_{i=1}^{n} \beta_i = 0$ (political uncertainty does not influence rental prices) and $H_1: \sum_{i=1}^{n} \beta_i \neq 0$ (political uncertainty influences rental prices) and the second hypothesis is $H_0: \sum_{j=1}^{m} \psi_j = 0$ (rental prices do not influence political uncertainty) and $H_1: \sum_{j=1}^{m} \psi_j \neq 0$ (rental prices influence political uncertainty) (see Asteriou and Hall, 2015).

Direction of Causality	Lags	Prob.	Decision	Outcome
EPU index → Rental Prices	6	0.0195	Reject Null	Political uncertainty in Spain is causing behavior in rental housing prices.
Rental Prices → EPU index	6	0.5289	Do not reject Null	Rental housing prices do not cause political uncertainty.

Table 4. Results Of Granger Causality Test

Table 4 presents the Granger causality results when causality runs from EPU index to Rental Prices and vice versa. If we focus on the EPU index direction with Rental Housing Prices, the test rejects the null hypothesis (Prob.=0.0195). This means that past values of the EPU index (representing political and economic uncertainty in Spain) contain useful information for predicting changes in rental housing prices. In simpler terms, political uncertainty in Spain is influencing or "causing" the behavior of rental housing prices. According to the results presented in Table 4, housing markets are reactive to the political context.

We observe from the results that the political uncertainty has a direct influence on rental housing prices. Therefore, there is a unidirectional causality because statistically rental housing prices do not cause political uncertainty. It means that the variable "EPU index" helps to predict the variable "Rental Prices Index" and political uncertainty provides useful information to predict rental housing prices.

Once we have determined that the political uncertainty in Spain is causing behavior in rental housing prices, we use a methodology based on Breitung and Candelon (2006) based on frequency domain to measure the causal effect in the long, medium, and short-term.

Hypothesis	**Long Term** $(\boldsymbol{\omega = 0.05})$	**Medium Term** $(\boldsymbol{\omega = 1.5})$	**Short Term** $(\boldsymbol{\omega = 2.5})$
Original Time Series			
EPU index →Rental Prices	3.74 (0.15)	5.24* (0.07)	4.76* (0.09)

Table 5. Breitung and Candelon Frequency Domain Causality Test Results

** This shows that there is a significant causality relationship at the 10% significance level. ** This shows that there is a significant causality relationship at the 5% significance level. *** This shows that there is a significant causality relationship at the 1% significance level. The* *values in the brackets are the probability value of the F statistics calculated for the relevant ω values.*

The Wald test statistics and corresponding p-values in Table 5 provide valuable insights into the relationship between political uncertainty in Spain and rental housing prices. To ensure a comprehensive analysis, we considered three significance levels for the Breitung and Candelon causality test: 1%, 5%, and 10%. This approach allowed us to capture varying degrees of statistical significance.

The results reveal statistically significant Wald test values with p-values below 0.10, indicating that political uncertainty has a causal effect on rental housing prices. Notably, this impact is observed not only in the short term but also extends to the medium term, highlighting both immediate and sustained effects.

These findings suggest that political uncertainty influences the housing market through multiple mechanisms. For instance, shifts in investor confidence may lead to fluctuations in rental supply and pricing, while changes in household mobility—driven by perceptions of instability—could alter rental demand. Additionally, adjustments in demand dynamics based on perceived economic and political risks may further explain the observed effects.

After determining with two causality tests and obtaining robust results that there is a relationship between the EPU index and the rental price index and that it is not spurious (the relationship between the two variables in the direction indicated above is significant), we want to determine the long-run equilibrium relationship of the two variables jointly and their co-movements.

To do this, we follow the model introduced by Johansen (2008) which was further expanded by Johansen and Nielsen (2012). The model is called the Fractional Cointegrated Vector AutoRegressive (FCVAR) model, and it is a step ahead of the Cointegrated Vector AutoRegressive (CVAR) model proposed by Johansen (1996).

The results of the FCVAR model have been summarized in Table 5.

	$d \neq b$	Cointegrating equation beta	
		EPU Index	Rental Housing Prices
Panel I: EPU index vs Rental housing prices	$d = 0.776\ (0.119)$ $b = 0.776\ (0.131)$	1.000	16.443
	$\Delta^d \left(\begin{bmatrix} EPU \\ Prices \end{bmatrix} - \begin{bmatrix} 36.636 \\ 7.124 \end{bmatrix} \right) = L_d \begin{bmatrix} -0.100 \\ -0.001 \end{bmatrix} \nu_t + \sum_{i=1}^{2} \hat{\Gamma}_i \Delta^d L_d^i (X_t - \mu) + \varepsilon_t$		

Table 5. Results of the FCVAR Model

We are going to focus on two terms. In the integrating and cointegrating part ($d \neq b$) and the beta term to analyze the behavior of the time series.

From Panel I, where we analyze the long-term relationship between political uncertainty and rental housing prices, we observe that the order of integration of the individual series is 0.776 ($d = 0.776$) getting the same magnitude in the reduction degree of integration in the cointegrating regression ($b = 0.776$). The results indicate that both time series exhibit long-memory properties, meaning that shocks affecting the EPU index and rental housing prices tend to persist over time rather than dissipating quickly. This persistence provides further evidence of a stable long-term relationship between the two variables. Policy-related shocks, therefore, can have prolonged effects on the rental housing market, highlighting the critical importance of reducing uncertainty to achieve market stability.

Like $(d - b) = 0$, this result support the hypothesis of cointegration in its classical way with 1 and 0 as the orders of integration for the parent series and the equilibrium relationship, respectively. The model incorporates a fractionally integrated adjustment process (Δ^d), which accounts for deviations from the equilibrium relationship between the EPU index and rental housing prices. This adjustment mechanism ensures that, although short-term deviations from the equilibrium may occur, both series will ultimately revert to their long-term equilibrium. This dynamic reflects the robust cointegration relationship between the variables and underscores the lasting and significant influence of political uncertainty on the housing rental market.

Additionally, the results reveal a significant cointegrating equation beta coefficient of 16.443 for rental housing prices, with the EPU index normalized to 1.000. This finding indicates a strong linkage between changes in the EPU index and rental housing prices in Spain. Specifically, a one-unit increase in the EPU index is associated with a rise of 16.443 units in the rental housing price index. This highlights the pronounced sensitivity of rental prices to fluctuations in political and economic conditions.

Finally, we use Continuous Wavelet Transform (CWT) that is a multivariate analysis based on the time-frequency domain to understand the correlation that exists between both variables. This methodology is very useful to identify periods of high correlation (relationship that exists between two variables over time), and to know if this relationship is located in the short, medium or long term through the frequency domain.

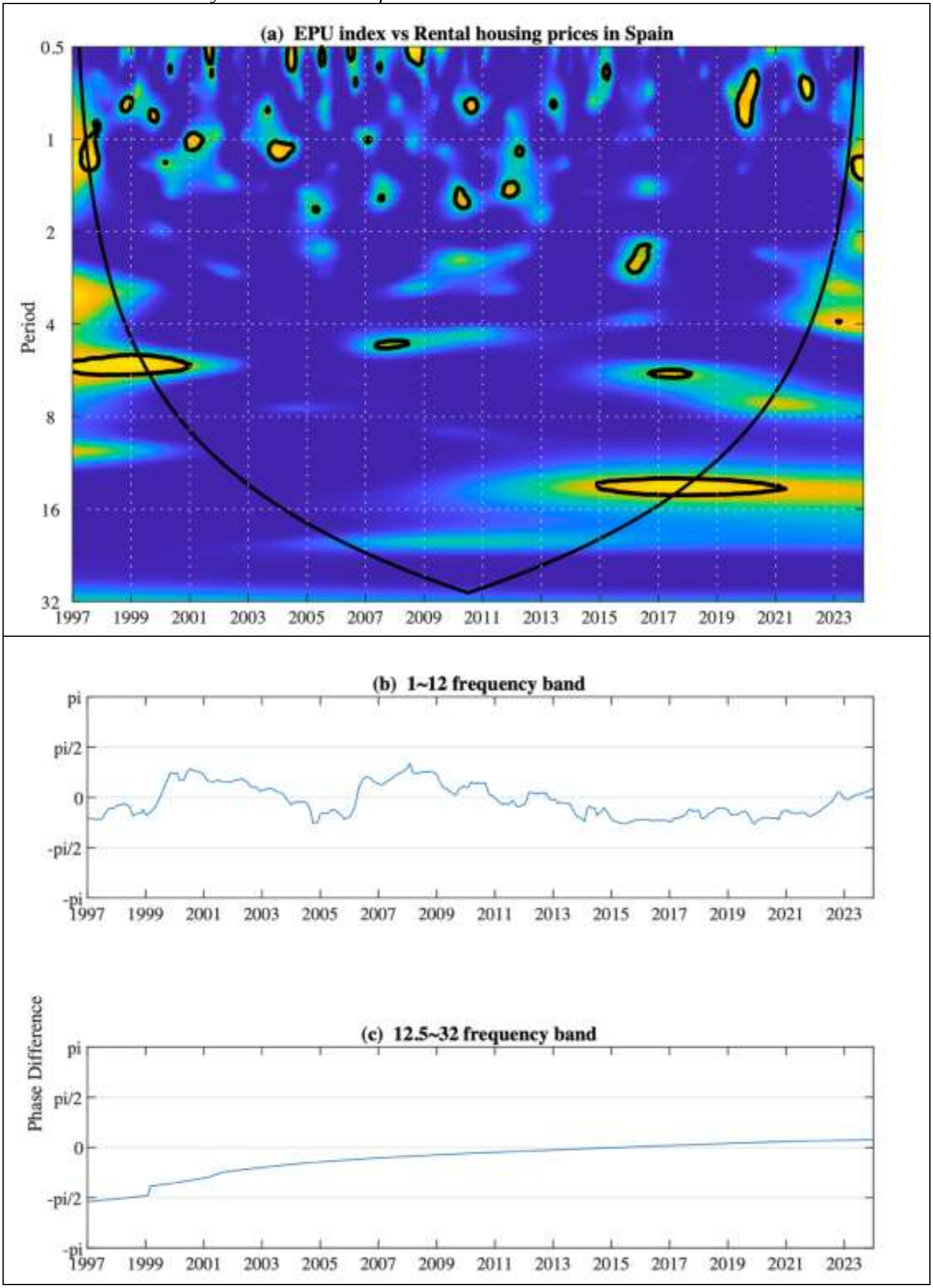
(a) EPU index vs Rental housing prices in Spain
Period
0.5
1
2
4
8
16
32
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
(b) 1~12 frequency band
(c) 12.5~32 frequency band
Phase Difference
pi
pi/2
0
-pi/2
-pi

Figure 2. Wavelet Coherency and Phase-Difference Analysis

Section (a) of Figure 2 illustrates the wavelike coherence between the EPU index and rental housing prices over time (horizontal axis) and across different frequencies or periods (vertical axis, measured in months). This analysis identifies when and with what frequencies the interactions between the two time series occur, as well as the periods during which these interactions are strongest. Statistically significant regions of coherence were determined by Monte Carlo simulations (n=1000). High levels of coherence are plotted in yellow in the graph.

Although some short-term relationships are observed (from 0.5 to 3 months), the main regions of high coherence are concentrated in the medium- and long-term frequencies, corresponding to the interval from 4 to 32 months. It is observed that the periods of high coherence are concentrated in the following periods: In the short term we identify the period from 1997 to 2001 and the period 2008-2009. In the frequencies comprised in the medium term we identify a period ranging from 2015 to 2021. However, only results up to 2018 can be reliably interpreted, as coherence beyond this point is outside the cone of influence, and statistical significance may not hold.

Having identified the regions corresponding to high coherence, we will analyze the phase difference in section (b) and (c).

Panel (b) focuses on the frequency band between 1 and 12 months, capturing the short- to medium-term relationships between the two variables. Within this band, two significant periods emerge. One of them is the period from 1997 to 2001. During this period, the phase difference lies between $[0, -\frac{\pi}{2}]$, indicating a negative correlation. This suggests that increases in rental housing prices were driven by declines in political instability. The other period is between 2008 and 2009. Here, the financial crisis caused a decrease in rental prices, which correlated with heightened political instability.

The period 2015–2018 falls within the frequency band between 12.5 and 32 months, requiring analysis in panel (c). We see that both series together have a positive relationship $[0, \frac{\pi}{2}]$, that is, an increase in policy uncertainty causes an increase in the rental housing prices. This finding aligns with the theoretical work of Pástor and Veronesi (2012, 2013), who demonstrated that policy uncertainty carries a risk premium, affecting the pricing of various asset classes. Empirical support for this relationship is found in studies by Brogaard and Detzel (2015), Gao and Qi (2013), Kelly et al. (2016), Liu et al. (2017), Brogaard et al. (2019), and Chien and Setyowati (2021).

During the 2015–2018 period, Spain experienced a series of significant political, economic, and social events that had far-reaching implications: 1) There were General Elections in 2015 with a fragmented parliament, without clear majorities, which led to new elections in June 2016; 2) In October 2017, the Catalan government held an independence referendum declared illegal by the Constitutional Court. That resulted in the Catalan parliament unilaterally declaring Catalonia's independence, which led to the application of Article 155 of the Constitution by the central government, suspending Catalan autonomy and dismissing its government; and 3) In June 2018, a successful motion of censure led by PSOE.

These events, marked by political uncertainty, coincide with the observed positive relationship between the EPU index and rental housing prices, further supporting the findings of our analysis.

Concluding Remarks

An investigation based on trends and persistence in the data using time series methodologies has been carried out in this paper.

Understanding how political uncertainty and its impact on rental prices in Spain is crucial to foresee how political events impact the real estate market and ultimately the quality of life of citizens.

Throughout time, various legislations have been adopted by different political parties and rulers in Spain with the purpose of to avoid the imbalances between owning and renting home in a real estate industry linked to the nation's economic expansion.

The alternation of political parties have resulted in different ideologies. Therefore, legislative and regulatory instrumentalization of policies may have unfavorable effects.

Due to the few studies have examined the effects of economic and policy events and their uncertainty in housing rental prices, this study makes several contributions which is not found in the existing literature.

This research paper analyzes the policy uncertainty into the rental housing prices in Spain between January 1997 to January 2024, using monthly frequency data. To do so, we have used the EPU Index for the case of Spain to measure the uncertainty. This index is based on newspaper coverage frequency and considers three fundamental aspects: 1) Economy (E); Policy (P) related to the taxes, regulation, expenditure, deficit, among others words; 3) Uncertainty (U). We decide to employ the EPU Index in considering Aye's (2018) research, which indicates that EPU contributes to actual housing return. Additionally, Choudhry (2020) discusses how crucial EPU is in determining housing demand and prices. For rental housing prices, the database used in this research paper was obtained from the National Statistics Institute (INE).

We employed advanced methodological tools to perform the thorough statistical and econometric analysis of the data. In order to determine the level of dependence in the data and to investigate the time series' stationarity and response to an external shock, we first conducted a univariate analysis of the data using fractional integration models. In the context of rental housing prices, ARFIMA models capture the dynamics of rental housing prices, helping us to determine whether prices follow a stable trend or whether shocks caused by political uncertainty have lasting effects over time. The results that we get using fractional integration suggests that rental housing prices time series has a nonstationary and with long memory behaviour. Also, like the fractional parameter is lower than 1 this result implies that the exogenous shocks in the price index have or will have temporary effects and will disappear by themselves in the long-run.

To rule out possible spurious relationships, we have calculated the VAR-based Granger-causality Test based on time domain. We conclude that there is a unidirectional causality, where the political uncertainty has a direct influence on rental housing prices.

In addition, we performed a causality test based on frequency domain (Breitung and Candelon, 2006). We find the same result as with the Granger test. That is, there is significant statistical evidence that political uncertainty in Spain is causal in the behavior of rental housing prices in the short and medium term.

Then, to understand the relationship that exists in the long term between both variables, we perform a fractional cointegrating test. With cointegration analysis we try to investigate whether rental housing prices and measures of policy uncertainty are cointegrated. This would indicate that, despite the non-stationarity of the individual series, there is a long-run equilibrium relationship between them.

The results support the hypothesis of cointegration in its classical way with 1 and 0 as the orders of integration for the parent series and the equilibrium relationship, respectively. Also, the results suggest that an increase in the policy uncertainty in Spain produces an increase (16.433) in the rental housing prices. This suggests that when there is a greater uncertainty around government policies (eg. potential changes in legislation, subsidies, or fiscal policies) rental prices tend to increase. This relationship may reflect how property owners and markets adjust prices in anticipation of risks or economic fluctuations, aiming to safeguard against potential instability. So, political uncertainty drives up rental prices, likely due to a perceived less predictable environment for investments and rental agreements.

Finally, to learn about relationship that exist between both variables in the short, medium and long-run we use Continuous Wavelet Transform (CWT). We find that an increase in the policy uncertainty in Spain caused an increase in the rental housing prices during the period 2015-2018.

Therefore, finding answers to issues like housing becomes one of the top objectives for all actors given the current economic and social situation. In this regard and according to Madden and Marcuse (2016), the true right to housing necessitates a major transformation of the political and economic framework of modern society.

Analyzing political uncertainty in housing prices in Spain in general is essential to capture national macro trends (impact of national policy, state legislation and subsidies and aid; financial markets and interest rates; national price indexes; migratory flows and population concentration in large cities; internation comparison; among others). However, this does not mean that regional analysis is not important; in fact, both levels of analysis complement each other and are necessary for a complete understanding of the housing market in Spain.

For this reason, this paper tries to help national policy makers and investors to make informed decisions, contributing significantly to their own knowledge of the subject.

The use of robust statistical tests, including causality, cointegration and correlation analyses, cannot completely rule out the possibility that other potential factors affect rental prices in Spain. Consequently, based on the results of this paper, the authors propose to carry out further studies related to these findings by combining univariate and multivariate analyses to explore whether variability and different national, regional and municipal characteristics and policies in Spain lead to similar or divergent patterns in rental housing prices.

References

Adenstedt, R. K. (1974). On large-sample estimation for the mean of a stationary random sequence. The Annals of Statistics, 1095-1107.

Aguiar-Conraria, L., Azevedo, N. and Soares, M. J. (2008). Using wavelets to decompose the time-frequency effects of monetary policy. Physica A: Statistical Mechanics and its Applications, 387, 2863-2878.

Aguiar-Conraria, L. and Soares, M. J. (2014). The continuous wavelet transform: Moving beyond uni- and bivariate analysis. Journal of Economic Surveys 28, 344–375.

Aizenman, J., and Marion, N. P. (1993). Policy uncertainty, persistence and growth. Review of international economics, 1(2), 145-163.
Akaike, H. (1973). Maximum likelihood identification of Gaussian autoregressive moving average models. Biometrika, 60(2), 255-265.
Akaike, H. (1979). A Bayesian extension of the minimum AIC procedure of autoregressive model fitting. Biometrika, 66(2), 237-242.
Alves, P., and Urtasun, A. (2019). Recent housing market developments in Spain. Banco de Espana Article, 4, 19.
Arrazola, M., de Hevia, J., Romero-Jordán, D., and Sanz-Sanz, J. F. (2015). Long-run supply and demand elasticities in the Spanish housing market. Journal of Real Estate Research, 37(3), 371-404.
Asteriou, D. and Hall, S.G. (2015) Applied Econometrics, Palgrave Macmillan, London.
Aye, G. C. (2018). Causality between economic policy uncertainty and real housing returns in emerging economies: A cross-sample validation approach. Cogent Economics & Finance, 6(1), 1473708.
Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. The quarterly journal of economics, 131(4), 1593-1636.
Beran, J. Bhansali, R. and Ocker, D (1998), On unified model selection for stationary and nonstationary short- and long-memory autoregressive processes, Biometrica 85, 4, 921-934.
Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. The quarterly journal of economics, 98(1), 85-106.
Bloom, N. (2009). The impact of uncertainty shocks. econometrica, 77(3), 623-685.
Box, G. E. P., and Jenkins, G. M. (1970). 1970: Time series analysis, forecasting and control. San Francisco: Holden-Day.
Breitung, J. and Candelon, B. (2006). Testing for Short and Long-run Causality: A Frequency Domain Approach. Journal of Econometrics, 132(2), 363–378.
Brogaard, J., & Detzel, A. (2015). The asset-pricing implications of government economic policy uncertainty. Management science, 61(1), 3-18.
Brogaard, J., Dai, L., Ngo, P. T., & Zhang, B. (2020). Global political uncertainty and asset prices. The Review of Financial Studies, 33(4), 1737-1780.
Caggiano, G., Castelnuovo, E., & Groshenny, N. (2014). Uncertainty shocks and unemployment dynamics in US recessions. Journal of Monetary Economics, 67, 78-92.
Caldara, D., Fuentes-Albero, C., Gilchrist, S., & Zakrajšek, E. (2016). The macroeconomic impact of financial and uncertainty shocks. European Economic Review, 88, 185-207.
Caldara, D., & Iacoviello, M. (2022). Measuring geopolitical risk. American Economic Review, 112(4), 1194-1225.
Chien, M. S., and Setyowati, N. (2021). The effects of uncertainty shocks on global housing markets. International Journal of Housing Markets and Analysis, 14(1), 218-242.
Christidou, M., & Fountas, S. (2018). Uncertainty in the housing market: evidence from US states. Studies in Nonlinear Dynamics & Econometrics, 22(2), 20160064.
Christou, C., Gupta, R., & Nyakabawo, W. (2019). Time-varying impact of uncertainty shocks on the US housing market. Economics Letters, 180, 15-20.
Choudhry, T. (2020). Economic policy uncertainty and house prices: evidence from geographical regions of England and Wales. Real Estate Economics, 48(2), 504-529.
Ciner, Ç. (2011). Eurocurrency Interest Rate Linkages: A Frequency Domain Analysis. International Review of Economics and Finance, Vol.20, pp. 498–505.

Colombo, V. (2013). Economic policy uncertainty in the US: Does it matter for the Euro area?. Economics

Letters, 121(1), 39-42.
De Jorge-Huertas, V., & De Jorge-Moreno, J. (2021). Analysis of the effects of (de) regulation on housing prices in Spain 1977–2019. Journal of Economic Studies, 48(6), 1194-1206.
Diebold, F.X., and Rudebush, G.D. (1991). On the power of Dickey-Fuller tests against fractional alternatives. Economics Letters, 35, 155-160.
Dickey, D. A and Fuller, W. A. (1979). Distributions of the estimators for autoregressive time series with a unit root, Journal of American Statistical Association, 74 (366), 427-481.
Dickey, D. A., and Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49, 10571072.
Echaves García, A. (2017). El difícil acceso de los jóvenes al mercado de vivienda en España: precios, regímenes de tenencia y esfuerzos. Cuadernos de Relaciones Laborales, Vol. 35 No. 1, pp. 127-149.
El-Montasser, G., Ajmi, A. N., Chang, T., Simo-Kengne, B. D., André, C., & Gupta, R. (2016). Cross-country evidence on the causal relationship between policy uncertainty and housing prices. Journal of Housing Research, 25(2), 195-211.
Gao, P., Murphy, D., & Qi, Y. (2019). Political uncertainty and public financing costs: Evidence from US gubernatorial elections and municipal bond markets. Available at SSRN 1992200.
Ghirelli, C., Pérez, J. J., & Urtasun, A. (2019). A new economic policy uncertainty index for Spain. Economics Letters, 182, 64-67.
Gimeno, R., and Martinez-Carrascal, C. (2010). The relationship between house prices and house purchase loans: The Spanish case. Journal of Banking & Finance, 34(8), 1849-1855.
González Pérez, J. M. (2007). Urban planning system in contemporary Spain. European Planning Studies, 15(1), 29-50.
González Pérez, J. M. (2010). The real estate and economic crisis: An opportunity for urban return and rehabilitation policies in Spain. Sustainability, 2(6), 1571-1601.
Gonzalez, L., and Ortega, F. (2013). Immigration and housing booms: Evidence from Spain. Journal of Regional Science, 53(1), 37-59.
Granger, C. W. (1980). Long memory relationships and the aggregation of dynamic models. Journal of econometrics, 14(2), 227-238.
Granger, C. W. (1981). Some properties of time series data and their use in econometric model specification. Journal of econometrics, 16(1), 121-130.
Granger, C. W., and Joyeux, R. (1980). An introduction to long-memory time series models and fractional differencing. Journal of time series analysis, 1(1), 15-29.
Geweke, J. and Porter-Hudak, S. (1983). The estimation and application of long memory time series models. Journal of Time Series Analysis, 4 (4), 221-238.
Gilchrist, S., Sim, J. W., & Zakrajšek, E. (2014). Uncertainty, financial frictions, and investment dynamics (No. w20038). National Bureau of Economic Research.
Gu, G. F., and Zhou, W. X. (2010). Detrending moving average algorithm for multifractals. Physical Review E, 82(1), 011136.
Hassler, U., and Wolters, J. (1994). On the power of unit root tests against fractional alternatives. Economics Letters, 45(1), 1-5.
Henzel, S. R., and Rengel, M. (2017). Dimensions of macroeconomic uncertainty: A common factor analysis. Economic Inquiry, 55(2), 843-877.
Hirata, H., Kose, M. A., Otrok, C., & Terrones, M. E. (2013). Global house price fluctuations: Synchronization and determinants. In NBER International Seminar on Macroeconomics (Vol. 9, No. 1, pp. 119-166). Chicago, IL: University of Chicago Press.

Hosking, J. R. (1981). Modeling persistence in hydrological time series using fractional differencing. Water resources research, 20(12), 1898-1908.

Huang, W. L., Lin, W. Y., & Ning, S. L. (2020). The effect of economic policy uncertainty on China's housing market. The North American Journal of Economics and Finance, 54, 100850.

Jiang, Z. Q. and Zhou, W. X. (2011). Multifractal detrending moving-average cross-correlation analysis. Physical Review E, 84(1), 016106.

Johansen, S. (1996). Likelihood-based inference in cointegrated vector autoregressive models. New York, NY: Oxford University Press.

Johansen, S. (2008). A representation theory for a class of vector autoregressive models for fractional processes. Econometric Theory, 24, 651-676.

Johansen, S., and M. O. Nielsen (2012). Likelihood inference for a fractionally cointegrated vector autoregressive model, Econometrica, 80, 2667–2732.

Jurado, K., Ludvigson, S. C., & Ng, S. (2015). Measuring uncertainty. American Economic Review, 105(3), 1177-1216.

Kelly, B., Pástor, Ľ., & Veronesi, P. (2016). The price of political uncertainty: Theory and evidence from the option market. The Journal of Finance, 71(5), 2417-2480.

Kırca, M., Canbay, Ş., and Pirali, K. (2020). Is the relationship between oil-gas prices index and economic growth in Turkey permanent?. Resources Policy, 69, 101838.

Kozeniauskas, N., Orlik, A., & Veldkamp, L. (2018). What are uncertainty shocks?. Journal of Monetary Economics, 100, 1-15.

Kwiatkowski, D., Phillips, P. C., Schmidt, P. and Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. Journal of Econometrics, 54(1-3), 159-178.

Lee, D., and Schmidt, P. (1996). On the power of the KPSS test of stationarity against fractionally-integrated alternatives. Journal of Econometrics, 73(1), 285-302.

Li, X., Liang, M., & Yang, J. (2024). Policy uncertainty and land transaction prices in China. Economic and Political Studies, 12(2), 117-142.

Liu, L. X., Shu, H., & Wei, K. J. (2017). The impacts of political uncertainty on asset prices: Evidence from the Bo scandal in China. Journal of financial economics, 125(2), 286-310.

Lopez Rodriguez, D., and Matea, M. D. L. L. (2019). Recent developments in the rental housing market in Spain. Recent Developments in the Rental Housing Market in Spain (August 1, 2019). Banco de Espana Article.

Madden, D. and Marcuse, P. (2016), En defensa de la vivienda, Capitán Swing Libros, available at: https://capitanswing.com/libros/en-defensa-de-la-vivienda.

Maldonado, J. and Martínez del Olmo, A. (2017). Tendencias recientes de la política de vivienda en España", Cuadernos de Relaciones Laborales, Vol. 35 No. 1, pp. 15-41.

Meinen, P., and Röhe, O. (2017). On measuring uncertainty and its impact on investment: Cross-country evidence from the euro area. European Economic Review, 92, 161-179.

Nelson, C. R., and Plosser, C. R. (1982). Trends and random walks in macroeconmic time series: some evidence and implications. Journal of monetary economics, 10(2), 139-162.

Pareja, M. and Sánchez-Martínez, M.T. (2012). La política de vivienda en España: lecciones aprendidas y retos de futuro. Revista Galega de Economía, Vol. 21 No. 2, pp. 1-32.

Pástor, Ľ., and Veronesi, P. (2012). Uncertainty about government policy and stock prices. The journal of Finance, 67(4), 1219-1264.

Pástor, Ľ., and Veronesi, P. (2013). Political uncertainty and risk premia. Journal of financial Economics, 110(3), 520-545.

Phillips, P. C. B. (1987). Time series regression with a unit root. Econometrica: Journal of the Econometric

Society, 277-301.

Phillips, P. C. B. (1999). Discrete Fourier transforms of fractional processes. Department of Economics, University of Auckland.

Phillips, P. C. B. (2007). Unit root log periodogram regression. Journal of Econometrics, 138(1), 104-124.

Phillips, P. C. B. and P. Perron, (1988). Testing for a unit root in time series regression, Biometrika 75, 335-346.

Podobnik, B. and Stanley, H. E. (2008). Detrended cross-correlation analysis: a newmethod for analyzing two nonstationary time series. Physical Review Letters, 100(8), 084102.

Robinson, P.M. (1994). Efficient tests of nonstationary hypotheses, Journal of the American Statistical Association 89, 1420-1437.

Robinson, P.M. (1995a). Gaussian semi-parametric estimation of long range dependence, Annals of Statistics 23, 1630-1661.

Robinson, P.M. (1995b). Log periodogram regression of time series with long range dependence, Annals of Statistics 23, 3, 1048-1072.

Rodrik, D. (1991). Policy uncertainty and private investment in developing countries. Journal of Development Economics, 36(2), 229-242.

Rodríguez, C., and Bustillo, R. (2010). Modelling foreign real estate investment: The Spanish case. The Journal of Real Estate Finance and Economics, 41, 354-367.

Sowell, F. (1992). Maximum likelihood estimation of stationary univariate fractionally integrated time series models. Journal of Econometrics, 53(1-3), 165-188.

Su, C. W., Li, X., & Tao, R. (2019). How does economic policy uncertainty affect prices of housing? Evidence from Germany. Argumenta Oeconomica, 42(1), 131-153.

Tastan, H. (2015). Testing for spectral Granger causality. The Stata Journal, 15(4), 1157-1166.

United Nations Economic Commission, & Housing Europe. (2021). #Housing 2030. Effective policies for affordable housing in the UNECE region.

Wang, S., Zeng, Y., Yao, J., & Zhang, H. (2020). Economic policy uncertainty, monetary policy, and housing price in China. Journal of Applied Economics, 23(1), 235-252.

Xia, T., Yao, C. X., & Geng, J. B. (2020). Dynamic and frequency-domain spillover among economic policy uncertainty, stock and housing markets in China. International Review of Financial Analysis, 67, 101427.

Zhou, W.X. (2008). Multifractal detrended cross-correlation analysis for two nonstationary signals. Physical Review E, 77(6), 066211.