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Antonakakis, Nikolaos and Gupta, Rangan and Andre, Christophe

Vienna University of Economics and Business, University of Portsmouth, Johannes Kepler University, University of Pretoria, Organisation for Economic Co-operation and Development (OECD)

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Nikolaos Antonakakis[a,b,c,*], Rangan Gupta[d], Christophe André[e]

[a] *Vienna University of Economics and Business, Department of Economics, Institute for International Economics, Welthandelsplatz 1, 1020, Vienna, Austria.*
[b] *University of Portsmouth, Department of Economics and Finance, Portsmouth Business School, Portland Street, Portsmouth, PO1 3DE, United Kingdom.*
[c] *Johannes Kepler University, Department of Economics, Altenberger Strasse 69, 4040 Linz-Auhof, Austria.*
[d] *Department of Economics, Faculty of Economic and Management Sciences, University of Pretoria, 0002, South Africa.*
[e] *Economics Department, Organisation for Economic Co-operation and Development (OECD), 75775 Paris Cedex 16, France.*

Abstract

We examine dynamic correlations between housing market returns and economic policy uncertainty in the United States. Our findings suggest that correlations are time-varying and sensitive to economic fundamentals and US recessions.

Keywords: Economic policy uncertainty, housing market return, dynamic correlation, US recession

JEL codes: C32; E60; E66; G10; G18

1. Introduction

Leamer (2007) notes that eight out of ten post-war recessions in the US were preceded by shocks to the housing sector. This number rises to nine, when we include the recent "Great Recession". Hence, appropriate modeling of the housing market, and particularly house prices, is of paramount importance; which in turn, implies determining variables that drive house prices. In this regard, a literature also exists that emphasizes the role of economic policy uncertainty (EPU) on real activity (e.g. Bloom, 2009; Colombo, 2013; Jones and Olson, 2013, for detailed reviews), which in turn is likely to feed into house price movements.

To the best of our knowledge, in this context the only existing paper is that of El Montasser et al. (forthcoming), wherein the authors study the causal relationship between real house prices and EPU in a constant parameter bi-variate panel vector autoregressive set-up of seven advanced economies, including the US. This paper detects one-way causality running from real house prices

*Corresponding author. Phone: +43 1313364133, fax: +43 1313 36904141, e-mail: nikolaos.antonakakis@wu.ac.at.

Email addresses: nikolaos.antonakakis@port.ac.uk (Nikolaos Antonakakis), rangan.gupta@up.ac.za (Rangan Gupta), christophe.andre@oecd.org (Christophe André)

to EPU for the US. Against this backdrop, our paper investigates the interdependence between a measure of EPU, developed by Baker et al. (2012), and real house prices by analysing time-varying co-movements between these two variables, allowing for a set of control variables. Hence, our paper extends the work of El Montasser et al. (forthcoming), by not only allowing for time-variation in the relationship, but also avoiding possible misspecification due to omitted variables bias.

To do so, we construct time-varying measures of correlations between economic policy uncertainty and housing market returns based on the dynamic conditional correlation (DCC) model of Engle (2002). Taking into account both time variation and conditional heterogeneity in correlations, the proposed measure has several advantages compared to other commonly used indicators. It is able to distinguish negative correlations due to single episodes, synchronous behavior during stable years and asynchronous behavior in turbulent years. Unlike rolling windows, an alternative way to capture time variability, the proposed measure does not suffer from the so called "ghost features", as the effects of a shock are not reflected in m consecutive periods, with m being the window span. In addition, under the proposed measure there is neither need to set a window span, nor loss of observations, nor is there a requirement for subsample estimation.

Our results based on monthly data between January 1987 and November 2014 reveal that dynamic correlations between economic policy uncertainty and housing market returns are consistently negative, and reach a trough during the global financial crisis. Strong negative correlations are also observed around the recession of the early 1990s. On the contrary, correlations are relatively weak during the 2001 recession, one of the two postwar recessions identified by Leamer (2007) as not associated with a housing market collapse. Econometric models of house prices generally include a measure of income or macroeconomic activity and a measure of the user cost of housing, as well as demographic and supply-side variables (e.g. Meen, 2002; Muellbauer and Murphy, 2008). In our study, which uses monthly data, growth in industrial production is used as the measure of activity, while the real federal funds rate is used as a proxy for the user cost of housing.[1] As expected, growth in real housing market returns is associated with increases in industrial production growth and negative changes in the real federal funds rate. Also in line with the literature, house prices show inertia, as measured by autoregressive coefficients. Having set these control variables, we find a significant influence of lagged EPU on housing market returns. Moreover, increases in lagged real housing market returns significantly reduce economic policy uncertainty, when controlling for implied stock market volatility (VIX) and growth in industrial production, which have the expected signs. In sum, there is a strong feedback loop between EPU and real housing market returns.

The remainder of the paper is organized as follows. Section 2 discusses the methodology. Section 3 describes the data. Section 4 presents the empirical findings, and Section 5 concludes the paper.

2. Methodology

In order to examine the evolution of co-movements between economic policy uncertainty and housing market returns, we obtain a time-varying measure of correlation based on the dynamic conditional correlation (DCC) model of Engle (2002).

[1] One could argue that a real mortgage rate would be a better proxy for the user cost of housing than the real federal funds rate. However, we consider that using the latter in our model is preferable, as the risk premium included in a mortgage rate is likely to be correlated with EPU. Given our focus on short-term developments, housing supply can be considered as fixed and demographic developments can be ignored.

Let $y_t = [y_{1t}, y_{2t}]'$ be a 2×1 vector comprising the data series. The conditional mean equations are then represented by:

$$A(L)y_t = B(L)x_t + \varepsilon_t, \quad \text{where} \quad \varepsilon_t|\Omega_{t-1} \sim N(0, H_t), \quad \text{and} \quad t = 1, ..., T \tag{1}$$

where A and B are matrices of endogenous and exogenous variables, respectively, L the lag operator and ε_t is the vector of innovations based on the information set, Ω, available at time $t-1$. The ε_t vector has the following conditional variance-covariance matrix:

$$H_t = D_t R_t D_t, \tag{2}$$

where $D_t = diag\sqrt{h_{it}}$ is a 2×2 matrix containing the time-varying standard deviations obtained from univariate GARCH(p,q) models as:

$$h_{it} = \gamma_i + \sum_{p=1}^{P_i} \alpha_{ip}\varepsilon_{it-ip}^2 + \sum_{q=1}^{Q_i} \beta_{iq} h_{iq-q}, \quad \forall i = 1, 2. \tag{3}$$

The DCC(M,N) model of Engle (2002) comprises the following structure:

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1}, \tag{4}$$

where:

$$Q_t = (1 - \sum_{m=1}^{M} a_m - \sum_{n=1}^{N} b_n)\bar{Q} + \sum_{m=1}^{M} a_m(\varepsilon_{t-m}^2) + \sum_{n=1}^{N} b_n Q_{t-n}. \tag{5}$$

$\bar{Q}$ is the time-invariant variance-covariance matrix retrieved from estimating equation (3), and Q_t^* is a 2×2 diagonal matrix comprising the square root of the diagonal elements of Q_t. Finally, $R_t = \rho_{ij_t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}}$ where $i, j = 1, 2$ is the 2×2 matrix comprising the conditional correlations and which are our main focus.

3. Data

The key data used in this study are the economic policy uncertainty index and the S&P/Case-Shiller 10-City composite home price index. The former series comes from Baker et al. (2012) and measures policy-related economic uncertainty in the United States.[2] The latter series is obtained from FRED, and converted to real returns by taking the annualized monthly change of the natural logarithm of the real (i.e. deflated by CPI) Case-Shiller home price index as: $1200 \times (\log(rCS_t) - \log(rCS_{t-1}))$. We also control for various factors, such as inflation, real industrial production growth, the implied volatility of stock markets (VIX) and the first difference of the real federal funds rate. Our sample ranges from January 1987 to November 2014 (totalling 335 observations).

Figure 1 presents the evolution of the aforementioned series. According to this figure, we observe that peaks of economic policy uncertainty are associated with declining housing markets returns, industrial production growth and interest rate changes, and increases in the volatility of

[2] In particular, it's a constructed index based on three components. The first component quantifies newspaper coverage of policy-related economic uncertainty. The second component reflects the number of federal tax code provisions set to expire in future years. The third component uses disagreement among economic forecasters as a proxy for uncertainty.

stock markets (VIX) and inflation (especially during US recessions). A feature which we explore further below.

Table 1 presents the descriptive statistics of our data. According to this table, we observe large variability in our main variables. The augmented Dickey-Fuller (ADF) test with just a constant indicates that all series are stationary.[3] The fact that the ARCH-LM test rejects the null hypothesis of homoskedasticity for each series indicates the appropriateness to model our series of interest as an ARCH-type process. Finally, the unconditional correlation between economic policy uncertainty (EPU) and each of the other series, apart from that between EPU and the VIX, is negative.

4. Estimation Results

Table 2 reports the results of the DCC model. Panels A and B present the conditional mean and variance results, respectively, while Panel C contains the Ljung-Box Q-Statistics on the standardized and squared standardized residuals, respectively, up to 12 lags. The choice of the lag-length of the autoregressive process (AR) process of the conditional mean (CM) is based on the Akaike information criterion (AIC) and Schwarz Bayesian criterion (BIC).

According to the results in Table 2, we observe that increased implied stock market volatility (VIX) and reduced industrial production growth increases economic policy uncertainty, while increases in industrial production growth and negative changes in the real federal funds rate are associated with positive housing market returns. Moreover, past real housing market returns increase current housing market returns and reduce economic policy uncertainty, while past economic policy uncertainty increases current economic policy uncertainty and reduces housing market returns. Last but not least, the model does not suffer from serial correlation in the squared (standardized) residuals, according to the misspecification tests in Panel C of Table 2.

In Figure 2, we present the dynamic conditional correlations of the model estimated in Table 2, along with their 90% confidence intervals. The dynamic correlations between economic policy uncertainty and housing market returns are consistently negative over time, and reach a trough during the latest global financial crisis. That is, during the "Great recession", the increase in economic policy uncertainty was associated with an unprecedented decline in housing market returns. Strong negative correlations are also observed around the recession of the early 1990s. On the contrary, correlations are relatively weak during the 2001 recession, one of the two postwar recessions identified by Leamer (2007) as not associated with a housing market collapse.[4]

5. Conclusion

The aim of this study is to examine the time-varying correlation between economic policy uncertainty and housing market returns, while controlling for various economic factors. The results reveal that the dynamic correlation between economic policy uncertainty and housing market returns is consistently negative over time, and reaches a trough during the latest financial crisis. Moreover, increased implied stock market volatility (VIX) and reduced output growth increases

[3]In the analysis below, we use the (stationary) first difference of the real interest rate series as that series in levels contains a unit-root.

[4]As a robustness check, we repeated the estimation with the real housing returns constructed based on the house price index from the Federal Housing Finance Agency (FHFA). Our main conclusions remain similar. These results are available upon request.

economic policy uncertainty, while increases in output growth and negative changes in real interest rates lead to positive housing market returns. Moreover, past real housing market returns increase current housing market returns and reduce economic policy uncertainty, while past economic policy uncertainty increases current economic policy uncertainty and reduces housing market returns.

A potential avenue for future research is to examine whether the results hold for European countries.

Disclaimer

The views expressed in this paper are those of the authors and do not necessarily reflect those of the Organisation for Economic Co-operation and Development (OECD) or its member countries.

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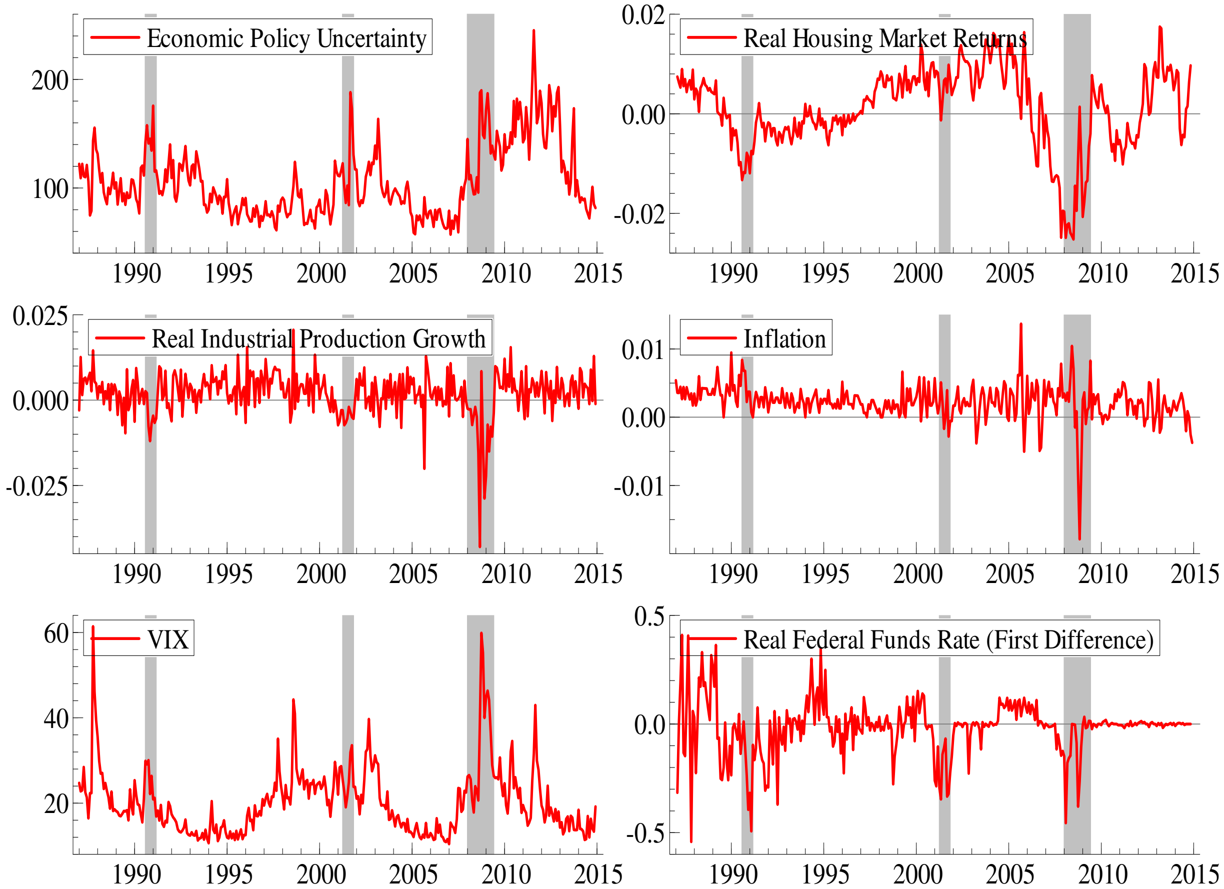
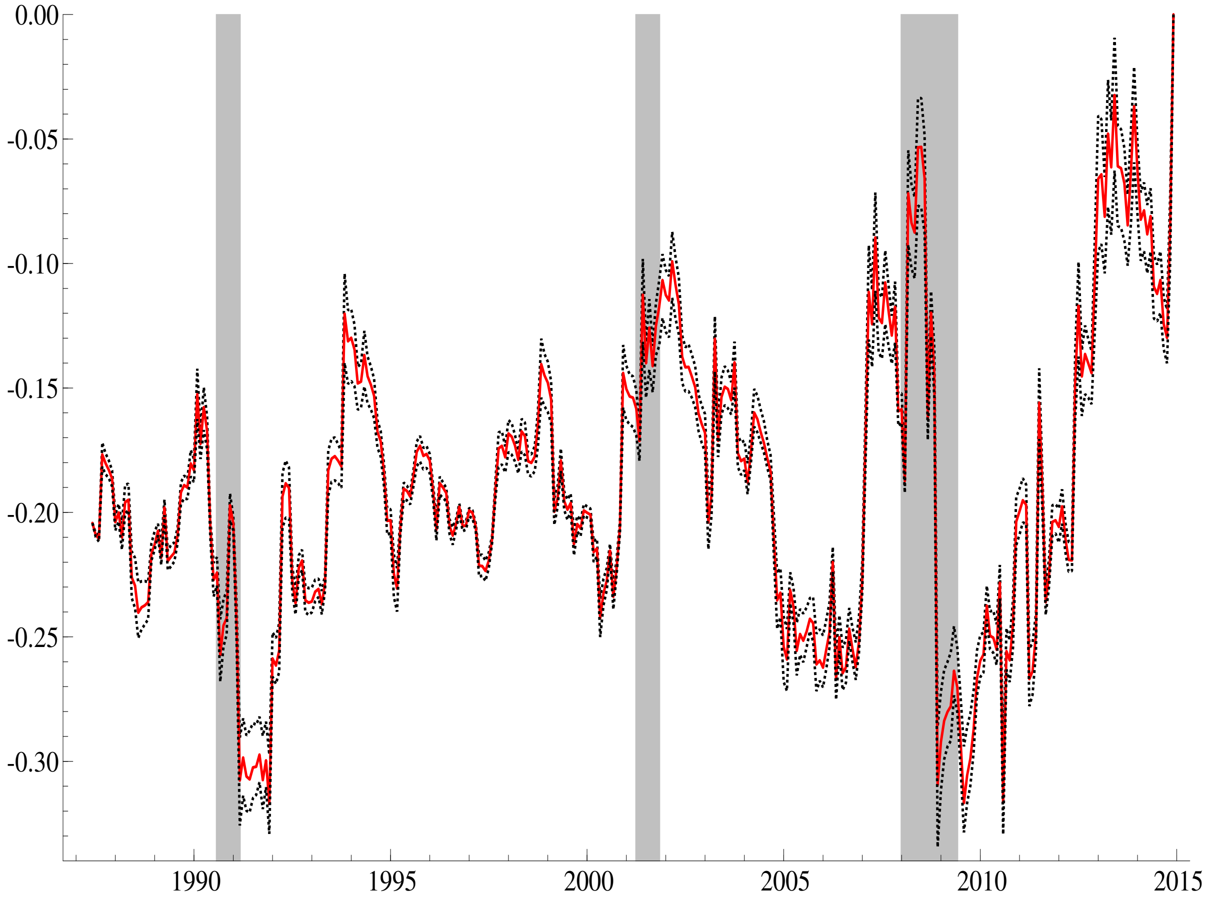
Figure 1: Plots of underlying series



Note: Shaded grey areas denote US recessions as defined by the National Bureau of Economic Research (NBER).

Figure 2: Dynamic conditional correlations between economic policy uncertainty and real housing market returns



Note: Dotted lines are the 90% confidence intervals. Shading denotes US recessions as defined by NBER.

Table 1: Descriptive statistics

	EPU	rCS returns	rIP growth	Inflation	VIX	DrFFR
Min	57.203	-0.0252	-0.0438	-0.0179	10.420	-0.5419
Mean	106.33	0.0010	-0.0003	0.0023	20.389	-0.0172
Max	245.13	0.0175	0.0194	0.0137	61.410	0.4098
Std	33.061	0.0080	0.0068	0.0026	7.8906	0.1262
ADF[a] (constant)	-5.298**	-3.981**	-14.98**	-11.47**	-5.567**	-10.49**
ARCH(10) LM Test	77.068**	65.618**	3.7136**	4.6747**	67.435**	5.9700**
	Unconditional Correlations					
EPU	1.0000					
rCS returns	-0.2018	1.0000				
rIP growth	-0.1342	0.3654	1.0000			
Inflation	-0.1096	-0.2733	-0.3553	1.0000		
VIX	0.4465	-0.0622	-0.0950	-0.1845	1.0000	
DrFFR	-0.2397	-0.1745	0.1527	0.0965	-0.2435	1.0000

Note: [a] The 5% and 1% critical values are -2.87 and -3.45, respectively. * and ** indicate significance at 5% and 1% level, respectively.

Table 2: Estimation results of DCC-GARCH model, Period: 1987M1 – 2014M11

Panel A: Conditional mean		
	EPU_t	$rCSr_t$
$Cons$	3.5592	0.1493
	(3.3082)	(0.8998)
EPU_{t-1}	0.6835***	-0.0021***
	(0.0609)	(0.0001)
EPU_{t-2}	0.0068	-0.0065
	(0.0746)	(0.0139)
EPU_{t-3}	0.0252***	-0.0268**
	(0.0073)	(0.0133)
EPU_{t-4}	0.1723***	-0.0353***
	(0.0495)	(0.0093)
$rCSr_{t-1}$	-0.3696**	0.7522***
	(0.1863)	(0.0538)
$rCSr_{t-2}$	-0.3647***	0.0150
	(0.1134)	(0.0663)
$rCSr_{t-3}$	-0.0226	0.0804
	(0.2377)	(0.0615)
$rCSr_{t-4}$	-0.1295***	0.0954*
	(0.0235)	(0.0495)
VIX_t	0.6798***	
	(0.1056)	
$IPgr_t$	-0.3697***	0.1383***
	(0.0929)	(0.0210)
$drFFR_t$		-0.1408***
		(0.0319)
Panel B: Conditional variance: $H_t = \Gamma'\Gamma + A'\epsilon_{t-1}\epsilon'_{t-1}A + B'H_{t-1}B$		
γ	28.5882	0.2445
	(19.4637)	(0.1788)
α_1	0.2785***	0.1012***
	(0.0914)	(0.0228)
β_2	0.6450***	0.8878***
	(0.1363)	(0.0215)
a	0.0658***	
	(0.0183)	
b	0.8966***	
	(0.0752)	
Panel C: Misspecification tests		
$Q(12)$	10.5237	11.2343
	[0.3958]	[0.3464]
$Q^2(12)$	10.7169	11.8465
	[0.3623]	[0.3218]

Note: EPU_t, $rCSr_t$, VIX_t, $IPgr_t$, and $drFFR_t$ denote economic policy uncertainty, real Case-Shiller house market returns, implied volatility index (VIX), real industrial production growth, and the first difference of the federal funds rate, respectively, at time t. $Q(12)$ and $Q^2(12)$ are the Ljung-Box Q-Statistics on the standardized and squared standardized residuals, respectively, up to 12 lags. Standard Errors in parenthesis and p-values in square brackets. ***, ** and * denote statistical significance at the 1%, 5% and the 10% level, respectively.