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The Relationships between Home Prices, Financial Literacy and Economic Policy Uncertainty: Empirical Evidence from the US Housing Market

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Abstract

This study aims to investigate whether home prices in cities with different levels of financial literacy respond differently to the changes in the Economic Policy Uncertainty (EPU) Index. To this aim, we apply panel unit root and cointegration tests for 19 US cities, tracked by S&P/Case Shiller Composite Home Price Index, over the period of 1990M1-2016M12. The first empirical finding is that increases in the EPU index decrease the Case Shiller index (home prices) in all sample cities. Additionally, the empirical findings indicate that the responsivenesses of home buyers in more financially literate cities to increases in the EPU index are pronouncedly lower than the home buyers in less financially literate cities. This may be interpreted that more financially literate home buyers mostly apply their financial knowledge rather than consider the EPU index, constructed by the newspaper articles, whereas less financially literate home buyers mostly consider the same index.

Key Words: Panel cointegration with multiple structural breaks, Economic Policy Uncertainty (EPU) Index, S&P/Case Shiller Composite Home Price Index, Financial Literacy.

JEL Codes: A20, R21, R30

1. Introduction

Housing industry dominates the US economy. According to the Bureau of Economic Analysis (BEA), the contribution of the housing industry to the US GDP in 2016 is 15.6% (BEA, 2017). Hence, home price fluctuations, as the epicenter of the business cycle, spillover to the US macroeconomy over time (Leamer 2007; Iacoviello and Neri 2010; Holly et al. 2010; Miller et al. 2011; Cesa-Bianchi 2013; Nyakabawo et al., 2015). There are many macroeconomic determinants affecting home prices. For instance, Mankiw and Weil (1989), Terrones and Otrok (2004) and Martin (2005) examine the effects of population demographics on home prices and they find strong positive relationships between these two variables. Similarly, Iacoviello and Neri (2010), Mikhed and Zemcik (2009) and Madsen (2012) find positive correlation between gross domestic production (GDP) and home prices. Furthermore,

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Greiber and Setzer (2007) and Goodhart and Hofmann (2008) find bidirectional causal relationships between monetary policy and housing prices. Similarly, Assenmacher- Wesche and Gerlach (2008), Andrews (2010) and Levin and Pryce (2009) find negative correlation between interest rates and home prices. Almeida et al. (2006) find a positive relationship between inflation and home prices. Schnure (2005) and Lee (2009) find that increases in unemployment rates lead home prices to decrease. Kishor and Marfatia (2017) find that permanent movements in interest rates, income and home prices are interrelated with each other. On the other hand, increasing uncertainty, especially after the recent global financial crisis in 2008, may have some negative effects on economies causing the fluctuations on home prices. Economic theory suggests that uncertainty may reduce investment demand (Bernanke, 1983; McDonald and Siegel, 1986; Dixit and Pindyck 1994) and delay consumers' spending on durable goods (Carroll 1996) including those within the housing market (Iacoviello and Neri 2010; Hirata et al. 2013; Balcilar et al. 2014). Furthermore, policy uncertainty is also considered to have some effects on the economies affecting home prices (Leamer 2007; Nyakabawo et al. 2015). At this stage, the economic policy uncertainty (EPU) index[2], recently constructed by Baker et al. (2013) may allow the researchers to reveal the effects of policy-related economic uncertainty on home prices. The capability of the EPU index to represent policy-related economic uncertainty in the form of an index, similar to a home price index, easily enables researchers to study both indices empirically.

The EPU index is based on the frequency of newspaper articles referencing some words such as "economy" or "economic", "uncertain" or "uncertainty", "deficit", "Federal Reserve", "legislation", and "regulation". More technically, the index, as a proxy, is a series of snapshots of economic policy uncertainty over time, constructed on the basis of three components: (i) the first component quantifies the leading newspapers' coverage of policy-related economic uncertainty, (ii) the second component reflects on the several federal tax code provisions to expire in the coming years, and (iii) the third component evaluates the discordances in economic forecasting by different institutions such as the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters for the United States. The advantage of using the EPU index for large countries like the U.S. is that it can be extended backwards in time and created at a daily frequency like daily stock prices. Therefore, this index may enable researchers to analyze the fluctuations in home prices (the home price index) in a long-run time horizon for more accurate empirical results.

2. Literature Review

Although, there are many studies testing the links between EPU index and macroeconomics fluctuations (Leamer 2007; Bloom 2009; Aastveit et al. 2013; Colombo 2013; Jones and Olson 2013, Mumtaz and Zanetti 2013; Karnizova and Li 2014; Alessandri and Mumtaz 2014; Mumtaz and Theodoridis 2015; Jurado et al. 2015) there are few studies testing the same links for the EPU index with home prices. For instance, El Montasser et al. (2016) apply the bootstrap panel causality test for seven countries, including the USA. They find unidirectional causality running from home prices to EPU for the USA. Similarly, Antonakakis et al. (2015a) apply the Dynamic Conditional Correlation–Generalized Autoregressive Conditional Heteroskedastic (DCC-GARCH) model for the USA for 1987-2014 and they find negative correlation between home prices and the EPU index. But more importantly they reveal that correlations highly increase during times of US recessions for this period. Antonakakis et al. (2015b) in their other studies apply the VAR-based spillover index approach for the USA and they find time-varying volatility spillovers from the EPU index to real home prices. On the

[2] For the construction methodology of index see Baker et al. (2017).

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other hand, André et al. (2015) apply a k-th order non-parametric Granger causality test for the USA and they find that EPU affects both real home prices and EPU affects both real housing returns and their volatility. Christou et al. (2017) use time series and panel data based on Vector Autoregressive models based for countries in the Organization for Economic Co-operation and Development (OECD). They find that the EPU index is convenient to forecast real home prices.

Financial literacy is another area which may affect home prices through influencing home buyers' demand decisions. Financial literacy is defined as the limited ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being[3]. There are some studies examining the relationship between financial literacy and home demand from different aspects. For instance, according Han (2013) and Turnbull and Vlist (2014), financially illiterate households pay more than the fair market value when they purchase their homes before the crisis. This result associates home price premiums with financial illiteracy. Similarly, financially illiterate home buyers, because of money illusion, may confuse real and nominal rates associated with future mortgage payments, causing home prices to increase in times of low inflation (Brunnermeier and Julliard 2008; Finocchiaro et al. 2011). Gerardi et al. (2010) reveal strong relationships between low financial literacy and defaults and foreclosures causing the changes in home prices. Moreover, faced with complicated mortgage options, financial illiteracy might be an important barrier to home ownership, which may affect the potential home prices (Gathergood and Weber 2015). According to Duca and Kumar (2011), financial literacy, learned by financial education programs, may lower rates of default and high borrowing that may affect home prices. Similarly, financial literacy has an important impact on choice for alternative mortgage products which may change the home prices (Cox et al. 2015).

However, the above literature only compares home prices- EPU index or home prices-financial literacy. This study differs because it seeks to combine these variables in order to determine how home prices in US cities with different levels of financial literacy respond to changes in the EPU index. The reason behind this approach is that we assume that more financially literate home buyers may respond to the changes in uncertainties in their home demand differently than the less financially literate home buyers do. It should be noted that we also assume that home price fluctuations are due to changes in home demand changing the prices. The rest of the paper is organized as follows. Section 3 explains the empirical model and data set. Section 4 and 5 provide empirical results and conclusion with recommendations for application and additional research.

3. Empirical Model and Data Set

In this study, we aim to analyze home prices and financial literacy in 19 US cities, tracked by S&P/Case Shiller Composite Home Price Index[4] of Case and Shiller (1987), over the period of 1990M1-2016M12. To this aim, we apply panel unit root and cointegration tests with multiple structural breaks under cross-sectional dependency. The S&P Case Shiller home price index (weighted repeat sales index) is one of the most widely used indices tracking the values of existing single-family homes. The index compares the sale prices of the same homes over time and excludes new constructions since they have not been sold at least twice. Therefore, the index allows us to gauge the real changes in prices since the index is based on actual transactional prices. The construction of the EPU index has been already explained in introduction section of this study.

[3] US Financial Literacy and Education Commission (2007).
[4] For the construction methodology of index see Shiller (1991).

The empirical model of the study, shown in logarithmic form in the Eq. 1, is derived from the models of Girouard and Blöndal (2001) and Brogaard and Detzel (2015).

$$LogCS_{it} = \beta_0 + \beta_1 LogEPU_t + u_{it} \quad (1)$$

In this equation, while LogCS and LogEPU are the Case Shiller and EPU indices respectively, t and i represent time period and cross-section units. The data of SP/Case-Shiller 20-City Composite Home price index are obtained from the database of the Federal Reserve Bank of St. Louis (FED). Dallas, as one of the 20 cities, is excluded from the model it is because of the lack of data for this city. The data of the EPU index were obtained from Baker et al. (2017). The financially literate cities are re-classified by us based of their five years rankings[5] constructed by the Central Connecticut State University. The data of these rankings are obtained from AMLC (America's Most Literate Cities). All series are seasonally adjusted.

4. Empirical Results

Before estimating the cointegration coefficients, first, we must test the cross-section dependency among the cities. If there is a cross-section dependency among the cities, second-generation tests are required to apply panel data analyses. Otherwise, first-generation tests are applied. For testing cross-section dependency, we apply a bias corrected scaled LM test (LMBC) developed by Baltagi et al. (2012). The null hypothesis of no cross-sectional dependence. The test results are reported in Table 1.

Table 1: Cross-Sectional Dependency Test Results

	Test-statistics	*P-values*
LogCS	2360.603***	0.000
LogEPU	2874.641***	0.000
Model	207.992***	0.000

Note: ***, **, and * denote the statistical significance at 1%, 5% and 10% level of significance, respectively.

The test results in Table 1 indicate that the null hypothesis of no cross-section dependence can be clearly rejected. Hence, it has been decided that there is a cross-sectional dependency among these cities. Therefore, in the next steps of the analyses, second-generation test methods, considering cross-section dependency, will be applied (Pesaran et al. 2008).

In the next step, we test the stationary of the series by applying the PANKPSS (Panel Kwiatkowski-Phillips-Schmidt-Shin) test method, developed by Carrion-i-Silvestre et al. (2005). This test method is one of the second-generation unit root test methods considering cross-section dependency and structural breaks. The null hypothesis of stationarity with multiple structural breaks. The results of unit-root test are reported in Table 2.

According to the results in Table 2, the null hypothesis of stationarity can be rejected. Hence, it has been decided that series are non-stationary in levels but are stationary in their first differences for the panel and each city. In other words, they are I (1). Hence, test of cointegration relationship between these series can be applied. Furthermore, PANKPSS test method reveals that the structural breaks of both series (the Case Shiller and EPU indices) coincide with the dates of some global and national financial or economic crises such as the early 2000s recession in the US, the 2007-2008 global financial crisis and the European sovereign debt crisis between 2010-2012.

[5] For the construction methodology of ranking see AMLC (2017).

Table: 2 PANKPSS Unit Root Test Results

	LogCS	*Break Dates*	*ΔLogCS*	*LogEPU*	*Break Dates*	*ΔLogEPU*
Washington DC	0.037 (0.032)	1999:M08, 2005:M11, 2009:M09	0.114* (0.132)	0.048 (0.032)	2000:M10, 2007:M07, 2013:M01	0.120* (0.185)
Seattle	0.033 (0.029)	1997:M03, 2006:M03, 2012:M09	0.102* (0.129)	0.045 (0.031)	2000:M10, 2007:M07, 2013:M01	0.106* (0.214)
Minneapolis	0.024 (0.023)	1999:M11, 2004:M11, 2008:M09, 2013:M03	0.175* (0.187)	0.045 (0.031)	2000:M10, 2007:M07, 2013:M01	0.105* (0.204)
Atlanta	0.034 (0.028)	2007:07, 2013:M03	0.159* (0.224)	0.044 (0.032)	2000:M10, 2007:M07, 2013:M01	0.100* (0.227)
Denver	0.029* (0.033)	2003:M01, 2013:M03	0.246 (0.225)	0.044 (0.031)	2000:M10, 2007:M07, 2013:M01	0.094* (0.246)
Boston	0.027 (0.025)	1996:M11, 2004:M03, 2013:M03	0.082* (0.150)	0.045 (0.031)	2000:M10, 2007:M07, 2013:M01	0.093* (0.245)
San Francisco	0.032 (0.030)	1996:M09, 2007:M07, 2013:M03	0.074* (0.197)	0.046 (0.029)	2000:M10, 2007:M07, 2013:M01	0.091* (0.213)
Portland	0.033 (0.028)	2005:03, 2013:M03	0.087* (0.145)	0.047 (0.030)	2000:M10, 2007:M07, 2013:M01	0.094* (0.205)
Cleveland	0.034 (0.027)	2005:M11, 2013:M03	0.342 (0.242)	0.048 (0.031)	2000:M10, 2007:M07, 2013:M01	0.092* (0.230)
New York	0.026 (0.025)	1997:M06, 2005:M09, 2013:M03	0.240 (0.143)	0.047 (0.032)	2000:M10, 2007:M07, 2013:M01	0.088* (0.192)
Tampa	0.022* (0.027)	1999:M06, 2005:M03, 2009:M05, 2013:M03	0.153 (0.110)	0.047 (0.030)	2000:M10, 2007:M07, 2013:M01	0.085* (0.214)
Chicago	0.022* (0.025)	1998:M01, 2005:M07, 2009:M05, 2013:M03	0.185 (0.132)	0.046 (0.030)	2000:M10, 2007:M07, 2013:M01	0.081* (0.186)
San Diego	0.023* (0.025)	1996:M07, 2004:M12, 2008:M10, 2013:M03	0.175 (0.147)	0.043 (0.030)	2000:M10, 2007:M07, 2013:M01	0.075* (0.209)
Miami	0.021* (0.027)	1999:M10, 2005:M05, 2009:M03, 2013:M03	0.133* (0.134)	0.043 (0.029)	2000:M10, 2007:M07, 2013:M01	0.073* (0.219)
Charlotte	0.026 (0.028)	2007:M09, 2013:M03	0.149* (0.173)	0.041 (0.028)	2000:M10, 2007:M07, 2013:M01	0.069* (0.79)
Detroit	0.022* (0.029)	2000:M06, 2005:03, 2009:M04, 2013:M03	0.181 (0.111)	0.042 (0.028)	2000:M10, 2007:M07, 2013:M01	0.068* (0.179)
Las Vegas	0.021* (0.031)	2001:M03, 2005:M01, 2009:M05, 2013:M03	0.156 (0.140)	0.043 (0.030)	2000:M10, 2007:M07, 2013:M01	0.069* (0.239)
Phoenix	0.018* (0.030)	2001:M06, 2005:M04, 2009:M02, 2013:M03	0.293 (0.163)	0.044 (0.030)	2000:M10, 2007:M07, 2013:M01	0.068* (0.212)
Los Angeles	0.029 (0.025)	1996:M02, 2004:M07, 2008:M05, 2013:M03	0.104* (0.263)	0.042 (0.028)	2000:M10, 2007:M07, 2013:M01	0.065* (0.212)
Panel	3.14 (1.317)	-	3.881* (7.887)	18.794 (2.886)	-	0.437* (2.998)

Note: Critical values were obtained by using bootstrap for 1000 replications. *; express stationary at 5% significance level.

Afterwards, the homogeneity of cointegration coefficients is analyzed by the slope homogeneity test introduced by Swamy (1970) and developed by Pesaran and Yamagata (2008). The null hypothesis of slope homogeneity. Pesaran and Yamagata (2008) developed two different test statistics for small and large samples as $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ respectively. The results of the slope homogeneity test of the model in Eq.1 are reported in Table 3.

Table 3: Homogeneity test

	Test Statistics	*P-values*
$\tilde{\Delta}$	18.718	0.000

$\tilde{\Delta}_{adj}$	18.808	0.000

According to the results in Table 3, the null hypothesis is rejected, i.e. the slope coefficients are not homogenous in the cointegration equation. Hence, individual city results are more reliable than panel. In the next step, the existence of cointegration is tested by the Basher and Westerlund (2009) method for considering cross-section dependency and structural breaks in the cointegration vector. The null hypothesis of cointegration. The test results of Basher and Westerlund (2009) are reported in Table 4.

Table 4: Test Results of Basher and Westerlund *(*2009*)*

	Test Statistics	*P-values*	*Structural Break Dates*
No break in constant	-2.765	0.997	-
No break in constant & trend	-1.391	0.918	-
Break in constant	-2.765	0.997	2001:M09, 2005:M11, 2007:M06
Break in constant & trend	-0.089	0.535	2001:M09, 2007:M07, 2008:M11, 2011:M08

Note: Critical values were obtained by using bootstrap for 1000 replications.

The results in Table 4 fail to reject the null hypothesis and indicate that series are cointegrated. Hence, the estimation of cointegration coefficients in the long-run can be applied. Structural break dates obtained from the cointegration analysis were added to the analysis with dummy variables to estimate cointegration coefficients.

Lastly, cointegration coefficients of the model were estimated by the Augmented Mean Group (AMG) method, developed by Eberhardt and Bond (2009), considering cross-section dependency. This method also considers the effects of common factors and dynamics and thereafter yields better results than the unbalanced panel models (Eberhardt and Bond 2009). The results are reported in Table 5.

Table 5: Cointegration Coefficients

Financially Literate City Ranks (High to Low)	*Constant*	*LogEPU*	$D_{2001:M09}$	$D_{2005:M11}$	$D_{2008:M11}$	$D_{2011:M08}$
Washington DC	5.53***	-0.21***	0.67***	0.14***	-0.018	0.21*
	[86.90]	[15.42]	[64.53]	[10.47]	[-1.06]	[1.58]
Seattle	5.56***	-0.25***	0.59***	0.12***	0.09***	-0.02***
	[134.47]	[-28.07]	[87.10]	[13.55]	[8.00]	[-2.54]
Minneapolis	5.62***	-0.26***	0.72***	-0.13***	0.004	-0.008
	[177.20]	[-38.17]	[137.77]	[-17.45]	[0.53]	[-1.24]
Atlanta	5.52***	-0.23***	0.45***	-0.08***	0.05***	-0.07***
	[129.83]	[-25.41]	[65.48]	[-9.33]	[4.65]	[-7.81]
Denver	5.72***	-0.30***	0.72***	-0.22***	0.28***	0.30*
	[64.61]	[-15.73]	[48.63]	[-11.14]	[11.81]	[1.61]
Boston	5.40***	-0.22***	0.83***	-0.15***	0.18***	-0.02***
	[120.98]	[-22.95]	[113.23]	[-15.74]	[15.55]	[-2.71]
San Francisco	5.97***	-0.34***	0.88***	-0.10***	0.02*	0.11***
	[104.43]	[-27.58]	[93.52]	[-8.11]	[1.31]	[9.53]
Portland	5.97***	-0.34***	0.54***	0.13***	0.14***	-0.03**
	[84.39]	[-21.83]	[46.30]	[8.25]	[7.53]	[-2.24]

Table 5: Cont.

Financially Literate City Ranks (High to Low)	*Constant*	*LogEPU*	$D_{2001:M09}$	$D_{2005:M11}$	$D_{2008:M11}$	$D_{2011:M08}$
Cleveland	5.25***	-0.17***	0.36***	-0.12***	0.06***	-0.06***

	[124.66]	[-18.82]	[53.17]	[-12.72]	[5.81]	[-7.06]
New York	5.28***	-0.18***	0.73***	0.08***	0.04***	-0.09***
	[129.72]	[-20.29]	[109.66]	[9.04]	[4.19]	[-11.43]
Tampa	5.85***	-0.29***	0.61***	0.15***	-0.13***	-0.01**
	[145.41]	[-33.25]	[92.64]	[17.47]	[-12.0]	[-2.15]
Chicago	5.44***	-0.21***	0.54***	0.009**	-0.02***	-0.10***
	[213.65]	[-38.10]	[129.74]	[1.67]	[-4.09]	[-19.74]
San Diego	5.81***	-0.30***	0.92***	-0.06***	0.0005	0.05***
	[78.50]	[-18.47]	[75.54]	[-4.02]	[0.03]	[3.19]
Miami	6.18***	-0.37***	0.73***	0.17***	-0.16***	0.03***
	[112.67]	[-30.52]	[81.47]	[14.58]	[-11.04]	[2.74]
Charlotte	5.24***	-0.17***	0.32***	0.01**	0.08***	-0.01*
	[114.76]	[-17.01]	[43.29]	[1.91]	[7.08]	[-1.52]
Detroit	5.90***	-0.34***	0.57***	-0.31***	-0.09***	0.09***
	[91.63]	[-23.90]	[54.03]	[-21.85]	[-5.39]	[6.82]
Las Vegas	6.43***	-0.42***	0.63***	0.08***	-0.28***	-0.01
	[79.98]	[-23.70]	[48.15]	[4.60]	[-13.18]	[-0.83]
Phoenix	6.31***	-0.42***	0.64***	0.13***	-0.20***	0.05***
	[146.14]	[-43.99]	[90.59]	[13.96]	[-17.06]	[6.48]
Los Angeles	5.73***	-0.27***	0.80***	0.13***	-0.06**	0.07***
	[58.37]	[-12.72]	[49.83]	[6.05]	[-2.34]	[3.57]
Panel	5.72***	-0.28***	0.65***	-0.001	0.0001	-0.001
	[71.67]	[-16.00]	[17.62]	[-0.0002]	[0.001]	[-0.0001]

Note: * and ** shows 10% and 5% significances level respectively. The values in square brackets are *t*-statistics.

The results in Table 5 indicate that a 1% increase in the EPU index decreases the Case Shiller index (home prices) at 0.28% in panel. On the other hand, home prices in different cities respond to the same percent increases in the EPU index differently. The negative effects of increasing uncertainty (EPU index) on home prices are lower in more financially literate cities than less financially cities since the more financially literate cities' elasticity coefficients are lower than the other cities. From another perspective, the responsivenesses of home buyers in more financially literate cities to the increases in the EPU index are pronouncedly lower than the home buyers in less financially literate cities. For instance, while the elasticity coefficient of Washington, as the most financially literate city, in Table 5 is -0.21, the same elasticity coefficients for Phoenix and Las Vegas are -0.42. The elasticity coefficients of each city and their trend line are shown in Graph 1.

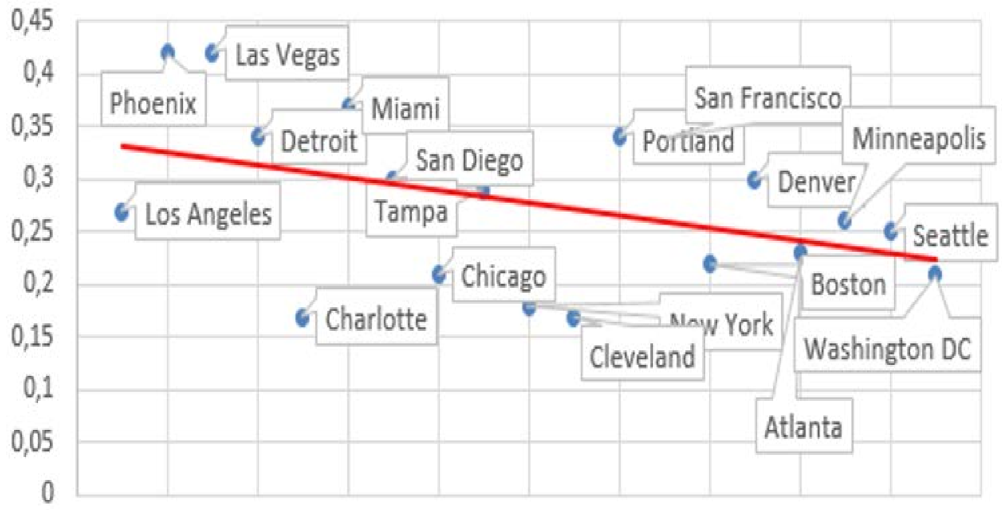

Figure 1: Elasticities between Case Schiller and EPU indices in 19 cities

The downward sloping trend line in the above graph clearly shows that elasticity coefficients decrease from less financially literate cities to more financially literate cities. It should be noted that elasticity coefficients are multiplied by -1 and moved to the upper side of graph. This means that they are as negative as they are in Table 5.

5. Conclusion

This study investigates whether the home prices in cities with varying levels of financial literacy respond differently to the changes in Economic Policy Uncertainty (EPU) Index. To this aim, we apply panel unit root and cointegration tests with multiple structural breaks for 19 US cities, tracked by the S&P/Case Shiller Composite Home Price Index, over the period of 1990M1-2016M12. The empirical findings of the panel analysis indicate that increases in EPU index decrease the Case Shiller index (home prices) in all cities. In regard to the separate responsivenesses of these cities to the changes in the EPU index, the findings also indicate that the negative effects of increasing uncertainty on home prices are lower in more financially literate cities than less financially cities. From a different point of view, this may be interpreted that more financially literate home buyers mostly apply their financial knowledge rather than considering the EPU index, constructed by the newspaper articles, whereas less financially literate home buyers mostly consider the same index. Hence, it can be said that to decrease the volatilities and negative effects of uncertainty on home prices (the home price index) and thereby the housing industry, financial institutions, governments, and international organizations should increase financial literacy of home buyers. This study also reveals the need for further empirical studies investigating the effects financial literacy has on home buying demand in terms of uncertainties in economies.

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