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Las Cruces Housing Price Fluctuations: 1971-2017

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THE UNIVERSITY OF TEXAS AT EL PASO

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LAS CRUCES HOUSING PRICE FLUCTUATIONS: 1971-2017*

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Abstract
This study analyzes the median price for existing single-family housing units in Las Cruces, New Mexico. The proposed theoretical model accounts for the interplay between supply and demand sides of a metropolitan housing market. Explanatory variables used in the analysis are real per capita income, the housing stock, real mortgage rates, real apartment rents, and the median real price of single-family units in the United States. Annual frequency data are collected for a 1971-2017 sample period. Parameter estimation is completed using two stage generalized least squares. Empirical results confirm several, but not all, of the hypotheses associated with the underlying analytical model. In particular, Las Cruces housing prices are found to be most reliably correlated with local income and national housing prices.

Keywords
Housing Economics; Las Cruces, New Mexico; Applied Econometrics

JEL Classifications
R15, Regional Econometrics; R21, Housing Demand; R31, Housing Markets

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INTRODUCTION

This study analyzes median prices for existing, or previously built, single-family residential units in Las Cruces, New Mexico. Las Cruces is the second largest metropolitan economy in New Mexico. In spite of that, comparatively little research has been conducted for this urban economy, including its housing market. The Las Cruces metropolitan statistical area is defined as Doña Ana County (USCB, 2010). As a medium-sized urban economy, it is similar to other housing markets whose characteristics are largely undocumented. This effort attempts to partially fill a portion of that gap in the housing economics literature.

Residential real estate is an important sector for any urban economy. This is particularly true in Las Cruces because property taxes, though generally unpopular in the United States, are used to help fund the municipal budget (Cabral and Hoxby, 2010). During Fiscal Year 2017, nearly $11.1 million in residential and non-residential property taxes accrued to the City of Las Cruces. Of that amount, approximately 68 percent of those revenues are residential property taxes (DFA, 2017). Previously built single-family housing units generate the bulk of the almost $7.5 million in residential property taxes collected between July 2016 and June 2017. Changes in prices for that segment of the Las Cruces housing stock can exercise important effects on the municipal coffer.

Las Cruces has a relatively cyclical economy. Subsequent to the Great Recession of 2008, Doña Ana County experienced population losses in 2013 and shed jobs in both 2009 and 2012. Preliminary estimates further indicate that nominal personal income in Las Cruces exhibited negative growth in 2013 (Fullerton and Fullerton, 2019). Those surprising fluctuations are likely to have exercised important impacts on the housing market and housing prices. To confirm that conjecture, an econometric analysis of Las Cruces single-unit housing prices is undertaken.

Because many aspects of the housing market in Las Cruces have yet to be documented, a fairly elementary approach is employed. Data utilized are collected by the University of Texas at El Paso Border Region Modeling Project. The reduced form model is derived from equating housing supply with housing demand (DiPasquale and Wheaton, 1994). The underlying equations are specified based on data available for the Las Cruces metropolitan economy.

Subsequent sections of the study are as follows. Section two provides a brief review of previously published housing price research and studies that are related to the economy of Las Cruces. The theoretical model is presented in the third section. Section four summarizes the data employed and the empirical results obtained. Section five encapsulates principal outcomes and offers concluding remarks.

PRIOR STUDIES

A variety of studies examine housing supply and demand. A typical approach is to specify separate equations for each of the relationships between housing stocks and home prices. Housing stocks are generally specified using dynamic functions based upon new construction and demolition rates (Muth, 1960; Follain, 1979; DiPasquale and Wheaton, 1994; Hedberg and Krainer, 2012). In the region where Las Cruces is located, a variant of this approach is employed for the single-family housing stock and the multi-family housing stock in El Paso, Texas (Fullerton and Kelley, 2008). Both specifications exhibit good empirical traits. Given that, this approach may be applicable to the Mesilla Valley housing market, as well.

Numerous studies also analyze different aspects of housing demand. As noted by Megbolugbe et al. (1991), there are so many approaches to analyzing housing demand that it is infeasible to include all of them in any single model. It may be feasible to successfully study the behavior of housing prices over time, however, if the analysis takes into account both structural and cyclical factors that influence market conditions. Such constructs generally include data that reflect unit prices, personal income, market demographics, and borrowing costs (DiPasquale and Wheaton, 1994; Chow and Niu, 2015; Gu 2018). Potentially relevant to this study, variables from each of those categories are included in the housing model estimated for El Paso by Fullerton and Kelley (2008).

Smaller urban economies such as Las Cruces frequently observe notable changes in residential dwelling prices due to a variety of factors. Members of the retirement market often relocate to less crowded cities and seek bargains in second home investments. As discussed in York et al. (2011), Las Cruces observed a 25 percent population increase between 1992 and 2001. Much of that increase was due to an inflow of new migrants. Understanding housing price fluctuations is important for areas such as the Mesilla Valley. Over the 50 year period between 1950 and 2000, real housing prices appreciated by 157.1 percent in Las Cruces (Gyourko, Mayer and Sinai, 2010). The basic model developed for this study is discussed in the next section.

THEORETICAL MODEL

Housing prices are affected by multiple variables in any urban economy. The housing supply is specified in a manner that is similar to DiPasquale and Wheaton (1994). That approach has the advantage of relying upon data that are available for Las Cruces and other small metropolitan economies. Equation (1) results from the following steps:

$$\Delta S_t = \alpha_0 + \alpha_1 P_t - \delta S_{t-1}$$

$$S_t - S_{t-1} = \alpha_0 + \alpha_1 P_t - \delta S_{t-1}$$

$$S_t = \alpha_0 + \alpha_1 P_t - \delta S_{t-1} + S_{t-1}$$

$$S_t = \alpha_0 + \alpha_1 P_t + (1-\delta) S_{t-1}$$

$$S_t = \alpha_0 + \alpha_1 P_t + \alpha_2 S_{t-1} \qquad (1)$$

Variables shown above include the Las Cruces housing supply, or stock, per capita, S, and the median real price per single-family housing unit in Las Cruces, P. The subscript t is used to denote the time period. Equation parameters are αi, while δ represents the rate of depreciation of the housing stock. Equation (1) specifies the supply of housing as a function of the current period single-family housing price and the prior period housing stock. In Equation (1), S is hypothesized to be positively correlated with the contemporaneous lag of P and with a one-year lag of S. The first slope parameter is expected to be greater than zero because higher housing unit prices allow builders to cover higher costs of material and labor (DiPasquale and Wheaton, 1994). The second slope coefficient is expected to be positive because the rate of single-family housing demolition in any given year is generally less than 2 percent of the existing stock (Pitkin and Myers, 2008).

Housing demand is also specified in a manner that is similar to DiPasquale and Wheaton (1994) and Fullerton and Kelley (2008). In Equation (2), P is, again, the median real price for a stand-alone housing unit in Las Cruces. Real income per household is a logical income measure to consider including in Equation (2). However, a relatively large percentage of the population in Las Cruces is comprised by out-of-town students who attend New Mexico State University and that affects the estimated number of households. Because of the transitory nature of college student residencies, the vast majority of student households are unlikely to purchase single-family dwelling units. Given that, Las Cruces real per capita income is included in the sample with a variable name of INC.

RM denotes the real mortgage rate charged on housing loans. RM is calculated as the difference between the nominal mortgage rate and the personal consumption expenditures deflator inflation rate. To control for competition from the non-owner portion of the residential real estate market, a variable for the real price renters must pay, RENT, to occupy housing that is leased appears in Equation (2). The national real median price for single-family houses, NHP, is also included in the specification to reflect investment characteristics of housing demand. D stands for Las Cruces housing demand.

$$D_t = \beta_0 + \beta_1 INC_t - \beta_2 RM_t + \beta_3 RENT_t + \beta_4 NHP_t - \beta_5 P_t \qquad (2)$$

In Equation (2), D is expected to be positively correlated with INC, RENT, and NHP. As real income per person increases, housing purchases are expected to increase. Rental housing is a substitute good for owner-occupied housing. Accordingly, as rental prices increase, housing purchases will tend to escalate due to both substitution and investment effects (Dusansky and Koc, 2007). Lastly, as the national housing market conditions strengthen, investment demand for housing in Las Cruces is also predicted to swell (Fullerton and Kelley, 2008).

In Equation (2), D is further hypothesized to be negatively correlated with RM and P. If real mortgage rates climb, affiliated real housing payments will rise, the pool of qualified borrowers will shrink, and fewer households will attempt to purchase houses (Wilcox, 1990). The slope coefficient for the real price, P, is also expected to be less than zero due to the standard inverse relationship between sales volumes and prices (Vargas Walteros et al., 2018).

To obtain an expression for P (Price), Equations (1) and (2) are set equal to each other, and then solved for P. The resulting reduced form equation expresses P as a function of the exogenous variables INC, RM, RENT, and NHP. Equation (3) is developed, as shown below:

$$S_t = D_t$$

$$\alpha_0 + \alpha_1 P_t + \alpha_2 S_{t-1} = \beta_0 + \beta_1 INC_t - \beta_2 RM_t + \beta_3 RENT_t + \beta_4 NHP_t - \beta_5 P_t$$

$$\alpha_1 P_t = \beta_0 - \alpha_0 + \beta_1 INC_t - \alpha_2 S_{t-1} - \beta_2 RM_t + \beta_3 RENT_t + \beta_4 NHP_t - \beta_5 P_t$$

$$\alpha_1 P_t + \beta_5 P_t = \beta_0 - \alpha_0 + \beta_1 INC_t - \alpha_2 S_{t-1} - \beta_2 RM_t + \beta_3 RENT_t + \beta_4 NHP_t$$

$$(\alpha_1 + \beta_5) P_t = \beta_0 - \alpha_0 + \beta_1 \ INC_t - \alpha_2 S_{t-1} - \beta_2 RM_t + \beta_3 RENT_t + \beta_4 NHP_t$$

$$P_t = (\beta_0 - \alpha_0 + \beta_1 INC_t - \alpha_2 S_{t-1} - \beta_2 RM_t + \beta_3 RENT_t + \beta_4 NHP_t) \,/\, (\alpha_1 + \beta_5)$$

$$P_t = \gamma_0 + \gamma_1 INC_t + \gamma_2 S_{t-1} + \gamma_3 RM_t + \gamma_4 RENT_t + \gamma_5 NHP_t \qquad (3)$$

The algebra of the coefficients in Equation (3) yields specific hypotheses for each of the explanatory variable coefficients. The intuition underlying the resulting arithmetic signs follows. Two of the slope parameters in Equation (3) are hypothesized to be negative: $\gamma_2 < 0$; $\gamma_3 < 0$. An inverse relationship is posited between the price for single-family housing, P, and the prior period stock of homes, S, due to supply effects and vacancy rates (Wheaton, 1990). The real housing payment slope coefficient, $\gamma 3$ is also hypothesized to be negative. That is because rising mortgage rates, RM, reduce the pool of qualified borrowers and the demand for owner-occupied housing.

The model developed, including the reduced form shown in Equation (3), is not very elaborate and does not include quality of stock measures. That is, primarily, due to data constraints associated with the Las Cruces housing market. As discussed in the next section, data gaps have to be addressed, even for the small number of variables shown in Equation (3). The data paucity problem, including age of the housing stock, quality changes, and over-supply, is a characteristic of most urban and regional economies throughout the world and does not represent a lack of transparency in terms of the analytic and/or empirical assessment of trends in those markets. In some cases, overcoming a portion of those informational constraints may be feasible, but, at this point, there is no universal solution to this problem (Ciaramela and Celani, 2014).

Because of the central role that the residential real estate sector plays in most economies, substantial attention is always given to stand-alone housing prices (Rappaport, 2007; Conefrey and Whelan, 2013). To date, there is very little research that has been published with respect to housing prices in Las Cruces, the second largest metropolitan economy in New Mexico. As a step toward partially filling that gap in the regional housing economics literature, a theoretical model is proposed that takes into account both supply and demand features of housing markets. Because data requirements are fairly reasonable, the model provides an attractive starting point for analyzing relatively small markets that typically do not have extensive statistical documentation. An empirical assessment of the model is performed in the next section.

SAMPLE DATA

Table 1 contains names, descriptions, units, and sources for the variables included in the data sample. Missing observations exist for four variables in the sample: median Las Cruces single-family housing price (P), median 2-bedroom apartment rent (RENT), single-family housing stock (S), and real mortgage rate (RM). In the cases of P, RENT, and RM, linear regression equations are utilized to impute the missing values (Friedman, 1962). In the case of S, missing observations are imputed using percentage changes of households and population to extrapolate the per capita housing stock (Sweet and Grace-Martin, 2012).

Table 1: Variable Names, Definitions, and Units of Measure

Variable	Description	Units	Sources
P	Las Cruces Real Median Single-Family Housing Price	2012 Real $	IHS and BRMP
INC	Las Cruces Real Income per Capita	2012 Real $	BEA and Census
S	Las Cruces Single-Family Housing Stock per Capita	SF Houses per Person	IHS, Economy.com, and BRMP
RM	Real Mortgage Rate	Percent	BRMP
RENT	Las Cruces Median Real 2-BR Apartment Rent	2012 Real $	HUD and BRMP
NHP	USA Real Median SF Housing Price	2012 Real $	FRED and BRMP

Notes:

BEA, U.S. Bureau of Economic Analysis.

Census, U.S. Census Bureau.

Economy.com, Moody's Analytics Economy.com.

FRED, Federal Reserve Bank of St. Louis Economic Data.

HUD, U.S. Department of Housing and Urban Development.

IHS, IHS Markit, formerly Wharton Econometrics.

BRMP, University of Texas at El Paso Border Region Modeling Project.

The sample data period is determined by historical mortgage interest rate availability (FRED, 2018a). Table 2 reports summary statistics for each variable from 1971 to 2017. In 2012 constant dollars, the single-family housing price in Las Cruces ranges from a low of $71,109 in 1971 to a high of $162,006 in 2007. The maximum price occurred on the eve of the financial sector collapse and a fairly severe economic downturn in the United States. The skewness statistic for P indicates that real housing price data for this sample are distributed symmetrically. Relative to a normal distribution, observations for P are slightly platykurtic. The coefficient of variation for P is 0.201.

Real per capita personal income, in 2012, constant dollars, has a mean of $23,232 and a median of $24,763. INC has a standard deviation of $5,508. The third moment indicates that the observations for INC are fairly symmetric, although a little positively skewed. The fourth moment indicates that PINC is somewhat platykurtic, but the coefficient of variation does not imply that the latter is very pronounced.

In Table 2, S, the Las Cruces single-family per capita housing stock, ranges from a low of 0.193 in 1971 to a high of 0.244 in 2017. S has a mean of 0.217 and a median of 0.219. The standard deviation for PCS is 0.013. The observations for PCS are distributed in a fairly symmetric but slightly platykurtic manner. Although not shown in the table, the total single-family housing stock grew from 15.0 thousand in 1970 to 52.7 thousand in 2017.

Table 2: Summary Statistics

Statistic	P	INC	S	RM	RENT	NHP
Mean	$117,450	$23,232	0.217	4.61	$642	$200,633
Median	$108,345	$24,763	0.219	2.76	$703	$209,730
Maximum	$162,006	$33,337	0.244	10.49	$775	$303,965
Minimum	$71,109	$16,189	0.193	-1.22	$584	$115,494
Std Dev	$23,664	$5,508	0.013	2.43	$41	$49,449
Skewness	-0.065	0.460	0.411	0.387	1.263	0.348
Kurtosis	2.382	1.710	2.533	3.243	5.213	2.165
Coef Var	0.201	0.237	0.059	0.527	0.063	0.246

Notes:
Sample Period, 1971-2017
All monetary units are expressed in 2012 constant dollars.
Std Dev is an acronym used for standard deviation due to space constraints.
Coef Var is an acronym used for coefficient of variation due to space constraints.

The real monthly mortgage rate, RM, is calculated as the difference between the 30-year conventional nominal mortgage rate and the personal consumption expenditures deflator inflation rate. The mean for RM is 4.61 and the median is 2.76. The standard deviation is 10.49 and the coefficient of variation is 0.53. As a consequence of tight monetary policy and historically high interest rates, the real mortgage rate reached a maximum of 10.49 in 1982. The minimum value of -1.22 occurred during the first oil crisis in 1974. RM is approximately symmetric and mesokurtic. While not shown in Table 2, real mortgage payments in Las Cruces, net of property tax and insurance payments, peaked at $1,408 per month in 1982. That is much higher than the sample average of $807.

Rental properties are substitutes for owner-occupied residences. Two-bedroom, monthly apartment rents are used to approximate the substitute price for this alternative form of housing. In Table 2, the sample mean for real RENT is $642 and the median is $703. The standard deviation for RENT is $41. The monthly real RENT of $584 occurred in 1996, while the maximum of $775 is from 2013. Higher-end units in this market cause 2-bedroom rents to skew to the right with a third moment of 1.26. The distribution is leptokurtic, however, with a fourth moment value of 5.21.

For the sample period in question, the real national housing price variable mean is $200,633, and the median is $209,730. NHP has a 2012 real dollar maximum of $303,965 reached in 2017 and a minimum of $115,494, which occurred in 1971. The standard deviation of NHP is $49,449. Surprisingly, NHP has a coefficient of variation of 0.25, reflecting more volatility than what is expected for the relatively small Las Cruces housing market. As documented in Table 2, the data for NHP are approximately symmetric and slightly platykurtic.

Although not shown in Table 2, the first differences of the natural logarithms of P, INC, S, RENT, NHP, and the first difference of RM are also tested for unit roots using an ADF procedure. All but one have computed t-statistics that exceed MacKinnon (1996) critical p-values at the 1-percent level. The t-statistic of the first difference of the per capita single-family housing stock variable, S, is also significant, but only at the 6-percent level.

All of the data, except RM, are transformed using natural logarithms prior to parameter estimation. Taking that step for all of the non-zero, positive "amount" values in the sample helps ensure that the normality assumption is satisfied (Gelman and Hill, 2007). RM is a "percentage" variable. It can take positive or negative values and does not require transformation prior to estimation.

Artificial regression tests are used to test for potential endogeneity (Davidson and MacKinnon, 1989). That step is taken because Equation (3) contains contemporaneous lags of two variables from the local economy, INC and RENT, as regressors. The computed t-statistics for both IINC and RENT surpass the 5-percent critical value and reject the null hypothesis of estimation consistency. Given that two stage least squares estimation is employed using real national income per capita (FRED, 2018b) and real median apartment rent (AL, 2019) variables as the instruments.

EMPIRICAL ANALYSIS

The price of single-family homes is analyzed using the reduced form of the theoretical model shown in Equation (3). It specifies the median real housing price as a function of per capita income (INC), the per capita housing stock (PCS), the real mortgage rate (RM), the two-bedroom real apartment rent (RR), and the national median single-family housing price (NHP). Table 3 reports the estimation results for the reduced form version of the model shown in Equation 3. Due to the presence of serially correlated residuals, a generalized least squares (GLS) autoregressive moving average exogenous (ARMAX) estimator is employed (Pagan, 1974). As shown in Table 3, autoregressive parameters estimated for lags of the residuals are included at lags 1 and 6. The latter may result from the long periods sometimes required for regional housing markets to re-attain equilibrium following shocks (Riddel, 2000).

The INC slope coefficient indicates that a 10 percent increase in real per capita income leads to a 2.4 percent growth in single-family housing prices in Las Cruces. The channel of influence from income to dwelling unit price has also been documented for housing markets worldwide (Arestis and Jia, 2019). In contrast to that outcome, the parameter estimate for the one-year lag of S has a positive sign that is illogical. Increases in the housing stock should, other things equal, drive prices down.

Another surprising outcome in Table 3 is the real mortgage rate, RM, coefficient, which is greater than zero and satisfies the 5-percent significance criterion. Higher mortgage rates typically shrink the pool of qualified borrowers, diminishing the demand for owner-occupied properties. Experimentation with an alternative specification using a dollar estimate of annual mortgage payments using instrumental variables to control for endogeneity did not render better results. Eventually, the inclusion of an affordability measure in the sample might prove useful (Fullerton and Kelley, 2008; Pitros and Arayici, 2017).

Table 3: Reduced Form Equation GLS ARMAX Output for LN(P)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.5949	3.5211	1.3049	0.2012
LN(INC)	0.2432	0.1662	1.4634	0.1531
LN(S(-1))	0.4821	0.9056	0.5323	0.5982
RM	0.0098	0.0034	2.4271	0.0199
LN(RENT)	0.0408	0.1346	0.3034	0.7635
LN(NHP)	0.4155	0.1118	3.7150	0.0008
AR(1)	0.8196	0.0769	10.6595	0.0000
AR(6)	-0.2808	0.0947	-2.9650	0.0057

R-squared	0.972	Mean dependent var	11.719
Adjusted R-squared	0.965	S.D. dependent var	0.1461
S.E. of regression	0.0271	Sum squared resid	0.0271
J-statistic	19.707	Prob(J-statistic)	0.0322
Resid unit root t-stat	-5.578	Prob (t-stat)	0.0000
Breusch-Godfrey S	2.175	Prob(BGSC F-stat)	0.1269
BPG Heterosced	0.4902	Prob(BPGH F-stat)	0.6909

Notes:
Instrument rank = 18.
LN is an acronym for natural logarithm.
Resid unit root t-stat is an augmented Dickey-Fuller t-statistic with MacKinnon p-values.
Breusch-Godfrey S and BGSC are acronyms for the Bresch-Godfrey serial correlation test.
BPG and BPGH are acronyms for the Bresch-Pagan-Godfrey heteroscedasticity test.

As hypothesized, the slope coefficient for real apartment rent variable, RENT, is positive. A 10 percent increase in real apartment rents is associated with a 0.4 percent price increase, but the computed t-statistic does not satisfy the 5-percent significance criterion. The parameter estimate for national housing prices, NHP, indicates that a statistically reliable link exists between that variable and single-family housing values in Las Cruces. That outcome is similar to what has been documented for the nearby El Paso housing market (Fullerton and Kelley 2008). For Las Cruces, a 10 percent increase in NHP leads to a 4.1 percent rise in local housing prices.

The next to last row in Table 3 summarizes the result of the Breusch-Godfrey serial correlation LM test (Asterious and Hall, 2016). The null hypothesis is that the residuals are not serially correlated. The computed F-statistic indicates that the null hypothesis fails to be rejected and that autocorrelation is not problematic at two lags for this equation.

The last row in Table 3 summarizes the outcome for a Breusch-Pagan-Godfrey heteroscedasticity LM test (Asteriou and Hall, 2016). The null hypothesis is that the residuals are homoscedastic. The computed F-statistic is relatively small, indicating that the null hypothesis fails to be rejected and that heteroscedasticity is not present in the equation residuals.

A final observation of the results summarized in Table 3 is warranted. Multicollinearity is present among the regressors. An eigenvector decomposition of the coefficient covariance matrix reveals that four of the six eigenvalues have condition numbers that are smaller than 0.001. That indicates that a substantial degree of multicollinearity is present among the regressors (Belsley, Kuh, and Welsch, 1980). An equation estimated using fewer explanatory variables is presented below.

As robustness checks, several additional specifications were also tested. Table 4 reports the estimation results for a specification that omits all of the regressors that have either low computed t-statistics or coefficient signs opposite of what is hypothesized. That expresses P as a function of only two explanatory variables, INC and NHP. The results in Table 4 indicate that a 10 percent increase in per capita income, INC, leads to single-family housing prices in Las Cruces to increase by 3.2 percent. A 10 percent rise in national housing prices, NHP, will precipitate a 3.5 percent escalation in single-family housing prices in Las Cruces. While not identical, these INC and NHP parameter estimate magnitudes are similar to those reported in Table 3.

Table 4: Reduced Form Equation GLS ARMAX Output for LN(P)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.1914	0.7883	5.3170	0.0000
LN(INC)	0.3203	0.1092	2.9345	0.0058
LN(NHP)	0.3504	0.1036	3.3811	0.0018
AR(1)	0.8379	0.0666	12.580	0.0000
AR(6)	-0.1906	0.0579	-3.2912	0.0022

R-squared	0.970	Mean dependent var	11.6418
Adjusted R-squared	0.967	S.D. dependent var	0.2222
S.E. of regression	0.0277	Sum squared resid	0.0275
J-statistic	14.209	Prob(J-stat)	0.0067
Resid unit root t-stat	-6.160	Prob(t-stat)	0.0000
Breusch-Godfrey S	2.510	Prob(BGSC F-stat)	0.0937
BPG Heterosced	0.3604	Prob(BPGH F-stat)	0.6994

Notes:
Instrument rank = 9.
LN is an acronym for natural logarithm.
Resid unit root t-stat is an augmented Dickey-Fuller t-statistic with MacKinnon p-values.
Breusch-Godfrey S and BGSC are acronyms for the Bresch-Godfrey serial correlation test.
BPG and BPGH are acronyms for the Bresch-Pagan-Godfrey heteroscedasticity test.

The next to last row in Table 4 summarizes the outcome for a Breusch-Godfrey serial correlation LM test (Asterious and Hall, 2016). The null hypothesis is that the residuals are not serially correlated. The computed F-statistic indicates that the null hypothesis fails to be rejected and that autocorrelation is not problematic at two lags for this equation.

The last row in Table 4 summarizes the result for a Breusch-Pagan-Godfrey heteroscedasticity test (Asteriou and Hall, 2016). The null hypothesis is that the residuals are homoscedastic. The computed F-statistics is relatively small, indicating that the null hypothesis fails to be rejected and that heteroscedasticity is not present in the residuals for this equation.

The specification shown in Table 4 is not very elaborate. That does not mean that it overlooks information relevant to housing price behavior in Las Cruces. The real per capita income variable, INC, provides and a good measure of local economic conditions. The real median national housing price, NHP, provides a measure of investment returns that affect housing purchases. It is also inversely correlated with the real mortgage rate, RM (Wilcox, 1990; Mikhed and Zemcik, 2009). Given the unexpected positive coefficient for RM in Table 3, the specification in Table 4 may work more reliably for out-of-sample forecasting purposes. Similar analyses for housing data from other small- and medium-sized markets will help determine whether these outcomes are unique to the Mesilla Valley or representative of what can be expected in general for this category of overlooked housing markets.

CONCLUSION

Las Cruces is the second largest metropolitan economy in New Mexico. In spite of that, the economy of Las Cruces, including the housing market, has not been very extensively researched. This is a plight that befalls many smaller urban economies, probably as a consequence of historical data constraints that are now starting to be overcome in many regions. To partially fill that gap in the applied economics literature, this study completes an econometric analysis of existing single-family home price fluctuations. A small-scale theoretical model is developed as the starting point for the analysis.

Parameter estimation of the reduced form price equation is accomplished using generalized least squares (GLS) analysis. Both equations estimated require autoregressive error correction via an autoregressive moving average exogenous GLS procedure (ARMAX). Results obtained shed light on the difficulty of modeling housing prices for small metropolitan economies like that of Las Cruces. The results do underscore the influences of local economic and national housing market conditions on housing prices in the Mesilla Valley.

The theoretical model developed does not address the impact of quality changes or new construction on median price fluctuations for a housing market like that of Las Cruces. Empirically modeling housing prices for small metropolitan economies is always difficult due to data constraints. This study offers one approach for completing at least partial assessments of housing price variations. To confirm overall usefulness, econometric analyses of other small- and medium-sized housing markets will be necessary.

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The authors of this publication are UTEP Professor & Trade in the Americas Chair Tom Fullerton and UTEP Border Region Modeling Project Associate Director & Economist Steven Fullerton. Dr. Fullerton holds degrees from UTEP, Iowa State University, Wharton School of Finance at the University of Pennsylvania, and University of Florida. Prior experience includes positions as Economist in the Executive Office of the Governor of Idaho, International Economist in the Latin America Service of Wharton Econometrics, and Senior Economist at the Bureau of Economic and Business Research at the University of Florida. Steven Fullerton has published research on Major League Baseball, the National Football League, and housing price fluctuations in Las Cruces.

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Professor Barraza is an award winning economist who has taught at several universities in Mexico and has published in academic research journals in Mexico, Europe, and the United States. Dr. Barraza currently serves as Research Provost at UACJ. Professor Fullerton has authored econometric studies published in academic research journals of North America, Europe, South America, Asia, Africa, and Australia. Dr. Fullerton has delivered economics lectures in Canada, Colombia, Ecuador, Finland, Germany, Japan, Korea, Mexico, the United Kingdom, the United States, and Venezuela.

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