The burden of property taxes on home appreciation: A relationship study between property taxes and home values in the U.S.

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ABSTRACT

This study adds to the body of research on the relationship between property taxes and home price appreciation. Distinct from other research, this study focus is on the property tax burden affecting appreciation. A tax per capita approach is used as a way to describe the burden on U.S. buyers as well as buyers by state. The study uses government data and other data from independent organizations. The primary period of interest is 2009-15, following the housing bubble and the great recession of 2008. The primary research question: Since the housing bubble, is there a relationship between the burden of property taxes per capita and property appreciation? This study concludes that there exists an inverse relationship between median values of homes and property taxes per capita.

The initial review of the relationship between property taxes and home price appreciation suggested that states with low property taxes tend to have higher appreciations. Following, the researchers tested a secondary question: Do high property tax per capita states have lower home appreciation growth rates, and vice versa? The researchers did not find a statistically significant relationship between property taxes and home price appreciations of median value homes by state. However, when using descriptive statistics, the tendency of this inverse relationship surfaced for some states and not for others.

The researchers acknowledge the complexity of the subject of home pricing as well as those of taxation. Therefore, the economic forces affecting home prices including taxation are explored and addressed.

Keywords: Property taxes, home prices, capitalization of home prices, home appreciation, burden of taxes, housing bubble, state and local revenue, housing crisis, housing transactional costs.

INTRODUCTION

This study expands the research on the relationship between property taxes and home price appreciation. In recent years, property owners have been stirring over high property taxes. The article that sparked this study, "Is there a link between property tax rates and the rate at which your home appreciates in value?" appeared in the Washington Post earlier this year (Ken Harney, 2018). The article was based on data produced by ATTOM Data Solutions (Daren Blomquist, 2018). However, the article focused on the property tax burden as a percentage of the estimated home value and is limited to 2017 values with two fixed periods of appreciation (one and five years). Whereas in this study, the property tax burden is in the form of a per capita approach and uses different sets of government data for the period following the housing bubble and its resulting aftermath.

Several couples from Illinois were the subject of a story entitled "Home is where the hurt is: How property taxes are crushing Illinois' middle class" (Austin Berg, 2015). The story appeared on December 17, 2015, on the website of an Illinois advocacy group (Illinois Policy). Mr. Berg reveals the following alarming data "Residential property taxes now eat up an average of 6.4 percent of a typical household income in Illinois. In 1990, that share was 3.6 percent" (p.3). For those property owners questioned, property taxes have become a "second mortgage" that they will never pay off even after paying off their first mortgage. More concerning is the question: Is the property appreciation rate being eaten up by its property taxes? In a period following the housing bubble and its subsequent bursting, compounded property tax rates appear to have exceeded those of property appreciation by twice when measuring the differences in their respective growth averages.

A few caveats are in order: The years studied were after the housing bubble and the great recession of 2008 in the U.S; the housing bubble is considered an aberration and caused financial and economic instability; after 2009 normalcy reappeared; for purposes in this study, a home, house, residential property, single-family dwelling, condos, or housing unit are used interchangeably to describe the same thing.

The property tax burden in this study is defined on a per capita basis, or the effective property tax burden per person. Accordingly, the research question for this study advanced to: Since the housing bubble, is there a relationship between the burden of property taxes per capita and property appreciation?

The initial review of the relationship between property taxes and home price appreciations suggested that the states with low property taxes tend to have higher appreciations. Therefore, the researchers decided to test a secondary question: Is there a relationship between per capita property taxes and home price appreciations by state?

The Background section of this paper provides a brief history of property taxation and reviews some fundamental economic forces that affect the price of homes. The Research Approach section provides the thought process and the metrics used. The Results section reveals the findings as well as provides an explanation of the tables and figures in this paper. The Conclusion provides the results of the research and provides a summary as well as other research needed on the subject matter.

BACKGROUND

History

Taxing property began originally to help fund national defense and subsequently to help pay for the Civil War (Larkin, 1988) and has evolved as a permanent source of income to both local and state government. However, "In the early 19th century, states began abandoning their property taxes just as they would in the early 20th century" (Wallis, 2001, p. 2). Wallis used marginal analysis in explaining this phenomenon: When the marginal benefits equal or exceed the marginal costs, the logical choice is to redirect the tax to where it is efficient. Essentially, he concludes that local governments are more efficient in providing benefits of public services to the voters than at the state level.

Over time, property taxes became the source for education funding because it was a reliable and immobile in nature of serving communities (Ronald C. Fisher, 2009) and because it supports what is considered a fundable need of society, the education of our children. The tie-in with real estate has made property taxes contemporary with inflation. Recently, questions of the effectiveness and inequities of primary/secondary schools, along with and support for private/charter schools and a school voucher system, have weakened its base. In addition, as states have received more federal assistance, the need for property taxation has reduced. However, the repeal of any tax system is near impossible, and even reducing them invokes a political battle.

One study by the Brookings Institute (Benjamin H. Harris, Brian D. Moore, 2013) declares "the burden of the property tax is substantial, making up about one quarter of homeownership costs at the median homeownership duration" (p. 1). By the turn of the century, property taxes became the domain of local governments and accounted for 76 percent of U.S. local government revenue (Anonymous, 2014, p. 1). In the third quarter of 2010, property taxes peaked as seen in Figure 1 of Appendix B. Most state governing bodies have accepted property taxes as being the purview of local government.

Several authors have attempted to influence policy decision makers by proposing models to predict the outcome of income tax legislation that affects housing. For example, Poghosyn suggests that "property taxation could be used as an important tool to dampen house price volatility" (Tigran Poghosyan, 2016, p. abstract). Harris (Benjamin H. Harris, 2013) proposes a discrete-period model that includes transactional costs in the price of housing with duration periods. The study provides a good review of the user-cost analysis and previous literature on the matter of tax proposals. However, like most authors, Harris makes several assumptions that are not static or independent of each other. For this reason, most proposed models may be limited in their predictive ability.

Basic Economic Forces at Play

When discussing the price and appreciation of housing, one has to invoke the economic forces affecting supply and demand. We know a price point is the intersection of these two forces, also known as the equilibrium level. The drivers of demand and supply are generally the number of participants, income, expectations, tastes and preferences, the price substitutes or alternatives (e.g. rent), technology, and taxes. While there may be other drivers, suffice to say that for this study property taxes are the focus. Additionally, economists use the concept of

"ceteris paribus," which means assuming all else remains the same. In this research, an attempt to address some of these drivers of supply and demand is made only to give a contextual framework and to warn the reader that many known and unknown forces are always at play when making declarative statements and using statistics to demonstrate a relationship.

We know that the price of a home is at the equilibrium point of demand and supply created by such factors as stated above. For example, the following can shift the supply and demand curve: a sudden growth or change in the buying population, the popularity of homeownership, a change in disposable income, a change in mortgage interest rates, legislative changes or taxation that change the expectations of buyers as well as sellers, or changes in the prices of substitutes or alternatives. The change resulting from these shifts as well as the elasticity of the supply and demand curves will determine the new equilibrium price. Changes may occur independently or concurrently making a price prediction uncertain. However, using the "ceteris paribus" concept, one may make short-term predictions. Related, policymakers often assume the supply of housing to be inelastic, thus simplifying the predictions of the price change focusing on shifts of the demand curve. Long-term effects are more challenging to predict, given the dynamic nature of most markets.

An example of how shifts in supply can change the price of a home is illustrated as follows: Anything that increases the cost to the supplier of the product (house builder) may increase the price the supplier is willing to sell it for in the market. Regulations account for approximately 25 percent of the final cost of a new home (Paul Emrath, 2011). An interesting fact is that over 8.6 percent of the price of the house "is the result of costs incurred by the builder after purchasing the finished lot" (p. 1) due to changes in the regulations. If one assumes that the demand of housing is perfectly inelastic, then one may conclude that the total cost will be passed on to the buyer, and the price will go up by the full cost.

Anything that affects the deductibility or benefits of owning a home may cause a shift in the demand curve. For example, reducing the deductibility of property taxes or mortgage interest would reduce the price of homes, ceteris paribus, because the demand curve would shift leftward. This is especially painful for the wealthy who bought high-value homes based on the deductibility of the mortgage interest and/or property taxes. The interest deductibility has been reduced under the new tax law by capping the mortgage loan amount at $750,000, along with a limit on State and Local Tax (SALT) deductions to $10,000. Further, the new doubling of the standard deduction reduces the benefit of itemizing one's tax deductions (Mark Zandi, 2018). Setting the principle of ceteris paribus to the side, an article posted in Forbes by a partner at Montage Ventures (Matthew Murphy, 2018), suggests that home ownership is much more than getting a tax break. He advocates that there are other benefits from the new tax law of 2018 that will encourage the purchase of homes by increasing disposable income and creating new jobs.

A research paper on tastes and preferences for homeownership (Rachel Drew, Christopher Herbert, 2012) found little evidence that preferences had changed post 2008. Millennials entering the housing market were expected to increase price via increased demand, however, millennials are less likely to own homes than their older generational counterparts. The millennials' paradox and preference on homeownership are further explored by several authors (Jung Choi, Jun Zhu, Laurie Goodman, Bhargavi Ganesh, Sarah Strochak, 2018) and (Doweell Myers, Hyojung Lee, Patrick Simmons, 2018).

The mortgage payment to income ratio is known to be an important determinant of housing demand. This ratio is created by adding the mortgage payment, taxes, and taking that sum over a person's income. Since the mortgage payment includes principal and interest, it

stands to reason that changing interest rates over a period of time will have an impact on the willingness of a buyer to purchase a home. As a related consideration, the price of the house will be determined in part by buyers that are qualified to make the purchase.

Low interest rates over a long time will increase the prices of homes. However, when the lending standards are lowered, and irresponsible behavior occurs at different levels--as coined by Alan Greenspan 22 years ago as "irrational exuberance" (Greenspan, 1996)--prices will skyrocket as they did from 2004-2007. Others argue that the housing bubble was not caused by unethical behavior and they seem to almost excuse it as "human nature" (Miller, 2010, p. 137). Others go to extensive means to explain the behavior of securitization managers as "bad incentives…as well as bad luck" (Ing-Haw Cheng, 2012, pp. abstract, 28).

Aside from interest rates, the buyer's income is considered in the qualifying ratio of the lending institutions, and thus increasing income (the denominator of the ratio) would create a lower ratio and help buyers qualify for a larger mortgage, or in this case, a higher priced house. Combined with income, expectations of all economic agents can play an important role in shifting both the demand and supply curves.

In 1978, California's Proposition 13 was the result of property owners' political revolt on the matter, and its storyline may prove to be a reminder that renewals of dissension may be stirring. History will reveal the effects of the new tax law on housing as well as studies on property taxes.

RESEARCH APPROACH

Some preliminary review of the literature was done to discover what had been written on the subject being studied, and preliminary statistical analysis was conducted to understand the relationship among the variables to be studied over time. This study surfaced a relationship between property taxes and property values. The results of the preliminary research gave support to another study by Byron Lutz (Lutz, 2008). Lutz concluded "that property tax revenues are quite responsive to changes in house values" (p. 568). However, they lag in administrative execution of assessment and collection by two years. It is not until the third year after changes in property values that tax collections appear in the local and state coffers. Figure 1 of Appendix B displays the lag between assessments and collections. The lag in collection depends on state and local government officials' reaction or lack thereof. This lag was not modeled in the statistical models, since to do so would significantly shorten the time series under consideration, and one would have to include years from the great recession, a time period which were excluded for reasons discussed below. In addition, both housing prices and property taxes appear to have stabilized after 2009 as seen in Figure 2 of Appendix B.

Both descriptive and inferential statistics were used to test the research questions using a computer statistical program (SPSS-version 22). The research questions include:

(1) Since the housing bubble, is there a relationship between the burden of property taxes and property appreciation?
(2) Do high property tax per capita states have lower home appreciation growth rates, and vice versa?

This study did not include data from the great recession, as the housing bubble was an aberration and caused great instability in the way markets work including creating a temporary

lower than normal collection of property taxes (see Figure 2 in Appendix 2 B). A conference paper presented at a forum by the Urban Institute and sponsored by the Lincoln Institute in 2017 stated that the municipal property tax revenue of the 91 largest cities dropped by 8.5 percent (Howard Chernick, Andrew Reschovsky, Sandra Newman, 2017) between 2007 and 2013. Prior to 2007, the property tax revenue had been climbing at a rate of 10 percent (Burtless, 2017). A more stable environment makes this study's findings more likely to be reliable.

Figure 2 in Appendix B was created from Table 1 in Appendix A, and Table 1 in Appendix A was created from two sources within the Federal Reserve Bank of St. Louis (Table S210400 and USSTHPI). However, the originator of these sources was the U.S. Bureau of Economic Analysis (Personal Current Tax Receipts). Please note that the property taxes are total receipts in the United States and not on a per capita basis. Also, the housing measurement is based on an index and not actual values. Both Figures 1 and 2 demonstrate why the period of 2009-2015 was used in the statistical analysis.

There is a plethora of literature on what caused the housing bubble and subsequent financial meltdown. Though testing the different theories is beyond the scope of this paper, Jeff Holt (Holt, 2009) provides four primary causes of the housing bubble resulting in financial fiasco. According to Mr. Holt, they were: "low mortgage interest rates, low short-term interest rates, relaxed standards for mortgage loans, and irrational exuberance" (abstract).

Some studies on the housing bubble suggests that the single most important spark that started it all was the new securitization formulation by the rating bureaus, mixing subprime debt obligations with prime obligations and creating a new investment instrument to sell investors. What followed was, irrational exuberance, "a heightened state of speculative fervor" (Shiller, 2005) by all parties in the mortgage process. This state of mind fueled the fire of financial destruction because the fundamentals of mitigating risk were abandoned. After 2009, the financial markets began to settle and returned to normalcy. Accordingly, the study's results cover this period.

RESULTS

Table 1 in Appendix A provides the compounded growth rates for the Property Taxes and Home Price Index in the U.S. over the period 2000-2018 and is illustrated in Figure 2 in Appendix B.

Table 2 in Appendix A provides the descriptive statistics for the means of the compounded growth rates of two variables, the medium value of single-family dwellings and condos (ATTOM Data Solutions) and the property tax per capita (Data Query System-Urban Institute-Tax Policy Center). The N is 51 for all states in addition to DC. To be noted is that the "mean" growth rate for the Property Tax per Capita is approximately half that of the "mean" growth rate for the median home values during the period of 2009-2015 (roughly, 1.5 percent versus 3 percent).

Table 3 in Appendix A provides the statistical correlation between the variables and provides the statistical significance when testing the variables as pairs. The key result, in answering the main research question, revealed a negative correlation (-0.444) and a statistically significant "p" value of 0.001 between the medium home value growth rate and property tax per capita growth rate for the period after 2009. In addition, a paired differences test suggests that rates of change differ from one another, and this is also a statistically significant result.

Table 4 in Appendix A provides a Pearson correlation matrix of the variables being measured. It confirms the negative correlation between variables as well as reaffirms the significant "p" value of 0.001. Figure 6 in Appendix B shows visually the differences among states in growth rates of property taxes and home values.

Table 5 in Appendix A provides a matrix table along with a Chi test that addresses the questions in the introduction section of this paper. Specifically, it addresses the notion that states having the highest tax per capita growth rate will have the lowest home appreciation growth rates over time. The table defines the relationship among the states in matrix form where the variables are divided into the lowest, middle, and highest categories to determine not only the statistical significance between the groups but their relationship to each other. The summary results are striking. The table shows that out of seventeen states having the highest appreciation (one-third of 51 states including Washington DC), nine states (Arizona, California, Colorado, Florida, Georgia, Indiana, Michigan, Nevada, and North Dakota) had the lowest growth rates of property taxes per capita. Five states came from the middle tax group followed by only three coming from the highest tax group.

Additionally, Table 5 in Appendix A reveals that out of seventeen states having the lowest appreciation, eight states (Arkansas, Maine, Massachusetts, Nebraska, New Mexico, New York, Pennsylvania, and Vermont) came from the highest tax group. Six states out the seventeen states with the lowest appreciation came from the middle tax group followed by only three coming from the lowest tax group.

Although one cannot conclude with statistical certainty that if a state is in the highest growth tax rate per capita that it will have a low growth rate of home price appreciation, the results do support the findings that there is a negative correlation between property tax growth per capita and home price appreciation.

Figure 3 and 4 in Appendix B graphically represent the Histograms of the compounded growth rates for the median home values and property tax per capita respectively. They appear to have normal distributions. Figure 5 in Appendix B graphically displays the "means" of the compounded growth rates of the variables used in this study. Notice the almost mirror image of the means between the two variables showing the inverse relationship. Figure 6 in Appendix B further depicts the inverse relationship showing the observations graphically with a linear line to visualize the pattern.

CONCLUSION AND RECOMMENDATIONS

The American dream of home ownership may well be in jeopardy with what may be called the permanent second mortgage, the property tax. Whether one uses the capitalization method or other methods, the projected cash outflows created by property taxes need to be factored in any models used in formulating projections. Otherwise, the property taxes may eat up the expected projections of property appreciations.

The main objective of this study was to test whether property taxes affect home price appreciation. An initial literature review was conducted and some databases were selected. Because the housing bubble created instability in financial markets, its consideration was of great importance and considered at depth. When applying several statistical methods, it was concluded that the research would concentrate on the period following the great recession. Consequently, for purposes of this study, the research targeted the period of 2009-2015 across 50 states and Washington DC. Because of the limited period of 6 years, the conclusions should be tempered.

However, they may spur further studies on the relationship between the property tax burden and home appreciation. The research question for this study became: Since the housing bubble, is there a relationship between the burden of property taxes per capita and property appreciation? This study concludes that there exists an inverse relationship between median values of homes and property taxes per capita for the period following the housing crisis and the great recession in the U.S. When more years of data are available to consider the lag between property assessments and collections, future studies will prove to be more conclusive.

The initial review of the relationship between property taxes and home price appreciations suggested that states with low property taxes tend to have higher appreciations. Therefore, the researchers tested a secondary question: Do high property tax per capita states have lower home appreciation growth rates, and vice versa? Though one cannot conclude with statistical certainty that this relationship exists, summary statistics support this notion. For example, nine states that had the highest growth rates of property appreciations had low growth rates of property taxes, only three states having the highest growth rates of appreciation also had the highest property taxes.

The researchers trust this brief study provides more insight to policymakers, builders, and real estate buyers seeking to create, deliver, and capture the American dream of homeownership. Further research would provide even more insight. Sincere thanks to the government and private agencies collecting the data necessary to make these studies possible.

REFERENCES

Anonymous. (2014). *The Property Tax Lag.* Federal Housing Finance Agency, US Census Bureau Survey of State and Local Government Finance. Washington DC: Open Gov, Inc. (U.S.). Retrieved August 3, 2018, from https://opengov.com/article/the-property-tax-lag

Austin Berg. (2015, December 17). Illinois policy.org/story. (D. Adam Schuster, Ed.) *Home is where the hurt is: How property taxes are crushing Illinois' middle class*. Retrieved August 15, 2018, from https://www.illinoispolicy.org/story/home-is-where-the-hurt-is-how-property-taxes-are-crushing-illinois-middle-class/

Benjamin H. Harris. (2013). *Tax Reform, Transaction Costs, and Metropolitan Housing in the United States.* Washington DC: Brookings Institute-Tax Policy Center. Retrieved from https://www.taxpolicycenter.org/sites/default/files/alfresco/publication-pdfs/412835-Tax-Reform-

Benjamin H. Harris, Brian D. Moore. (2013). *Residential Property Taxes in the United States.* Washington DC: Brookings Urban-Brookings Tax Policy Center. Retrieved August 13, 2018, from http://www.brookings.edu/research/residential-property-taxes-in-the-united-states

Burtless, G. (2017). *Drop in public investment picks up steam under GOP tax plan.* Washington DC: Brookings Institute. Retrieved August 31, 2018, from https://www.brookings.edu/blog/up-front/2017/12/06/drop-in-public-investment-picks-up-steam-under-gop-tax-plan/

Daren Blomquist. (2018, April 11). ATTOM Data Solutions. *ATTOM 2017 Property Tax Analysis-State-County-MSA-with Home Price Appreciation.XLSX*. Irvine, California, USA. Retrieved from https://www.attomdata.com/

Doweell Myers, Hyojung Lee, Patrick Simmons. (2018). *Resolving the Millennial Homeownship Rate Paradox.* FannieMae. Washington DC: Fanniemae Portal. Retrieved August 3, 2018, from http://www.fanniemae.com/portal/research-insights/perspectives/millennial-homeownership-paradox-myers-lee-simmons-050918.html

Greenspan, A. (1996, December 5). Speech: The Challenge of Central Banking in a Democratic Society. *Annual Dinner and Francis Boyer Lecture of The American Enterprise*. Washington, D.C., USA. Retrieved September 5, 2018, from https://www.federalreserve.gov/boarddocs/speeches/1996/19961205.htm

Harris, 2013 as cited by Benjamin H. Harris, Brian D. Moore. (2013). *Residential Property Taxes in the United States.* Washington DC: Brookings Urban-Brookings Tax Policy Center. Retrieved August 13, 2018, from http://www.brookings.edu/research/residential-property-taxes-in-the-united-states

Holt, J. (2009). A summary of the primary causes of the housing bubble and the resulting credit crisis: A non-technical paper. (U. V. University, Ed.) *The Journal of Business Inquiry, 8*(1), 120-129.

Howard Chernick, Andrew Reschovsky, Sandra Newman. (2017). The effect of the housing crisis on the finances of central cities. *forum on Housing Markets and the Fiscal Health of US* (p. 6). Washington DC: Urban Institute. Retrieved September 6, 2018, from https://www.urban.org/sites/default/files/the_effect_of_the_housing_crisis_on_the_finances_of_central_cities.pdf

Ing-Haw Cheng, S. R. (2012, April 1). *http://www.econ.yale.edu/~shiller/behfin/2012-04-11/Cheng_Raina_Xiong.pdf.* Retrieved September 1, 2018, from Yale University: http://www.econ.yale.edu/~shiller/behfin/2012-04-11/Cheng_Raina_Xiong.pdf

Jung Choi, Jun Zhu, Laurie Goodman, Bhargavi Ganesh, Sarah Strochak. (2018). *Millennial Homeownership, Why is it so low, and how can we increase it?* Washington DC: Urban Institute. Retrieved August 3, 2018, from https://www.urban.org/sites/default/files/publication/98729/millennial_homeownership.pdf

Ken Harney. (2018, April 18). *realestate/is there a link between property taxes and the rate at which your home appreciates in value?* Retrieved July 21, 2018, from Washingtonpost.com/realestate/: https://www.washingtonpost.com/realestate/is-there-a-link-between-property-tax-rates-and-the-rate-at-which-your-home-appreciates-in-value/2018/04/17/1a56806a-418d-11e8-8569-26fda6b404c7_story.html?noredirect=on&utm_term=.e8ced2b651e1

Larkin, J. (1988). The Reshaping of Everyday Life: 1790-1840. (Significance Features of the Property Tax). Cambridge, MA, USA: Lincoln Institute of Land Policy. Retrieved August 6, 2018, from http:/centers//datatoolkits.lincolninsti.edu/sub/significant-features-property-tax/state-by-state-property-tax-at-a-glance

Lutz, B. F. (2008). The Connection Between House Price Appreciation and Property Tax Revenues. *Nationl Tax Journal*(61(3)), 555-572. Retrieved July 22, 2018, from http://www.jstor.org/stable/41790463

Mark Zandi. (2018, January 4). Housing market could shift under new tax law. *Washington Post*, p. Real Estate Section. Retrieved September 4, 2018, from https://www.washingtonpost.com/realestate/2018/01/02/2e2ff048-efcc-11e7-b390-a36dc3fa2842_story.html?utm_term=.33ef8592d1b0

Matthew Murphy. (2018, July 19). How Will the New Tax Law Shake up the Housing Market? *Forbes*, p. Forbess Real Estate Council post. Retrieved September 2, 2018, from https://www.forbes.com/sites/forbesrealestatecouncil/2018/07/19/how-will-the-new-tax-law-shake-up-the-housing-market/#3d0cb2a871de

Miller, R. T. (2010). Morals in a market bubble. *University of Dayton Law Review, 35:1*, 113-137. Retrieved September 5, 2018, from https://udayton.edu/law/_resources/documents/law.../

Paul Emrath. (2011). *How Government Regulation Affects the Price of a New Home.* National Association of Home Builders, Economic and Housing Group. Washington D.C.: HousingEconomics.com. Retrieved August 3, 2018, from http://www.nahbclassic.org/generic.aspx?

Rachel Drew, Christopher Herbert. (2012). *Post-Recession Drivers of Preferences for Homeownership.* Boston: Joint Center for Housing Studies of Harvard University. Retrieved September 1, 2018, from http://www.jchs.harvard.edu/sitesR/default/files/w12-4_drew_herbert.pdf

Ronald C. Fisher. (2009, January 1). *What Policy Makers Should Know About Property Taxes.* Retrieved September 6, 2018, from Lincoln Institute of Land Policy: http://datatoolkits.lincolninst.edu/pubs/dl/1551_776_Article%202.pdf

Shiller, R. J. (2005). *Definition of Irrational Exurberance.* Princeton: Princeton University Press. Retrieved September 2, 2018, from http://www.irrationalexuberance.com/definition.htm

Tigran Poghosyan. (2016). *Can Taxes Reduce House Price Volatility?* International Monetary Fund. Washington DC: International Monetary Fund. Retrieved July 21, 2018, from http://www.imf.org/en/Publications/Search?series=IMF+Working+Papers&when=During&year=2016&title=Can+Property+Taxes+Reduce+House+Price+Volatility%3F&author=Poghosyan&subject=property+taxes

Wallis, J. J. (2001). *http://econweb.umd.edu/~wallis/MyPapers/PTFinal.pdf.* Retrieved August 31, 2018, from umd.edu: http://econweb.umb.edu/~wallis/MyPapers/PTFinal.pdf

APPENDIX A

TABLE 1. Compounded Growth Rates for Property Taxes and Home Price Index in the U. S. (2000-2018).

Compounded Growth Rates U.S. (2000-2018) Property Taxes and Home Price Index									
Date	Yr	S210400[1]	Δ Yr/Yr	Tx Base	CAGR PropTx	USS THPI[2]	HPI Base	Δ Yr/Yr	CAGR HPI
1/1/2000	0	4911		4911	0.00%	228.84	228.84		
1/1/2001	1	4984	2.61%	4911	0.07%	246.37	228.84	2.46%	0.37%
1/1/2002	2	5056	-0.92%	4911	0.14%	261.24	228.84	1.44%	0.63%
1/1/2003	3	5599	4.58%	4911	0.60%	278.13	228.84	1.22%	0.89%
1/1/2004	4	5710	-1.77%	4911	0.66%	298.50	228.84	1.56%	1.16%
1/1/2005	5	5982	2.94%	4911	0.83%	331.67	228.84	2.30%	1.56%
1/1/2006	6	6492	1.60%	4911	1.12%	366.32	228.84	1.59%	1.90%
1/1/2007	7	6868	1.31%	4911	1.30%	378.28	228.84	0.36%	1.95%
1/1/2008	8	6954	-0.27%	4911	1.30%	369.96	228.84	-0.72%	1.80%
1/1/2009	9	7331	2.26%	4911	1.44%	348.70	228.84	0.74%	1.52%
1/1/2010	10	7691	0.61%	4911	1.56%	324.11	228.84	-1.20%	1.21%
1/1/2011	11	7537	-1.17%	4911	1.44%	313.08	228.84	-2.74%	1.05%
1/1/2012	12	7374	-0.16%	4911	1.32%	308.04	228.84	-1.05%	0.96%
1/1/2013	13	7792	4.03%	4911	1.45%	314.91	228.84	0.53%	1.00%
1/1/2014	14	8345	0.49%	4911	1.62%	330.65	228.84	0.90%	1.12%
1/1/2015	15	8376	-0.14%	4911	1.58%	348.17	228.84	0.99%	1.24%
1/1/2016	16	8703	1.60%	4911	1.65%	366.65	228.84	0.94%	1.36%
1/1/2017	17	9102	0.85%	4911	1.73%	388.19	228.84	1.04%	1.48%
1/1/2018	18	9405	0.71%	4911	1.77%	413.88	228.84	1.21%	1.61%
Source: Valadez, R. & Smith, D.M. (2018) Adapted from FRED Table S210400 and USST HPI Retrieved September 5, 2018									
[1] https://fred.stlouisfed.org/series/S210400 [2] https://fred.stlouisfed.org/series/USSTHPI									

TABLE 2. Means Comparison of the Compounded Growth Rates of the Median Home Values and Property Taxes per Capita (2009-2015)

Frequency Statistics			
		PropertyTax per Cap CAGR0915	MedianValHse CAGR 0915
N	Valid	51	51
	Missing	0	0
Mean		.015353	.029251
Std. Error of Mean		.0026225	.0035964
Median		.019900	.025700
Mode		.0204[a]	.0227[a]
Std. Deviation		.0187285	.0256836
a. Multiple modes exist. The smallest value is shown			

TABLE 3. Paired Samples Test

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PropertyTax per Cap CAGR0915 & MedianValHse CAGR 0915	51	-.444	.001

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			

Pair 1	PropertyTax per Cap CAGR0915 - MedianValHse CAGR 0915	-.0138980	.0379095	.0053084	-.0245603	-.0032358	-2.618	50	.012

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PropertyTax per Cap CAGR0915	.015353	51	.0187285	.0026225
	MedianValHse CAGR 0915	.029251	51	.0256836	.0035964

TABLE 4. Correlations of Property Taxes per Capita and Median Home Values (2009-2015)

Correlations

		PropertyTax per Cap CAGR0915	MedianValHse CAGR 0915
PropertyTax per Cap CAGR0915	Pearson Correlation	1	-.444**
	Sig. (2-tailed)		.001
	Sum of Squares and Cross-products	.018	-.011
	Covariance	.000	.000
	N	51	51
MedianValHse CAGR 0915	Pearson Correlation	-.444**	1
	Sig. (2-tailed)	.001	
	Sum of Squares and Cross-products	-.011	.033
	Covariance	.000	.001
	N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 5. Crosstabs Tables

States * Percentile Group of PTCap0915CAGR * Percentile Group of MedVal0915CAGR Crosstabulation

	States	Property Tax / Cap Rank Lowest	Middle	Highest	Total		States	Property Tax / Cap Rank Lowest	Middle	Highest	Total		States	Property Tax / Cap Rank Lowest	Middle	Highest	Total
Lowest Appreciation Group	Alabama	1	0	0	1	Middle Appreciation Group	Alaska	0	0	1	1	Highest Appreciation Group	Arizona	1	0	0	1
	Arkansas	0	0	1	1		Hawaii	0	1	0	1		California	1	0	0	1
	Connecticut	0	1	0	1		Idaho	0	0	1	1		Colorado	1	0	0	1
	Delaware	0	1	0	1		Iowa	0	0	1	1		DC	0	1	0	1
	Illinois	0	1	0	1		Louisiana	0	0	1	1		Florida	1	0	0	1
	Kansas	1	0	0	1		Mississippi	0	0	1	1		Georgia	1	0	0	1
	Maine	0	0	1	1		Missouri	1	0	0	1		Indiana	1	0	0	1
	Maryland	0	1	0	1		New Hampshire	0	0	1	1		Kentucky	0	0	1	1
	Massachusetts	0	0	1	1		North Carolina	1	0	0	1		Michigan	1	0	0	1
	Nebraska	0	0	1	1		Ohio	0	1	0	1		Minnesota	0	1	0	1
	New Jersey	0	1	0	1		Oklahoma	0	1	0	1		Montana	0	1	0	1
	New Mexico	0	0	1	1		Oregon	0	1	0	1		Nevada	1	0	0	1
	New York	0	0	1	1		Rhode Island	0	1	0	1		North Dakoda	1	0	0	1
	Pennsylvania	0	0	1	1		South Carolina	1	0	0	1		South Dakoda	0	0	1	1
	Vermont	0	0	1	1		Utah	0	1	0	1		Tennesse	0	1	0	1
	Washington DC	0	1	0	1		Virginia	1	0	0	1		Texas	0	1	0	1
	Wisconsi	1	0	0	1		Wyoming	1	0	0	1		West Virginia	0	0	1	1
	Total	**3**	**6**	**8**	**17**		**Total**	**5**	**6**	**6**	**17**		**Total**	**9**	**5**	**3**	**17**

Source: Valadez, R. & Smith, D.M. (2018) SPSS Statistical Output September 20, 2018 using data from ATTOM Data Solutions and Data Query System (DQS) Urban Institute Retrieved September 6, 2018 from https://slfdqs.taxpolicycenter.org/pages.cfm

APPENDIX B

FIGURE 1. Property Tax Collections Lag Housing Market Fluctuations

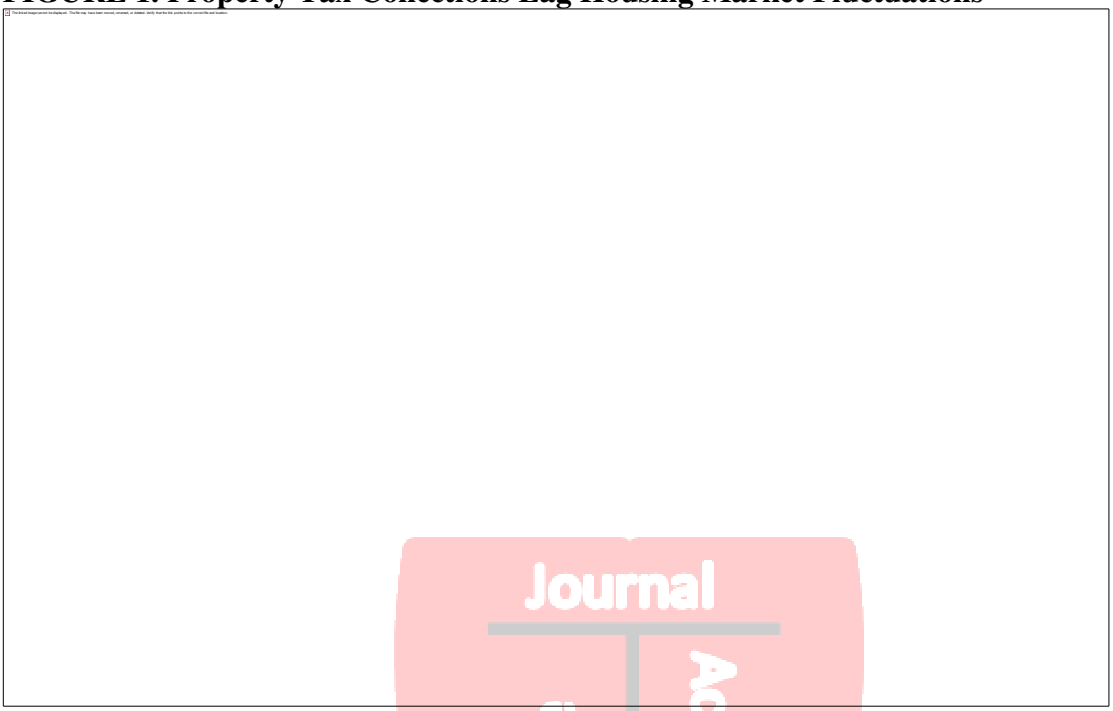

FIGURE 2. Compounded Growth Rates of Property Taxes and the Housing Price Index in U.S. from 2000-2018

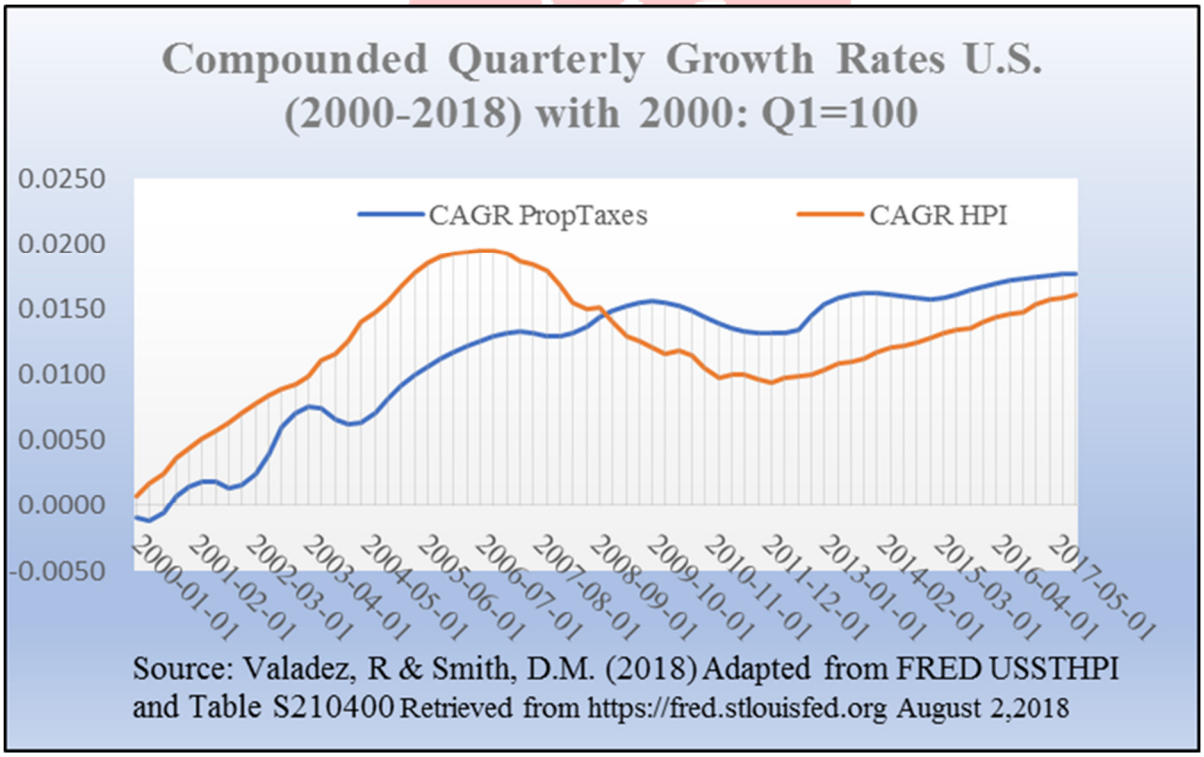

FIGURE 3. Data Histogram of the Compounded Growth Rate of U.S. Median Home Values (2009-2015)

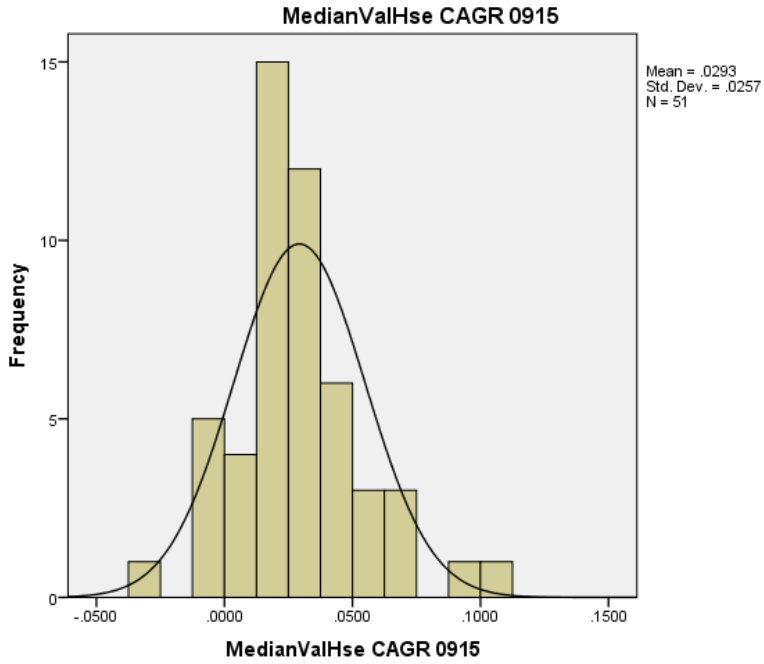

FIGURE 4. Data Histogram of the Compounded Growth Rate of U.S. Property Taxes per Capita (2009-2015)

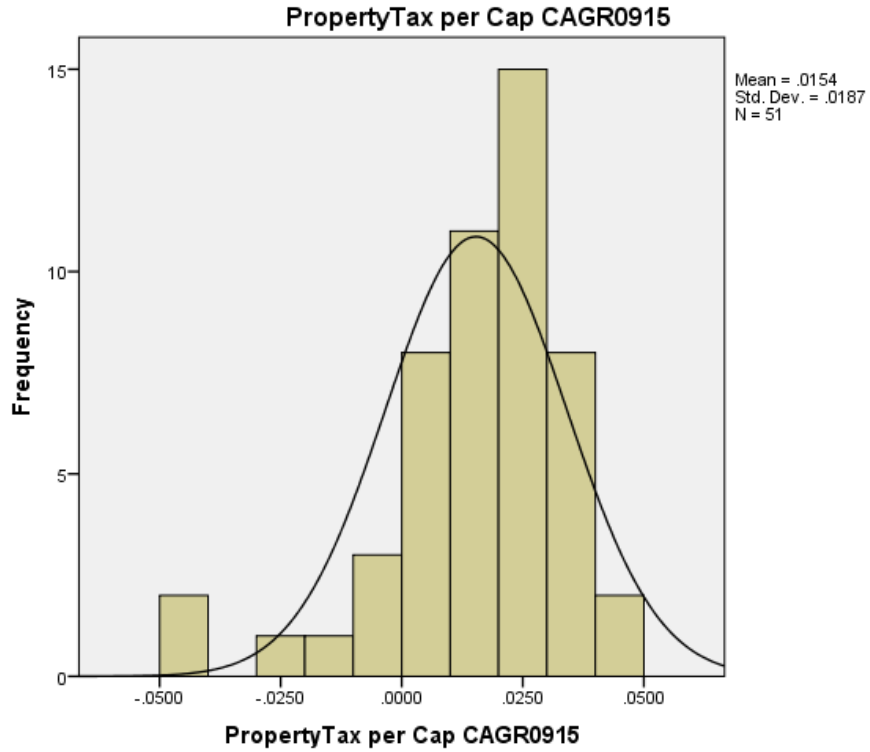

FIGURE 5. Means Comparison of Compounded Growth Rates of U.S. Median Home Values and Property Taxes per Capita (2009-2015)

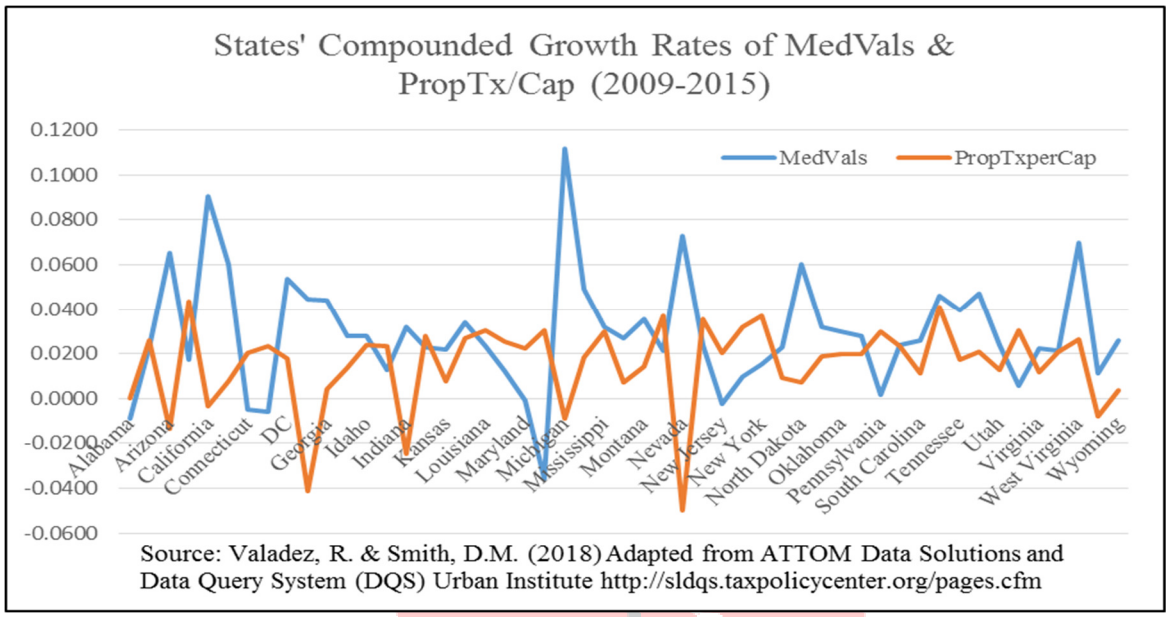

FIGURE 6. Curve Fit Compounded Growth Rate of U.S. Property Taxes per Capita & Median Home Values (2009-2015)