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The Effects of Demographics on the Real Estate Market in the United States and China

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Abstract

This paper focuses on the demographic and economic factors that affect the changes in prices of the housing market. The study focuses on the United States housing market after its recent collapse due to the US financial crisis of 2008. It also looks at the Chinese housing market based on the determinants that are observed in the United States. It will also examine the after effects of the One Child Policy enacted in 1979 on the housing prices. The study will look at the current situation with the Chinese housing market and its similarities to the United States housing market before the US financial crisis.

The study uses data from the United States Federal Bank of St. Louis' Federal Reserve Economic Database (FRED) in a regression analysis to find the determinants of the National Composite Home Price Index for the United States, which tracks housing price fluctuation. The factors used are GDP, CPI, Supply of Homes, Real Median Income, Age Group "15-64", Unemployment Rate, Mortgage Debt Outstanding, and Higher Education (Bachelor's Degree or higher).

The results show that working age population of "15-64" is statistically significant in the change of housing prices. Using the model, we will forecast the housing prices in the year 2030 and 2050. The study will also explore the options for the United States and Chinese government to maintain a healthy and transparent housing market.

Introduction

During the beginning of the 1960's, the People's Republic of China had a growing population of 600 million people. In the aftermath of a famine and the Cultural Revolution, the growing Chinese population was becoming a major issue. The government felt that the economy was not able to support the massive population, and thus began the propaganda campaign to encourage the use of contraception. It was not until 1979, when China created and enacted the One Child Policy. The policy included government forced abortions and sterilizations, which successfully prevented millions of births.

Now 30 years later, the effect of the One Child Policy has successfully limited the population growth and created a rising economy. The new concern that stands is that as the Chinese workers age and head to retirement, many cities will experience an outflow of population as well as declines in output of production. With the demographics of the labor supply rapidly aging, the economy will likely have lower production output levels. This raises the questions of how it would affect the economy and the housing prices.

In the recent years, the Chinese government closely monitored what seems like a growing real estate bubble in the economy. According to the *New York Times*, "China's unrelenting real estate boom has driven housing prices up by 140 percent nationwide since 2007, and by as much as 800 percent in Beijing over the past eight years"[1]. In addition, many cities have built massive houses and malls, but they end up as ghost towns because of the astronomical prices compared to the average income level. While construction of the real estate as well as their prices continues to rise, the demographics might play a huge role in the sustainability of what seems like a real estate bubble.

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[1] Source: New York Times (April 11th, 2014)

Meanwhile, across the globe the United States has gone through the fears of the Chinese housing bubble. After the massive collapse of the United States real estate bubble in 2008, the health of the housing market has been a relevant factor in the global economic recovery. As the housing market recovers, there is a sense of stability in the economy and investors expectations. Much like China, the US demographics are also shifting; many of the baby boomers are aging and heading into retirement. As demographics change the US will have a smaller workforce and the overall production will decline. Investments in the real estate market might be slowing down as the shifts in demographics continue even during a period of economic growth. This could mean disasters in the financial economy once again.

This paper will investigate the impact of demographics and economic factors on the real estate market and the overall economy in the United States and in China. It will address the economic repercussions of the One Child Policy and its effects on the Chinese housing market in the long run. In addition, the paper will look at the similar demographic changes in the United States and its effects on the housing market. It will also forecast changes on US housing prices in the future based on expected demographic and economic fluctuations. Finally, the study will evaluate the potential policies these countries could implement to maintain a stable economy even with the demographic and economic shifts.

Literature Review

One of the earlier works on demographic patterns on the real price of housing is by Mankiw and Weil (1989) where they concluded that demographics plays a major role in the fluctuations of real estate prices. Mankiw and Weil (1989) sampled 203,190 individuals from the 1980 United States Census data and found that the age specific housing demand reaches its apex at the age of 40. They also found that a major part of the housing demand is made up of those between the ages of 20 to 30. Researchers in various countries replicated the study and it was heavily criticized due to the varying results in each country. Ohtake and Shintani (1996) replicated Mankiw and Weil's (1989) study using Japanese data and found that demographics had no significant effect on the determination of house prices. They concluded that housing prices were price elastic, and demographic shifts only affect the short run housing prices. Similarly, DiPasquale and Wheaton (1994) replicated the study and found that real per-capita income was an important factor on real estate demand. They concluded that the negative shocks, including demographic shifts and the real estate demand was negated in the long run because the supply of housing is price elastic. Atkin and Myers (1994) made a major break through after following the housing demand over a 30-year period. They concluded that housing demand continues to rise until the age of 70 instead of the age of 40, as previously concluded by Mankiw and Weil (1989). This could imply that the baby boomers rapid retirement might not have a significant effect on the housing market. Similarly, Green and Hendershott (1996) found a correlation between education and the housing consumption after the age of 40. This would suggest that with higher education and higher levels of lifetime income, the housing market would not be significantly affected by the baby boomer generation heading to retirement.

Fortin and Leclerc's (2000) study had researched the demographic and non-demographic factors that contributed to the changes in the Canadian real housing prices. They were also concerned with the fact that the Canadian baby boomer generation is aging and heading to retirement soon. As we see, some studies hypothesized that the shift in demographics would directly cause real estate prices to fall because of the diminishing number of buyers. Others believed that demographics have very little or no effect on real estate prices. Fortin and Leclerc (2000) concluded that the real estate prices would not be significantly affected by demographic shifts, since the shift in real per capita income would be enough to offset any negative effects in the market.

They formulated a housing demand model to examine the shocks of demographics and found that the "25-54" age group had the greatest impact on housing demand during 1958-1997. The model shows that both the economic and demographics factors played a role in the fall in real prices in the 90's. Specifically, the economic downturn caused a 35% decline in the housing prices. On the other hand, the slow growth in the age group "15-54" contributed only 20% in the decline in the housing prices. Fortin and Leclerc (2000) concluded that the economic downturn had a greater impact on the decline in housing prices, than the demographic factor. Finally, they determined that the housing prices would rise if the real income level begins to rise. They argued that macroeconomic fluctuations, the slow growth rate of real income, economic recessions, and a substantial rise in interest rates would cause the housing prices to temporarily fall.

Based on the Fortin and Leclerc's (2000) results, we can hypothesize that the effects of demographics on unregulated population fluctuations, such as the United States, would have a minor impact on housing prices. In the situation for China, with a highly regulated population growth, we might see a more significant impact on the housing prices. In addition, there are the

growing concerns of a housing bubble in the Chinese real estate market. In order to examine the impacts of demographics on the housing prices, we will create a model base on the United States to determine the factors that affect the housing prices. We will use the model to forecast the potential trends of the real estate prices in the United States in the future. We will also examine the implications of demographic and economic shifts on the Chinese housing market.

Methods

We will examine economic factors, as well as, the demographic fluctuations to observe the impacts on housing prices. Due to data constraints we will only examine the quarterly data between the years 1992 and 2012 for the United States in order to observe the impacts of demographics and economic factors on the changes on the housing prices. The lack of data for the Chinese economy does not provide us with a clear picture of the housing market. However, we will study the Chinese housing market qualitatively based on the quantitative analysis on the United States housing market.

Fortin and Leclerc's (2000) study shows that the changes in the age group "15-54" would have a larger effect on the housing prices than the "54 and up" age group. In addition, Atkin and Myers (1994) found that housing demand continues until the age of 70. Therefore we will examine the percent change in the age group "15-64". Fortin and Leclerc (2000) formulated a housing demand model to examine the shocks of demographics. A housing stock logarithm was used to estimate the demand for houses and it consists of various factors in the market. They estimated the real housing prices using a measure calculated as the average Multiple Listing Service (MLS) divided by the Consumer Price Index. They used Statistics Canada to measures the stock of houses. Income was calculated as real GDP divided by population over 15 years old. Based on their study, we also examine the changes in average income of the people to gain a better understanding of their ability to purchase homes. Green and Hendershott (1996) concluded that income and education are important factors in the housing markets. Thus, we will also include the change in the population with higher education (bachelor's degrees and higher) over the same period.

To factor in the economic fluctuations, we will use the percent change in GDP, the percent change in consumer price index, and the percent change in unemployment rates. For a better understanding of the housing market, we will specifically look at the percent change of supply of homes, and the percent change in mortgage debt outstanding.

Using a regression analysis we can examine the impacts of each variable on the change in National Composite Home Price Index for the United States, which tracks the housing price fluctuations. The regression analysis will also allow us to forecast the future changes in the housing prices as we extrapolate the variables based on our future expectations on the economic and demographics fluctuations.

The basic model is as follows:

$$\Delta P_{it} = \Delta\beta_0 + \Delta\beta_1 Y + \Delta\beta_2 K + \Delta\beta_3 S + \Delta\beta_4 W + \Delta\beta_5 A + \Delta\beta_6 F + \Delta\beta_7 D + \Delta\beta_8 E + C_{it}$$

Where:

$P = The\ National\ Composite\ Home\ Price\ Index\ for\ the\ United\ States$

$Y = Gross\ Domestic\ Product$

$K = Consumer\ Price\ Index$

$S = Supply\ of\ Homes\ in\ the\ United\ States$

$W = Real\ Median\ Income\ in\ the\ United\ States$

$A = Age\ group\ "15\text{-}64"$

$F = Unemployment\ Rate$

$D = Mortgage\ Debt\ Outstanding$

$E = Education\ of\ Bachalor's\ degree\ or\ higher$

Data

There were 81 observations for each variable between the years 1992-2012 used in the

model. The summary statistics are as follows:

Table 1. Summary Statistics

		Housing Price Index (%)	GDP (%)	Income (%)	CPI (%)	Supply of Housing (%)	Unemployment (%)
N	Valid	81	81	81	81	81	81
	Missing	16	16	16	16	16	16
Mean		.6864	1.1654	.1786	.6210	.0074	5.3531
Median		.8000	1.2000	-.1000	.7000	.0000	4.8000
Minimum		-5.60	-2.00	-3.60	-2.30	-18.90	3.40
Maximum		4.70	2.50	3.60	1.50	20.80	9.20

		Mortgage Debt Outstanding (%)	Age15 to 64 (%)	Education (%)
N	Valid	81	81	81
	Missing	16	16	16
Mean		1.5333	.2704	-.0988
Median		1.6000	.3000	.0000
Minimum		-1.60	-.20	-1.40
Maximum		3.70	1.30	.90

These tables show the summary statistics including number of samples (N), mean, median, minimum, and maximum of each variable used in the model.

The source of data comes from The United States Federal Bank of St. Louis' Federal

Reserve Economic Database (FRED), but each factor is provided by various sources. The

National Composite Home Price Index for the United States is from Standard and Poor's Case-

Shiller Home Price Index. The Home Price Index tracks the changes in the housing prices. The

Gross Domestic Product (GDP) factor is provided by the U.S. Department of Commerce: Bureau

of Economic Analysis. The Consumer Price Index (CPI) and the age group "15-64" is from the Organisation for Economic Co-operation and Development. The Supply of homes in the United States and real median Income in the United States is provided by the U.S. Department of Commerce: Census Bureau. The Unemployment rate and the Education of Bachelor's Degree or higher are from the U.S. Department of Labor: Bureau of Labor Statistics. Finally, Mortgage debt outstanding is from the Board of Governors of the Federal Reserve System.

Results

First we run t-tests for each variable in the model to examine the variable's significance in the model. Variables with a p-value greater than the 10% threshold will be considered insignificant in our model, and will be removed from the analysis.

Table 2. T-test Full Model

Model	Unstandardized Coefficients		t	Sig. (P-value)
	B	Std. Error		
(Constant)	-6.640	1.190	-5.579	.000
GDP	.914	.292	3.128	.003
Income	.171	.114	1.506	.136
CPI	-.124	.356	-.349	.728
Supply of Housing	-.048	.020	-2.377	.020
Unemployment	-.677	.171	3.968	.000
Mortgage Debt Outstanding	1.309	.190	6.888	.000
Age15to64	2.664	.915	2.911	.005
Education	.421	.294	1.433	.156

This table summarizes the t-tests and p-values of each variable in the model. It will show us the variables that are insignificant in the model.

The t-test in Table 2 shows that the CPI has a p-value of 72.8%, which means it has very little significance in our model and should be removed. After removing CPI, we run the t-test again to reexamine the significance of the variables in the reduced model. We find that education is above the 10% threshold and needs to be removed as well.

Table 2.1 T-test Parsimonious Model

Model	Unstandardized Coefficients			t	Sig.
	B	Std. Error	Beta		
(Constant)	6.820	1.153		-5.914	.000
GDP	.930	.250	.296	3.715	.000
Supply of Housing	-.046	.020	-.167	-2.248	.028
Unemployment	-.684	.167	.522	4.106	.000
Mortgage Debt Outstanding	1.300	.188	.826	6.906	.000
Age15 to 64	2.707	.916	.219	2.956	.004
Income	.195	.107	.154	1.812	.074

This table summarizes the T-tests and p-values of each variable in the parsimonious model. We have excluded CPI and Education due to its lack of significance in the model. This will reexamine the variables in the model and determine its significance in the model.

As shown in Table 2.1, the removal of CPI and education from the model provides a model where all the variable's p-values are below the 10% significance level. The parsimonious model has six factors and is as follows:

$$\Delta P_{it} = \Delta\beta_0 + \Delta\beta_1 Y + \Delta\beta_2 S + \Delta\beta_3 F + \Delta\beta_4 D + \Delta\beta_5 A + \Delta\beta_6 K$$

Next, we look at the overall significance of the model, and how well the model explains the data. We look at the coefficient of determination and run an Analysis of Variance (ANOVA) f-test to examine the significance of the overall model.

Table 3. Coefficient of Determination (r^2)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.793[a]	.628	.604	1.35989

The table summarizes the r^2 and adjusted r^2 of the Parsimonious model, which shows how well the model explains the data.

Table 4. ANOVA F-Test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	234.557	5	46.911	25.367	.000[b]
Residual	138.698	75	1.849		
Total	373.255	80			

This table examines the ANOVA f-test, which determines the impact of the independent factors on the dependent factor.

As seen in Table 3, the coefficient of determination explains that 62.8% of the variation in the Housing Price Index can be attributed to the factors GDP, Supply of Housing, Unemployment, Mortgage Debt Outstanding, and the Age group "15 to 64". We examine the r^2 with adjusted r^2, which takes into account missing data, deleting, adding data, and adding or removing independent factors. The adjusted r^2 is 60.4%, so there is a 2.4% difference between r^2 and adjusted r^2. This shows that 2.4% of the data is lost with the use of these factors. The ANOVA f-test gives a p-value of 0% in Table 4, which suggests that at least one of our factors' mean is not equal to zero. This also implies that our model is a decent fit for our data and can be used for forecasting. The parsimonious model is as follows (derived from table 2.2):

$$\Delta P = -6.82 + 0.93Y - 0.046S - 0.684F + 1.30D + 2.707A + 0.195K$$

Analysis

As depicted by the model, a country's economic factors play a role in the housing prices. The GDP has a slight impact on the prices of homes since a growing GDP means a growing economy. The state of the economy tends to influence people to spend or save. When the economy is growing, people are more willing to purchase homes and banks are more willing to lend. For a 1% change in GDP there is a 0.93% increase in the housing prices. Similarly to Fortin and Leclerc's (2000) conclusions, macroeconomic factors have an impact on housing prices. Economic downturn and economic prosperity would affect the housing prices. As fundamental economics suggests the more supply of homes the lower the prices of the homes. A 1% increase in the supply of homes would mean a 0.046% decrease in the housing prices. There is a slight change in prices when the unemployment is higher; a 1% increase in unemployment leads to a 0.684% decrease in housing prices. The mortgage debt outstanding also plays a factor in the housing prices. For every 1% increase in debt outstanding the housing prices rise by 1.30%. With more mortgage debt this would signify a higher demand for housing, which would raise prices. More importantly, as the model suggests the demographics of the working age population play a statistically significant role in the changes of the housing prices. A 1% increase with the people between the ages of "15-64" causes a 2.707% increase in the housing prices. Lastly, a 1% increase in the income level cause a 0.195% increase in housing prices. As concluded by Fortin and Leclerc's (2000), this age group is the main demanders of housing and has the greatest impact on prices.

Impacts

The last part of the American baby boomer generation of 1946-1960 has almost come to the end of their working careers. In the next few years the number of people heading to retirement will skyrocket. As seen in Graph 1, the growth rate of the working age group has been stagnating and will begin a decline. In 2012, there is only a 0.42% growth in the working age group relative to a 0.76% growth in the previous year. The echo boomer generation (generation between 1980's-2000's) has been distressed by the recent housing market collapse. They would be less inclined to invest in the still unstable housing market. As the baby boomer generation begin their retirement and sell their houses, there will be an excess in supply and lack of demand.[2] In the year 2030, if the trend continues as shown in Graph 1 and Table 5, then the age group will increase by 0.694%.

Based on the projected economic and demographic variables in Table 5, we examine the forecasted housing prices using our model. The model examines the economy in a linear business model, rather than the pro-cyclical business model. It also reflects many of the financial issues experienced by the United States during the subprime mortgage crisis. Nonetheless, in 15 years, if the economic and demographic trends continue then there will be a 3.82% decrease in the housing prices. This may seem insignificant, but if we look towards 2050 the model forecasts a 14% decrease in housing prices. Historically housing prices tend to rise so a decrease in the housing prices may indicate that the current economic and demographic fluctuations will lead to another economic downturn. However, all things being equal, a 1% increase in the working age population would cause a 2.707% increase in housing prices. With a steady working age population, growth in the housing market would not suffer too much

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[2] Source: NPR (June 21, 2011)

volatility. Pew Research has projected a 28.52% increase in the working age population by 2050, which could mean that there will be a steady increase in housing prices in the next 35 years, ceteris paribus. However, this would mean that financial crisis must be avoided and the United States government has to pose stricter regulations to prevent another crisis. In 2008, due to the spread of subprime mortgages and the lack of financial transparency with shadow banking the real estate market collapsed. We see in graph 2, the mortgage debt increase exponentially beginning in 2000. The debt peaked over $60 million in 2008. Since there was a growth of subprime mortgages, this put banks and the housing market in a dangerous position. Banks were giving out credit to almost anyone, regardless of their income levels. The availability of credit, as depicted in Graph 2, and the loosening of regulation was one of the major factors that contributed to the United States subprime mortgage meltdown.

Much like the United States crisis, China is facing a similar housing market issue. However, the United States has a relatively stable working age population fluctuation, but if it were to decrease dramatically then we would see a more significant dive in the housing prices. As seen in Graph 1, the change in Chinese working age population is extremely volatile. China's population might experience a decline as early as 2035, and it is projected that 31% of the population will be older than 60.[3] As our model suggests, a sharp decline in population will pull housing prices down. However, Chinese cities are facing huge increases in housing prices, and it is forming a housing bubble. Much like during the growth of the American housing bubble, the Chinese government encouraged a credit boom in 2009. This gave birth to massive amounts of real estate construction projects, which contributed to China's 45% growth in GDP in the past

[3] Source: Smithsonian (August 2010).

five years.[4] The availability of cheap credit and the growth of shadow banking led to a lack of transparency in the housing market. As the model suggests, a growth in GDP leads to a 0.93% increase in housing prices, and debt outstanding leads to a 1.30% increase. The huge growth of supply of homes will lead to a 0.046% decrease in prices. This suggests that the continued growth of cheap credit will allow the housing market to continue to expand.

The economic growth comes from the continual construction of towns and cities. These cities have grown so large that some of them are like ghost towns without any people living in them. Although real estate in China seems like a senseless investment, the middle class feels that real estate is the safest investment since housing prices continue to rise above inflation. As a result, "a typical apartment in Shanghai costs about 45 times the residents average annual salary".[5] This has prompted the Chinese government to pass a law in 2011 that prevents people from purchasing more than one home. This caused massive issues with the demand for homes. Therefore the constructions and the real estate development slowed down to a point where buildings are left half finished. This caused the GDP and the housing supply to fall. As the model suggests housing prices will fall 0.93% as the GDP decreases by 1%. As the value of the real estate decreases, the owners are still obligated to pay the mortgage payments that remain fixed. Much like during the United States subprime mortgage crisis, owners might begin to default on their loans as they see the value of the home decrease significantly.

The collapse of the financial markets would cause a financial disaster in China. As the government is working to tame the bubble, the changing demographics from the One Child Policy are likely to take effect. When the working age population begins to fall it would have a significant impact on the expanding housing bubble. The smaller working population would

[4] Source: New York Times (March 24th 2014).
[5] Source CBS News (March 3rd 2013).

mean less demand for homes and lower prices. This would prompt loan defaults and the

beginning of another financial crisis.

Graph 1. Percent Change in Working Age Group

Working Age Population
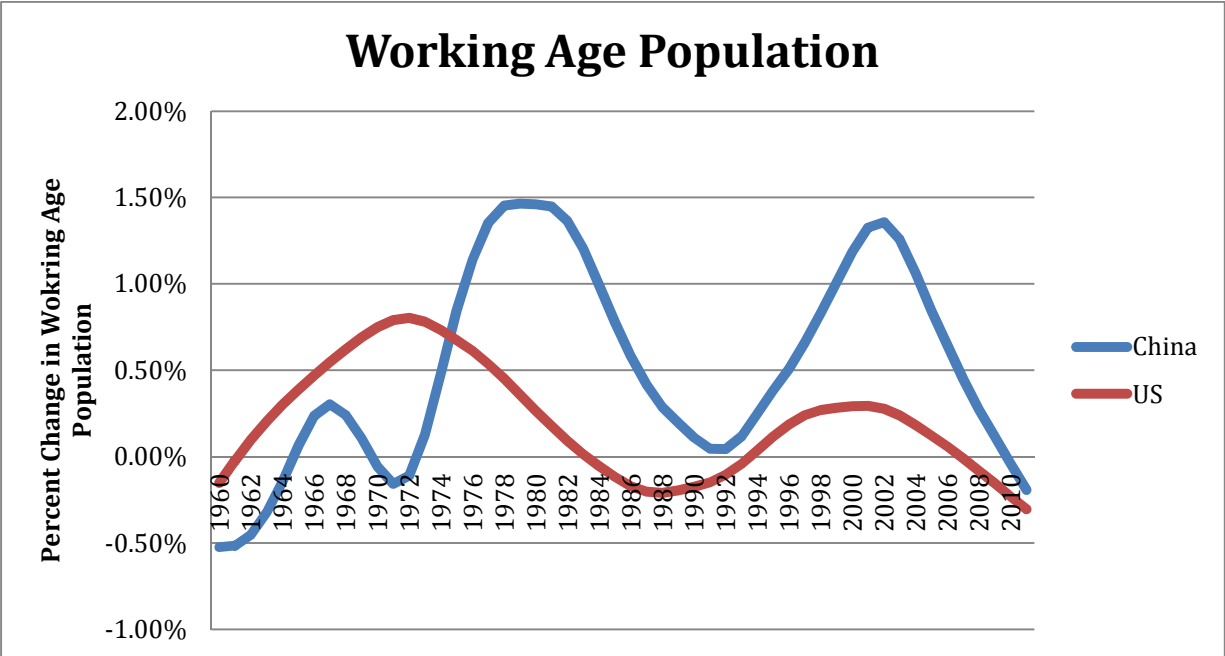
This graph shows the percent change of the working age population in the United States and China between 1960 and 2010.

Graph 2. Mortgage Debt

Mortgage Debt Outstanding
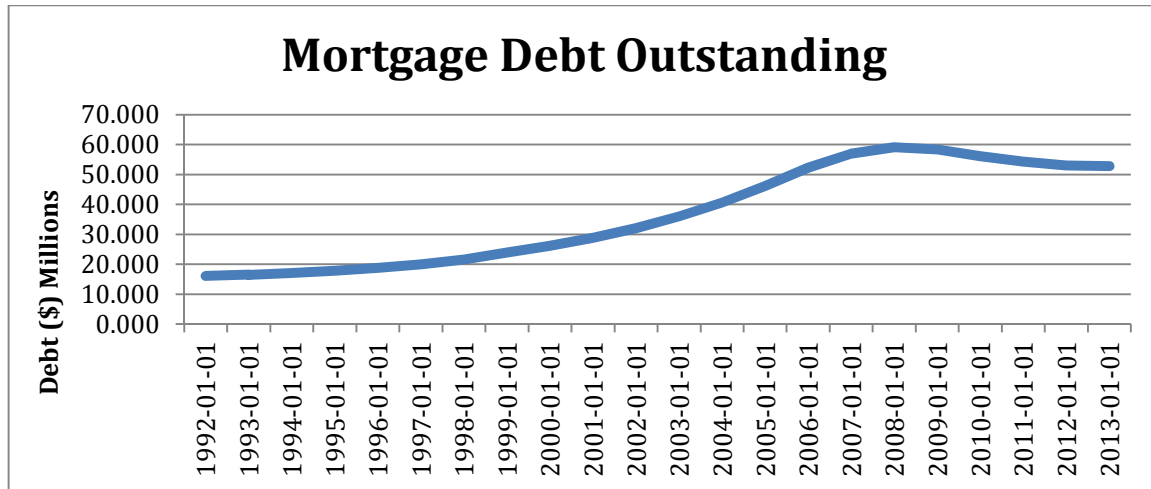
This graph shows the annual mortgage debt outstanding during the years of 1992-2012 in millions of dollars.

Table 5. Projections

Variable	Simple Regression	R²	Year 2030 (Percent Change)	Year 2050 (Percent Change)
GDP	Y = -0.1691x + 8.5934	0.42896	0.1384	-3.2436
Supply of Homes	Y = 0.024x - 0.4022	0.00021	0.7978	1.2778
Unemployment	Y = 6E-06x - 0.1639	0.00050	-0.164	-0.1635
Mortgage Debt Outstanding	Y = -0.2467x + 11.608	0.22771	-0.727	-5.661
Age	Y = -0.0115x + 1.269	0.08935	0.694	0.464
Income	Y = -0.0003x + 9.5441	0.16270	9.5291	9.5231
Change in Housing Prices	Parsimonious Model	0.62800	-3.8244	-14.030

This table shows the simple regression analysis of the each variable if the current trends continue. It shows the percent change in each variable. It also shows the predicted values of this variable in 2030 and 2050, and the forecast using our model.

Conclusion

The economic and demographic factors both influence the change in the real estate prices. In fact, in our model the change in working age population has a significant effect on the change of real estate prices. A 1% increase with the people between the ages of "15-64" causes a 2.707% increase in the housing prices. Along with economic factors the working age population tends to be the main demanders of real estate, and the main influencers of the shifts in real estate prices.

While demographics do apply a subtle pressure on the direction of housing prices, economic factors are much easier to regulate. Since there is no way to directly influence the fluctuations of the working age population, each country must increase transparency in their financial system. The United States government is working hard to create transparency in the financial markets. They should continue to strengthen regulations and increase capital requirements for all lenders especially the shadow banking markets. This would prevent lenders from originating mortgages for the sole purpose of creating derivatives for investors. The real estate market recovery is progressing slowly, but with a stable economy and rising income levels, the United States has a relatively a sound real estate market.

On the other hand, China's growing housing bubble is something we should examine further. The housing prices rose too quickly and the housing demand diminishing demand, which caused the prices to slowly fall. With the shock of the after effects of the One Child Policy and higher retirement rates, China could be facing a huge real estate crisis. As Green and Hendershott's (1996) study concluded, education and income levels would support the housing market. China could encourage education by providing more financial aid and creating more education opportunities in order to increase income levels. This would allow people to be able to

afford living in those ghost cities, and it would effectively raise demand for housing. There is

nothing the government can do about the aging population. As the people head to retirement the

economy must continue growing and the income levels must rise in order to maintain a stable

real estate market.

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