

# Supply, Demand, GDP, Mortgage Interest Rate, House Income, and Prices in the Housing Market

The supply of new and existing homes, and other source of price pressure in the housing market is the number of vacant homes.

First, the relationship between house prices and the supply of home for sale. Then which of housing supply- new homes, existing homes or vacant homes has the most effect on house price.

Second, the dynamics relationship that there is excess supply of house in the market and that it is depressing house prices.

Then the simple regression model that can be simulated to project the future evolution for new homes sales, supply and house prices.

Then Understand Supply condition in the market for existing homes, the vacancy rate, time on the market and other fundamental variables such as mortgage rates or GDP growth are found to have little impact on house prices once one controls for the role of supply conditions in the market for new homes.

Rather, it is that they impact house prices via their effect on months supply of new homes. For instance, low mortgage rates may stimulate new homes sales, thus reducing months supply and so raising house prices generally.

## House Prices and Fundamentals

A popular approach involves estimating a model of the housing market based on fundamentals where price are determined by factors such as income, interest rates and demographics.

## House Prices and House Supply of existing home and New home

First to estimate a relationship between the change in house prices and a measure of the balance between supply and demand in the housing market.

A longer sample (from 1968 to 2012) and use real house prices as the dependent variables controlling for movements in the general price level by dividing the house price index by the Consumer price index.

The existing homes measure used by Calculated Risk and the months supply of new homes as measured by the US Census Bureau.

An excess supply of new homes may exert more influence on the general level of house prices because building contractors stuck with excess houses are perhaps more likely to need a quick sale than those who can live in their homes and afford to wait for a higher price to come along.

**Figure 1**

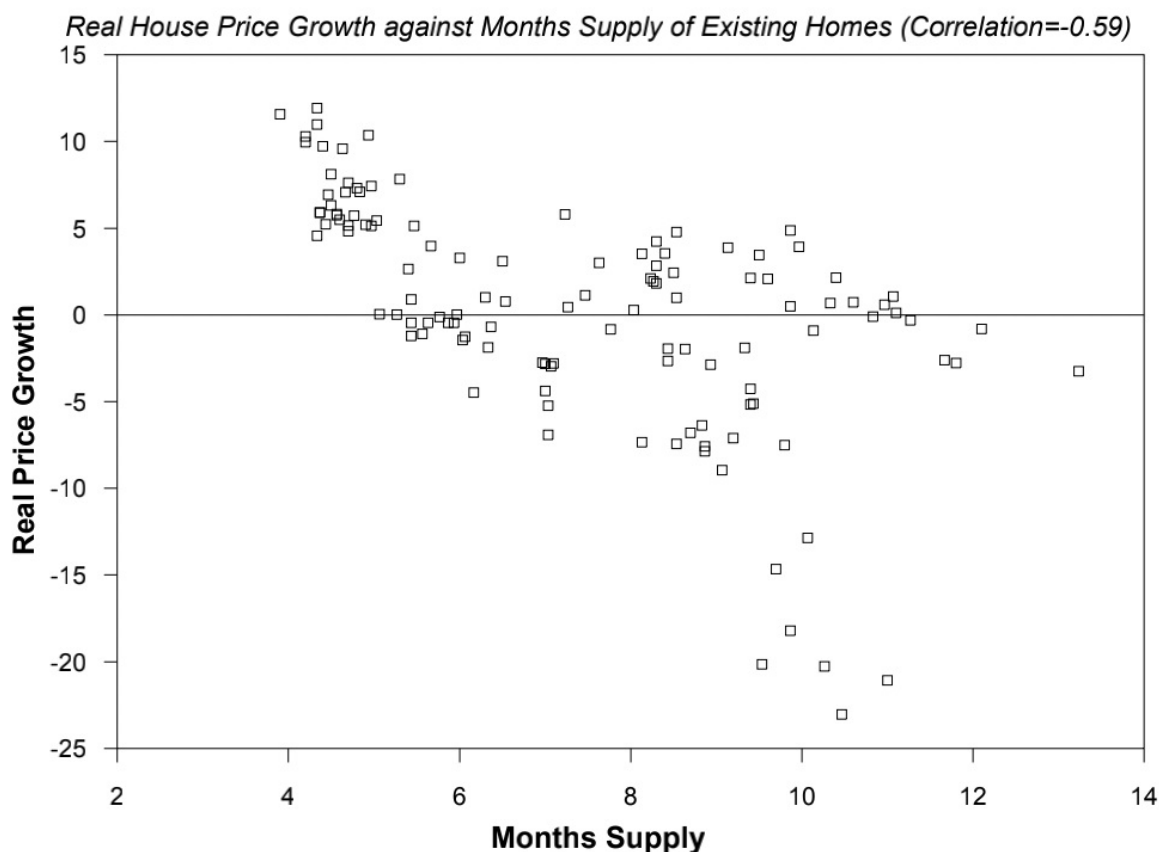


Figure 1 shows a scatter plot of the year-over-year percentage changes in real house prices against the months supply of existing homes. The sample for this chart is 1982:Q2 to 2012:Q1.

**Figure 2**

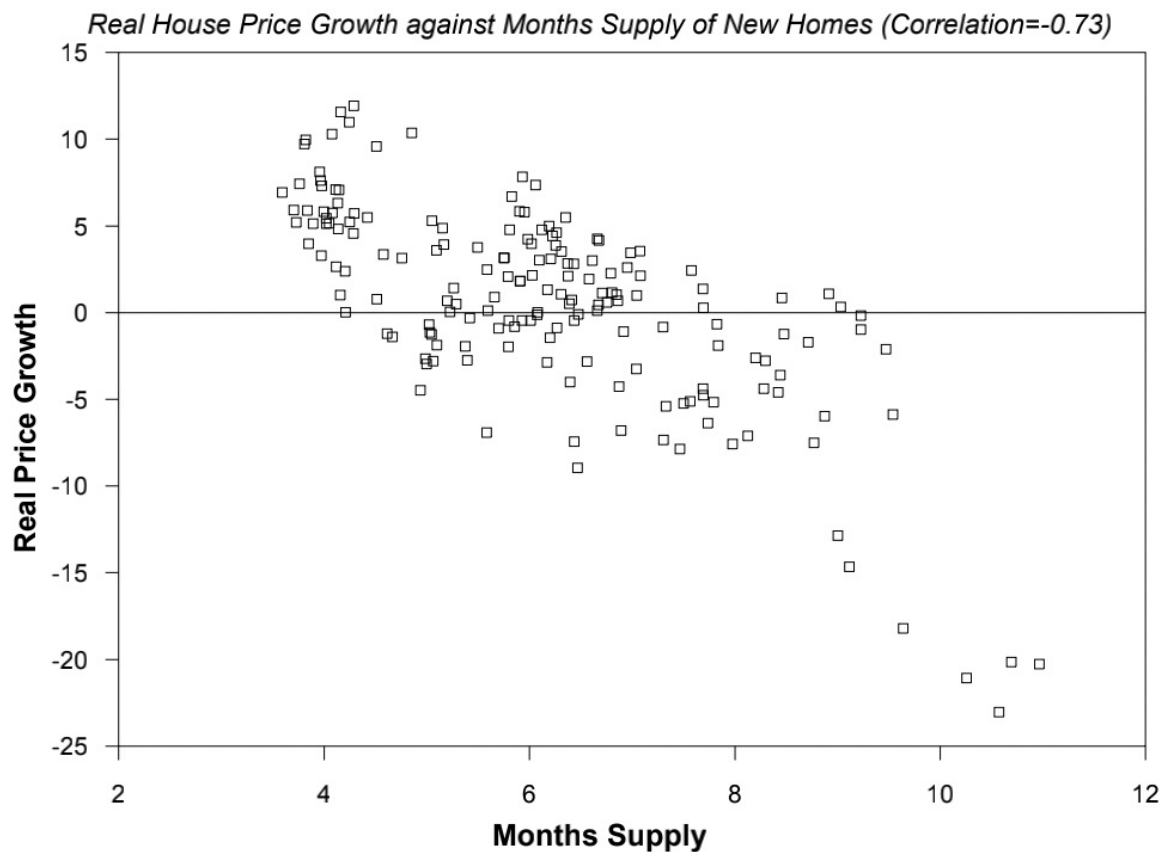


Figure 2 shows, however, that the relationship between the growth rate of real house prices and months supply of new homes- which can be estimated over the longer sample of 1968:Q1 to 2012:Q1 - is noticeably stronger correlation.

**Figure 3**

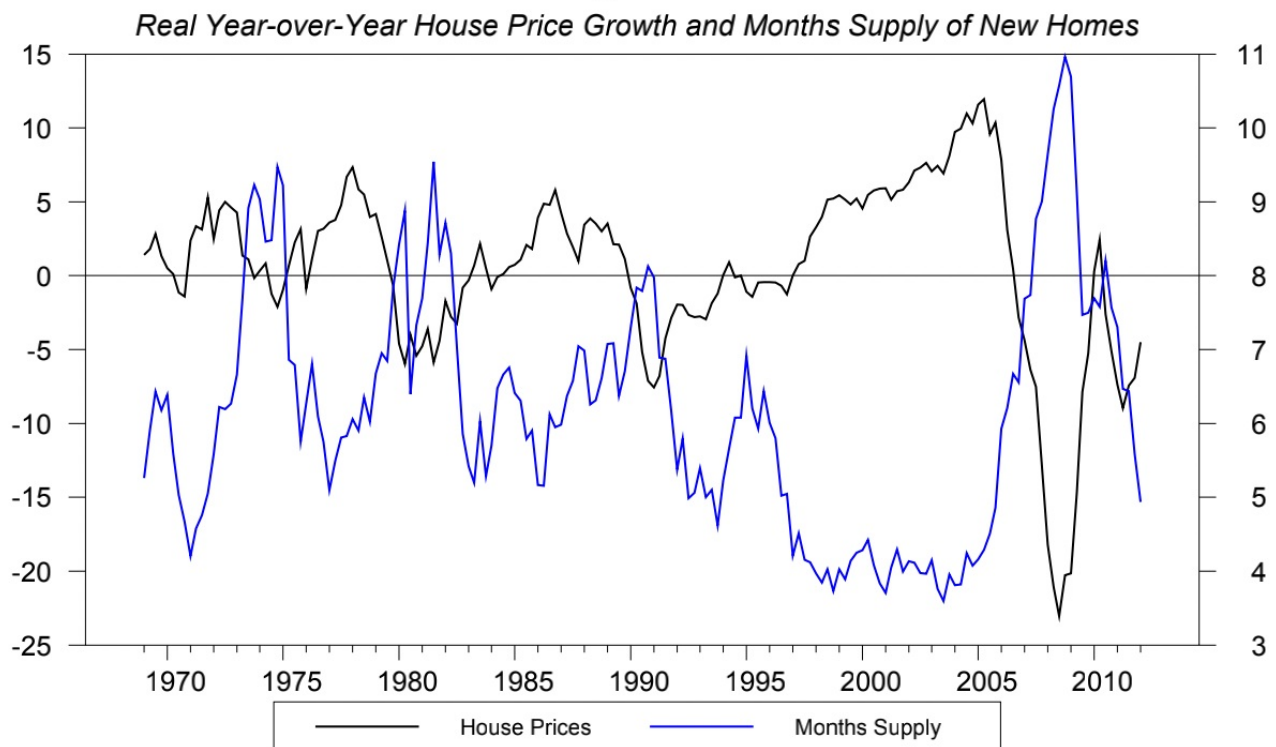


Figure 3 shows this scatter diagram is consistent with a striking time-series correlation between the rate of growth in house prices and the balance between supply and demand indicated by the months supply series.

Each of the clear booms or busts in house prices have been accompanied by a corresponding movement downwards or upwards in months supply.

Most notably, the recent house price bust saw the move in house prices from rapid growth to substantial declines mirrored by a similarly sharp sawing in months supply.

Months supply has increased sharply from around four months during the period of strong house price growth between 2002 and 2007 to over 11 months in the period coinciding with the contraction in house prices since 2008.

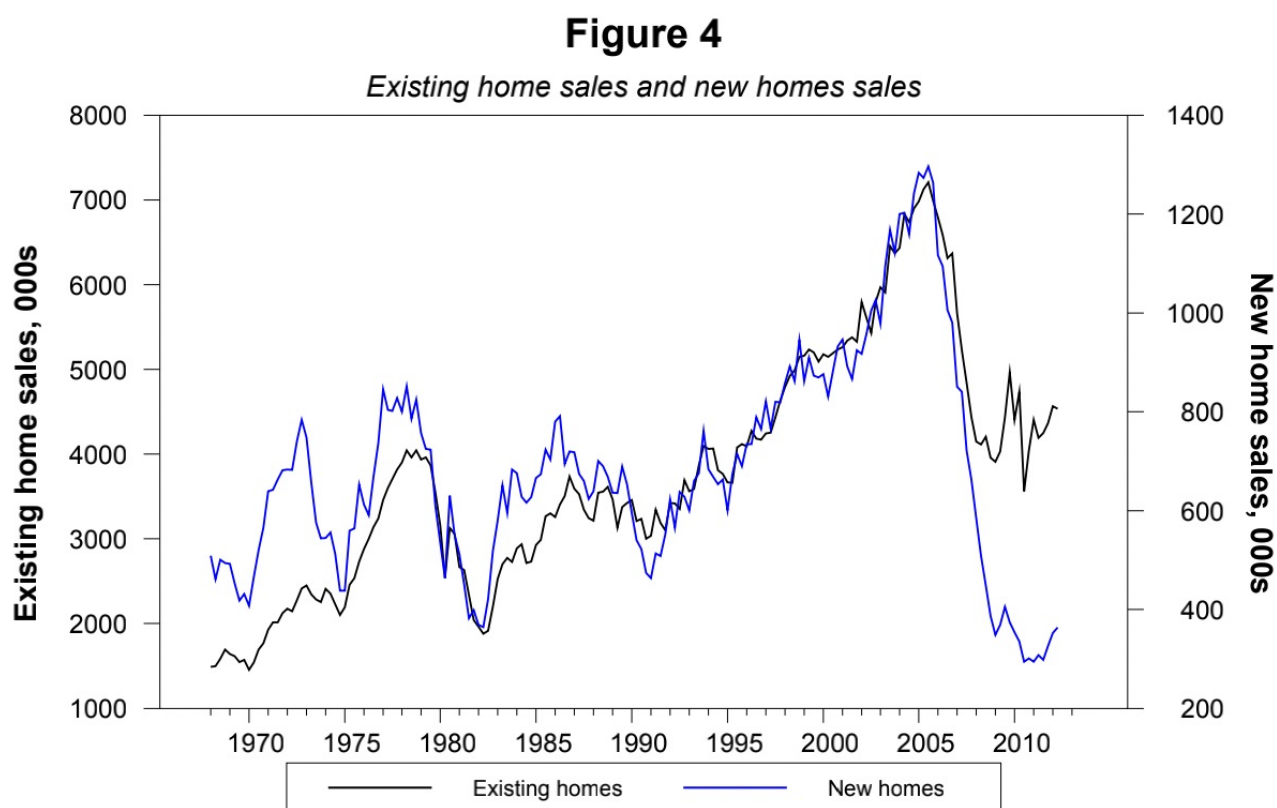
### Recent Housing Market Developments

As above image, illustrates that a strong inverse relationship between house prices and months supply of new homes has existed over much of the period 1970 to 2012. However, over recent quaters there appears to have been some breakdown in this relatio ship with house prices and months supply both moving in the same direction.

Number of possible explanations as to why the recent relationship between supply and prices in the US has not been as strong as in the past. The homebuyer tax credit introduced by the US Congress in 2009 provided a temporary boost to home sales leading to a reduction in months supply and a receovery in prices.

Another recent development in the US housing market has been the mergence of a widening gap between new and existing home sales since mid-2007.

Figure 4, trends in new home sales closely tracked movements in existing home sales up to mid-2007 at which point new home sales continued to decline sharply while existing home sales stabilised from early 2008.



The emergence of this gap between new and existing home sales has been attributed to the increase in distressed property sales following the bursting of the property market bubble.

The increase in distressed property sales has helped stabilise existing home sales which at the same time reducing new home sales as home builders and owners of new homes find it difficult to compete with distressed property sales.

## Model results of House price and supply of new homes

Table reports the results of year-over-year changes in new house prices regressed on the two different definitions of months supply as well as the vacancy rate.

Table 1: House Prices and Months Supply

<i>Dependent Variable: <math>\log(PH_t/CPI_t) - \log(PH_{t-4}/CPI_{t-4})</math></i>							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	12.92 (1.55)	19.72 (1.36)	19.78 (1.35)	16.67 (1.53)	17.32 (1.46)	15.50 (1.51)	18.26 (1.64)
$MSupply_t^e$	-1.72 (0.25)		-0.04 (0.16)				
$MSupply_t^{new}$		-3.30 (0.24)	-3.26 (0.31)	-2.62 (0.26)		-2.49 (0.25)	-2.72 (0.26)
$MSupply_{t-1}^{new}$					-2.73 (0.26)		
$GDP_t$						0.56 (0.38)	
$r_t$							-0.19 (0.12)
Sample	1982:2-2012:1	1982:2-2012:1	1970:1-2012:1	1970:1-2012:1	1970:1-2012:1	1970:1-2012:1	1970:1-2012:1
$\bar{R}^2$	0.35	0.69	0.68	0.54	0.58	0.54	0.58

Notes: Standard errors in brackets.

In the first column, the results from the regression for year-over-year changes in house prices on months supply of existing homes are reported.

In column 2, the relationship between months supply of new homes and changes in prices is examined. The regression results are in keeping with the trend evident in Figures 1 and 2, that the months supply of new homes appears to drive house prices more than the supply in the larger existing home market.

In column 3, the results when both measures of months supply are included in the same regression. The results in the third column show that when both months supply variables are included in a regression specification for the rate of change of real house prices, the existing home series is statistically insignificant. This suggests that most of the variation in the house prices is driven by changes in supply of new homes.

In Column 4, the table estimates the relationship over the full sample. The coefficient on the months supply of new homes does not change substantially when the equation is estimated over this longer time period.

In Column 5, shows that the months supply series tends to lead house prices, with a specification based on a single lag having  $R^2$  of 0.58 compared with the 0.54 for the model based on the contemporaneous effect.

Column 6 and column 7 shows the regression results when two variables, GDP and real mortgage interest rates are added as explanatory variables along with our months supply measure.

The results from the regression analysis indicating that months supply of new homes is more important determinant changes in house prices than the existing homes measure.

## House prices, house supply, and other fundamentals

Table 2: House Prices, Months Supply and Vacancy

<i>Dependent Variable: <math>\log(PH_t/CPI_t) - \log(PH_{t-4}/CPI_{t-4})</math></i>			
	(1)	(2)	(3)
Constant	32.15 (4.53)	20.88 (3.25)	22.01 (3.17)
$MSupply_t^e$	-1.83 (0.21)		-3.06 (0.36)
$MSupply_t^{new}$		-3.25 (0.23)	-0.16 (0.21)
$Vacancy_t$	-4.85 (0.96)	-0.38 (0.67)	-0.67 (0.85)
Sample	1982:2-2012:1	1982:2-2012:1	1982:2-2012:1
$\bar{R}^2$	0.51	0.69	0.68

Notes: Standard errors in brackets.

The mixed results obtained after including the GDP and interest rate variables suggest that after controlling for months supply, these variables do not have significant explanatory power for house prices in this model.

This is not to say that fundamentals do not have an important influence on house prices, rather the results indicate that months supply of new homes functions well as summary measure of the price pressures in the housing market.

Variables such as interest rates and GDP are likely to effect months supply of new homes on the market and through this channel are likely to impact on house prices.

# House prices, House Supply, and Time on the Market

The median time on the market which averaged around four months over the period 2000 to 2008, increased sharply after 2008 and peaked at around 14 months in mid 2010.

Table 3 shows the results when we include the variables for time on the market (TOM) in our regression equation for changes in house prices.

Table 3: House Prices, Months Supply and Time on the Market

<i>Dependent Variable: <math>\log(PH_t/CPI_t) - \log(PH_{t-4}/CPI_{t-4})</math></i>				
	(1)	(2)	(3)	(4)
Constant	15.39 (1.79)	20.45 (1.49)	9.79 (1.68)	17.89 (1.69)
$MSupply_t^e$	-1.17 (0.25)		-1.94 (0.28)	
$MSupply_t^{new}$		-2.92 (0.29)		-2.83 (0.27)
$TOM_t$	-1.12 (0.34)	-0.51 (0.28)	-0.43 (0.30)	-0.48 (0.28)
$GDP_t$			2.27 (0.80)	0.57 (0.50)
$r_t$			1.10 (0.26)	0.28 (0.16)
Sample	1982:2-2012:1	1982:2-2012:1	1982:2-2012:1	1982:2-2012:1
$\bar{R}^2$	0.45	0.69	0.63	0.72

Notes: Standard errors in brackets.

In column 1, time on the market enters with a negative and significant coefficient when it is included in the house price regression along with months supply of existing homes.

Column 2, the results form the regression model incorporating time on the market and months supply of new homes. In contrast to the results when the existing homes measure of months supply is used, the time on the market variable is only significant at the 10 per cent significance level when it is included along with the months supply of new homes as an explanatory variable.

Column 3 and column 4, the results when the fundamentals variables are included in the model along with the two months supply measures and time on the market.

Column 4, months supply of new homes performs best as an explanatory variables for changes in house prices.

This result is consistent with the findings from the anaysis reported earlier which indicated that months supply of new homes provides a good summary measure of the factors affecting changes in real house prices.

## Regression Model for house price

The relationship just described between the rate of changes in real house prices and the months supply of new homes gives a snapshot of how supply and demand condition interract in the housing market.

In order to examine the dynamics of how the housing market reponds to changes in supply, demand and prices.

**ZHt - year-over-year change in the real house prices**

**St - new home sales**

**Ft - flow of new homes brought to the market**

**FSt - the number of homes for sale**

**Mt - months house supply**

**GDPt - GDP growth**

**Rt - real mortgage interest rate**

Begin by defining an identity for the months supply of new homes as the number of homes for sale divided by the number sold.

$$M_t = \frac{FS_t}{S_t} \quad (1)$$

The number of homes for sale evolves in line with the flow of homes into and out of the housing market.

$$FS_t = FS_{t-1} + F_t - S_t \quad (2)$$

We can thus model the changes over time in months supply using an approach that forecasts Ft and St. Thus, our simulation model consists of an equation linking house prices to months supply, equations for Ft and St and a set of identities defining the stock-flow dynamics and the months supply variables.

The first equation in our simulation model relates the year-over-year change in house prices to its lags and to lagged months supply.

$$ZH_t = \beta_{11} + \sum_{k=1}^4 \beta_{12k} ZH_{t-k} + \beta_{13} M_{t-1} \quad (3)$$

The next equation a quasi-VAR is sales and the flow of homes brought to the market. St and Ft have two lags of St and Ft, the year-over-year change in real house price (ZH), the growth rate of GDP and the real mortgage interest rate.

$$S_t = \beta_{21} + \sum_{k=1}^2 \beta_{22k} S_{t-k} + \sum_{k=1}^2 \beta_{23k} F_{t-k} + \sum_{k=0}^1 \beta_{24k} ZH_{t-1} + \beta_{25} M_{t-1} + \beta_{25} GDP_t + \beta_{27} R_t \quad (4)$$

$$F_t = \beta_{31} + \sum_{k=1}^2 \beta_{32k} S_{t-k} + \sum_{k=1}^2 \beta_{33k} F_{t-k} + \sum_{k=0}^1 \beta_{34k} ZH_{t-1} + \beta_{35} M_{t-1} + \beta_{36} GDP_t + \beta_{37} R_t \quad (5)$$

Table 5 reports the results from the estimation of the equation for new home sales (equation 4) and the equation for the flow of homes put on the market (equation 5).

## Simulation Results

In order to examine the dynamics of the relationship between supply, demand, and prices in the US housing market. The analysis by simulating values for the three exogenous variables in the model, GDP, inflation and the mortgage interest rate.

Implement shocks to five different variables in the model:

1. House prices
2. The flow of homes put on the market - supply
3. New homes sales - demand
4. GDP rate
5. Mortgage interest rates

Table 5: Supply, Demand, Months Supply and House Prices

Dependent Variable	( $F_t$ )	( $S_t$ )
Constant	9.17 (3.00)	8.94 (4.86)
$F_{t-1}$	0.65 (0.09)	0.13 (0.13)
$F_{t-2}$	0.16 (0.78)	0.02 (0.11)
$S_{t-1}$	0.17 (0.18)	0.76 (0.27)
$S_{t-2}$	-0.08 (0.14)	-0.05 (0.21)
$MSupply_{t-1}^{new}$	-1.79 (1.18)	0.91 (1.76)
$MSupply_{t-2}^{new}$	1.14 (1.13)	-0.89 (1.69)
$ZH_t$	1.39	1.14



	(0.17)	(0.23)
$ZH_{t-1}$	-1.14	-0.83
	(0.18)	(0.25)
$GDP_t$	1.44	0.89
	(0.40)	(0.55)
$r_t$	29	
	-0.01	-0.12
	(0.12)	(0.18)
Sample	1970:1-2012:1	1970:1-2012:1
$\bar{R}^2$	0.97	0.97

Notes: Standard errors in brackets.

### 1% Shock to House Prices

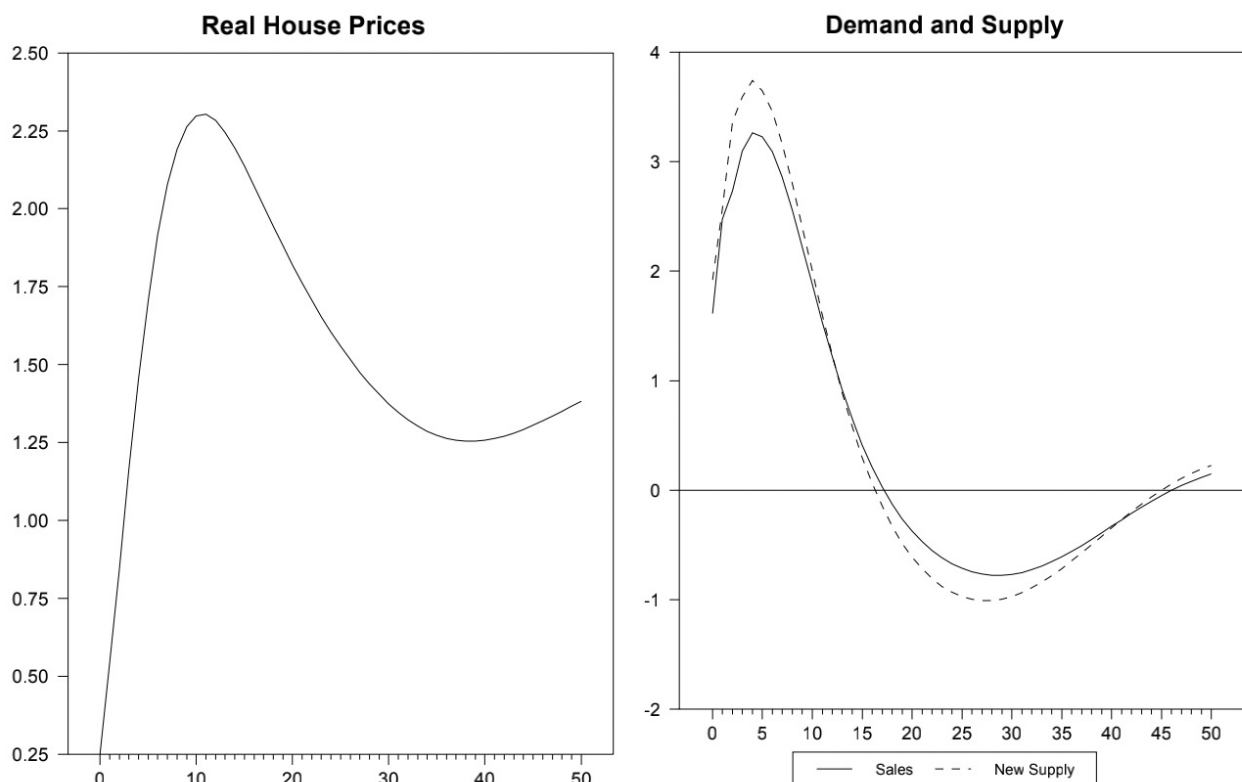
Increase house prices by one per cent for one period and examine the response of the housing market over the following quaters.

In response to this shock, the level of house prices rises initially by over 2 per cent before settling around 1.5 per cent above the baseline over the medium-term.

The increase in sales (demand) in response to an increase in prices where higher prices typically lead to a decrease in demand.

## Figure 5

Response to 1% Price Shock



### 1% Shock to supply

This shock examines the response of the housing market to a one per cent increase in the flow of new homes put on the market.

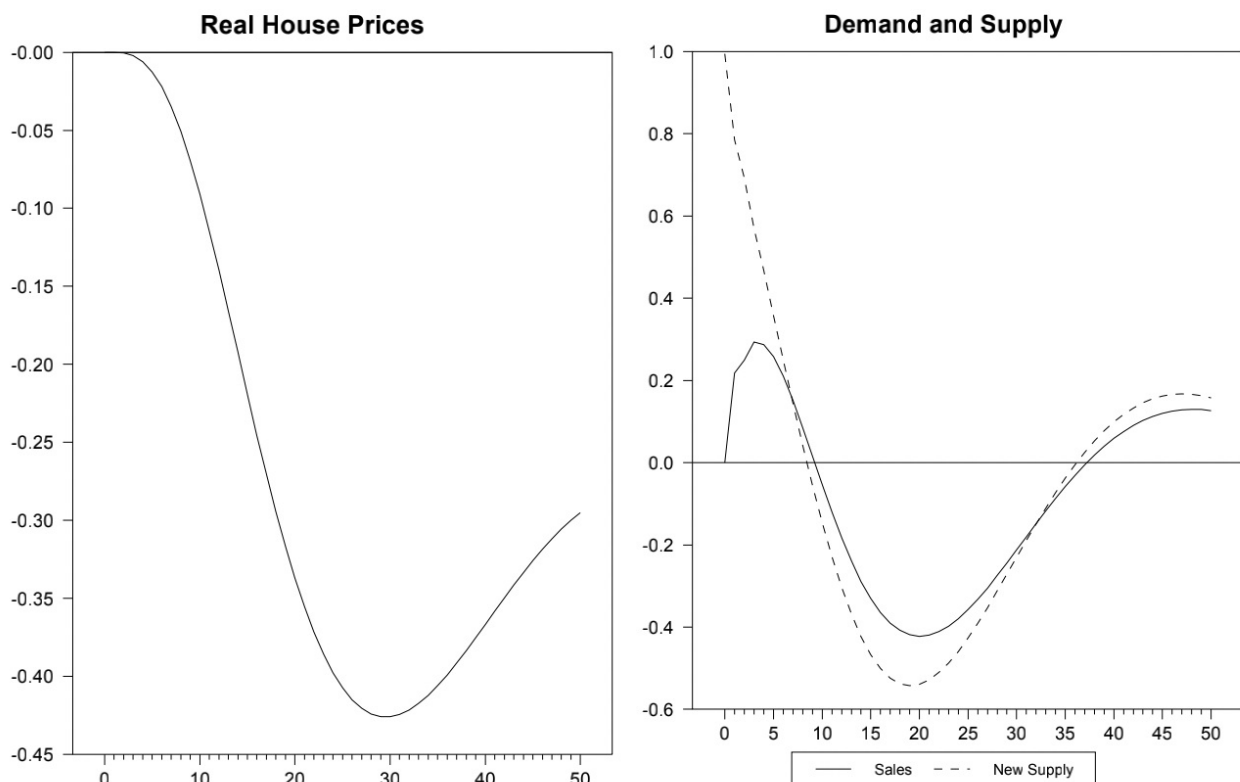
An increase in the supply of homes on the market leads to an initial increase in sales because the ratio of buyers to sellers in the market decreases which in turn reduces buyer time on the market.

This effect, higher supply implies fewer mismatched households in the future, results in lower sales in later periods. This effect kicks in after around one year.

This experiment provides some insights into how the housing market unwinds from a position of high months supply.

The increase in supply also leads to lower prices and since prices and sales tend to move in the same direction, sales in later periods also decline.

**Figure 6**  
*Response to 1% Supply Shock*



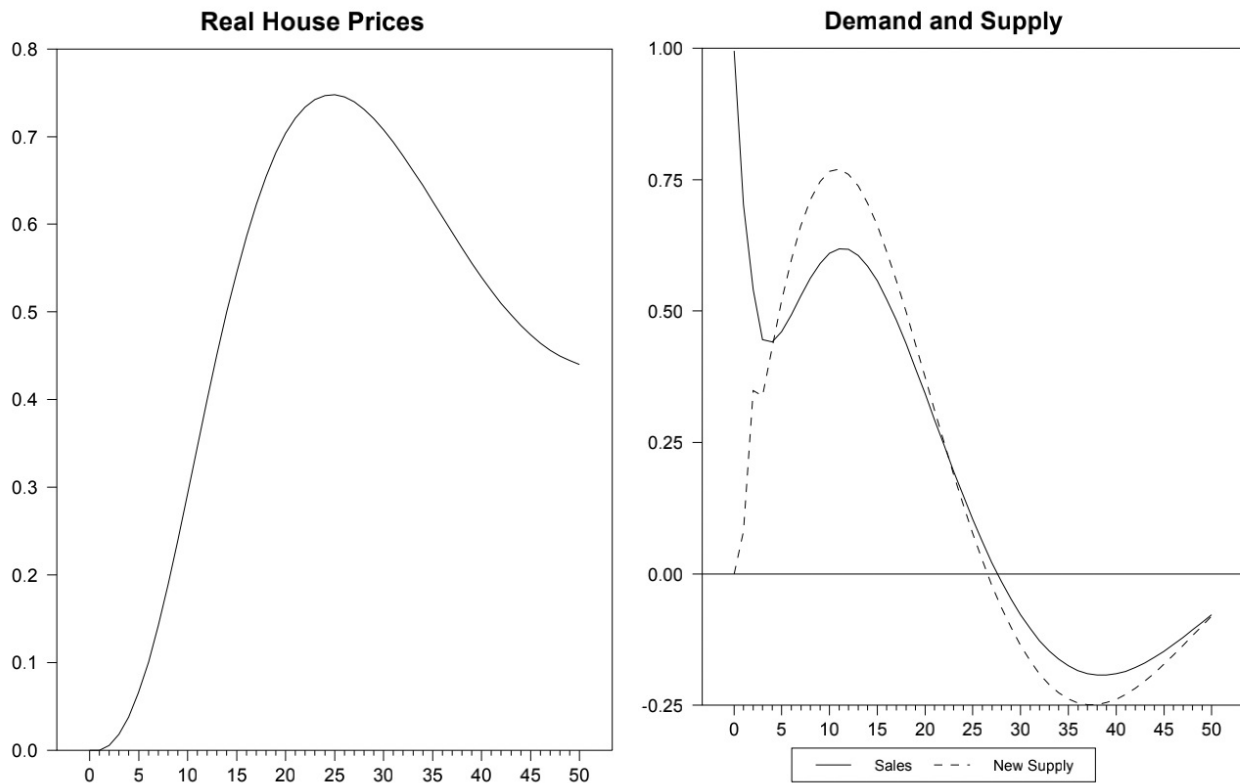
### 1% Shock to Demand

The sales and prices respond positively to the demand shock. Higher sales reflect a higher level of mismatch in the market which increase sales and prices.

This makes it more difficult for buyers in the market to find a suitable housing unit and as a result the increase in demand is propagated into the next period.

The flow of new homes put on the market eventually increases in response to the demand shock which brings about a moderation in the increase in the price over the long run.

**Figure 7**  
*Response to 1% Demand Shock*



### 1% Shock to macro Variables

Figure 8 and Figure 9 shows the response of supply, demand and prices to a 1 per cent increase in the real mortgage interest rate and a one percent increase in the real GDP growth rate respectively.

#### Real Mortgage Interest Rate

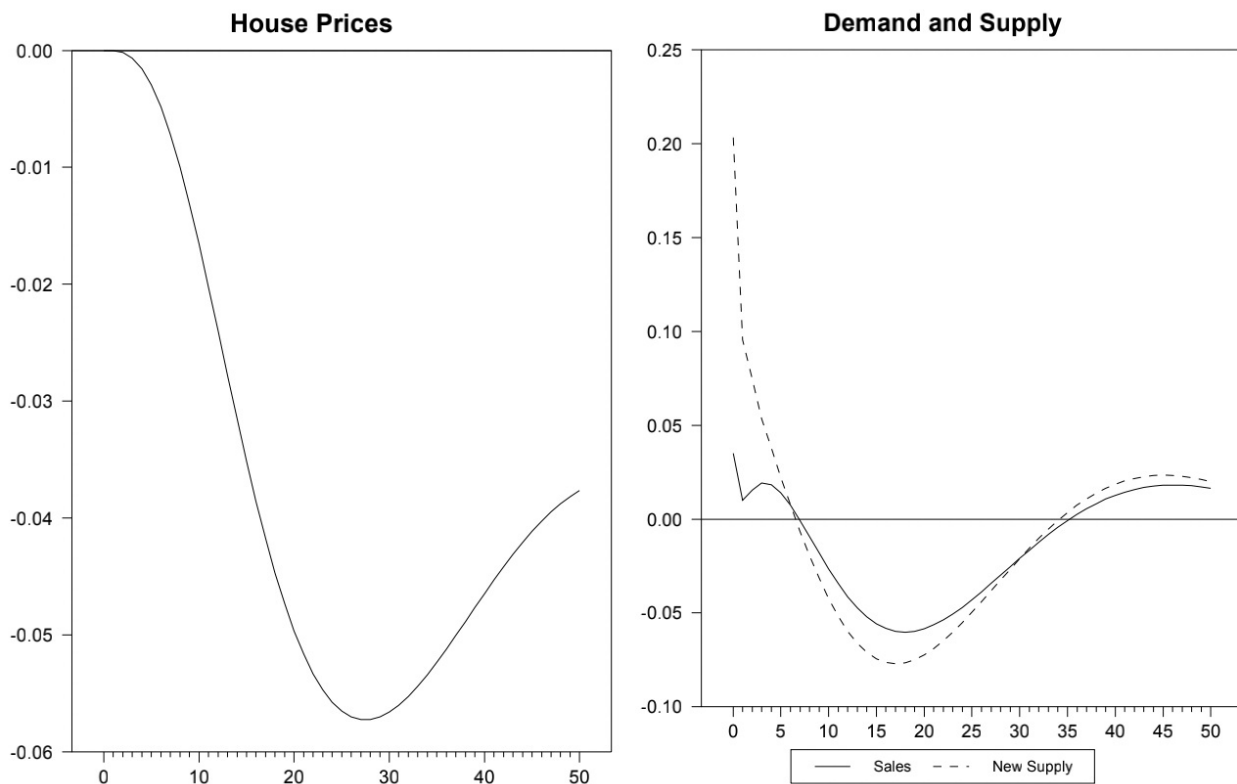
This shows that house prices fall in response to an increase in the interest rate.

The fall in prices in response to the positive shock to interest rates is accompanied by an initial increase in both sales and supply.

When prices decline, liquidity constrained owners experience a loss of equity meaning fewer households can afford to move house. The reduction in new supply eventually leads to a recovery in prices and sales.

## Figure 8

*Response to 1% Interest Rate Shock*



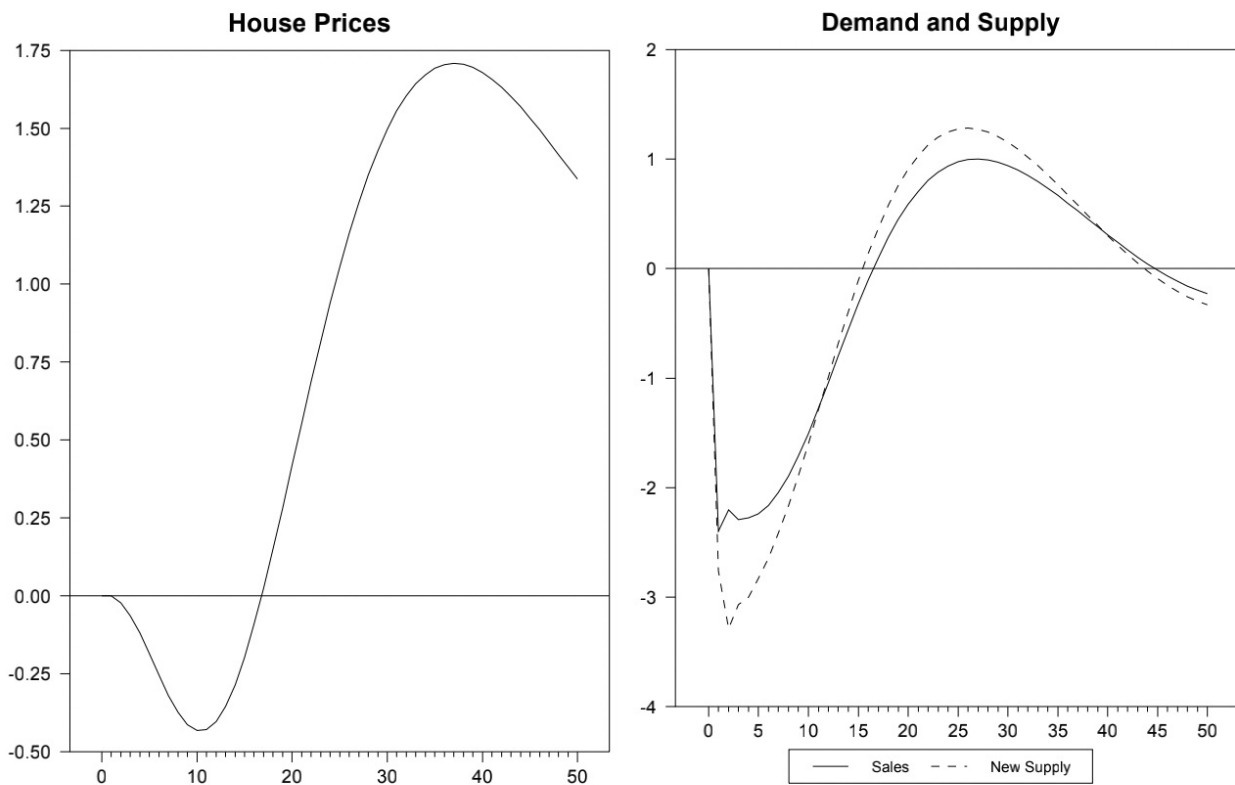
### GDP growth Rate

An initial small decline, house prices increase sharply in response to an increase in the GDP growth rate.

The increase in the prices leads to an increase in sales and supply after about two years.

## Figure 9

*Response to 1% GDP Shock*



## Forecasting Sales, Supply and Prices

### Forecas Simulation of New Homes Sales and New-to-Market Homes

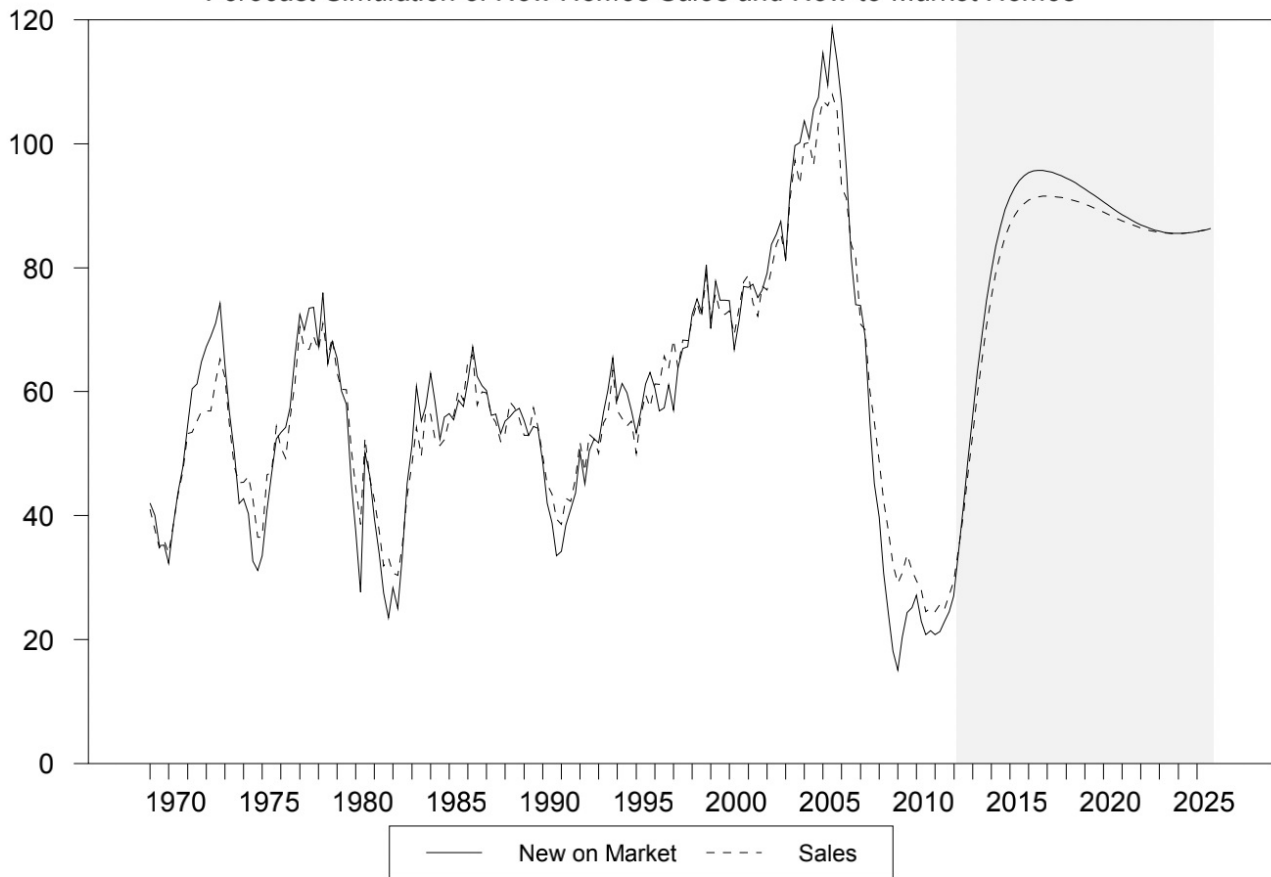
Model to simulate future values for new homes sales, the flow of homes put on the market, house prices and months supply.

Using forecasted values for the exogenous variables and the estimated coefficients from the regression model. We generate projections for the future path of key housing market variabes.

Below figure shows forecasts for new homes sales and supply.

## Figure 10

*Forecast Simulation of New Homes Sales and New-to-Market Homes*



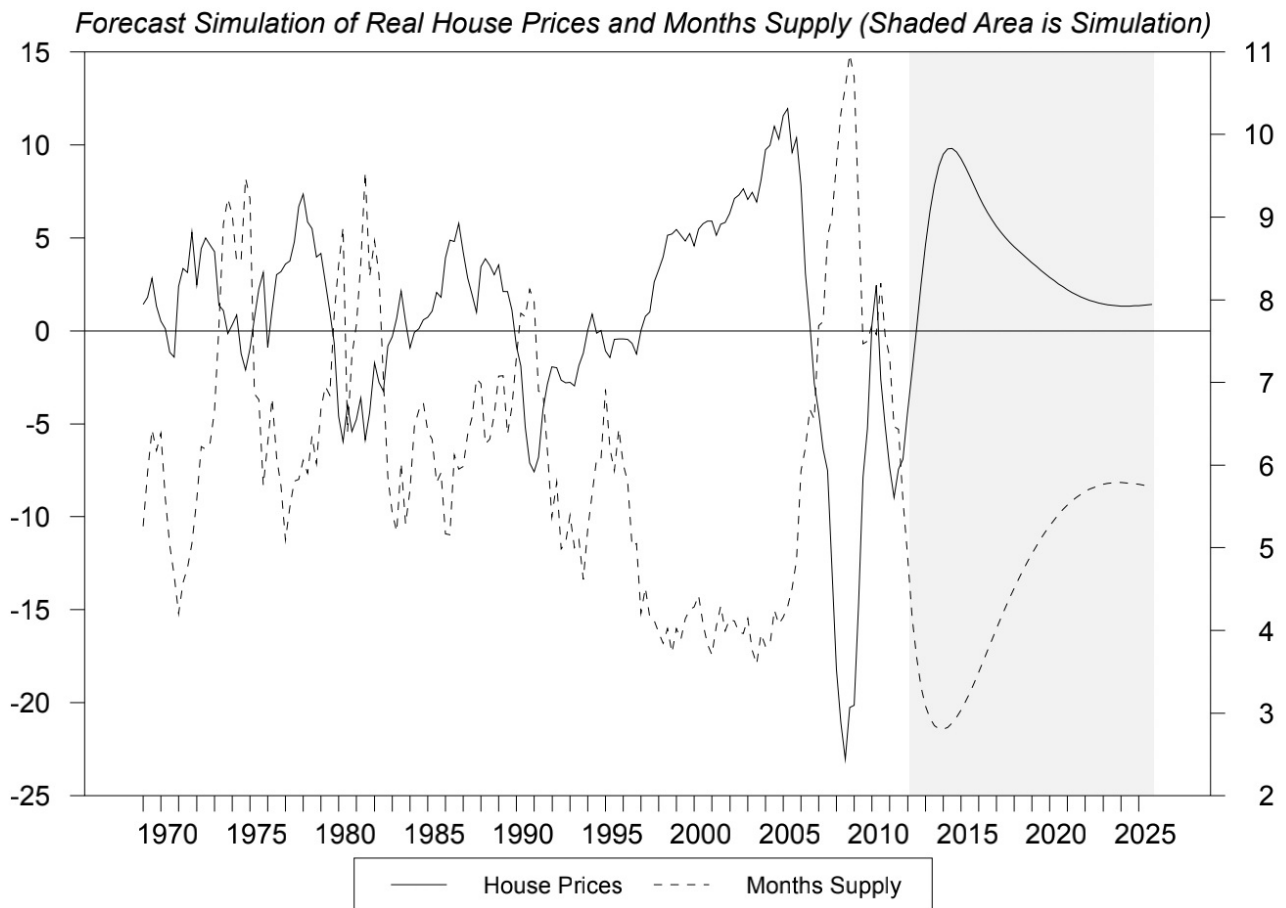
### Forecast Simulation of Real House Prices and Months Supply

The model's predictions for house prices and months supply of new homes. Months supply of new homes increased sharply from around four months prior to the collapse in house prices to over 11 months during 2008 and 2009.

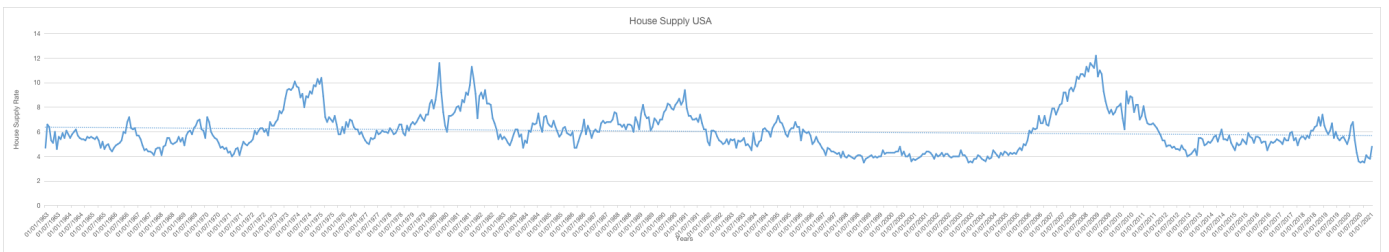
House supply has fallen back slightly from the high levels reached in 2008 and currently stands at around 5 months.

The model projects a recovery in house prices and a reduction in months supply of homes to below pre-crisis levels by the middle of this decade. Thereafter months supply of houses is expected to return to close to its long run average level of around 6 months.

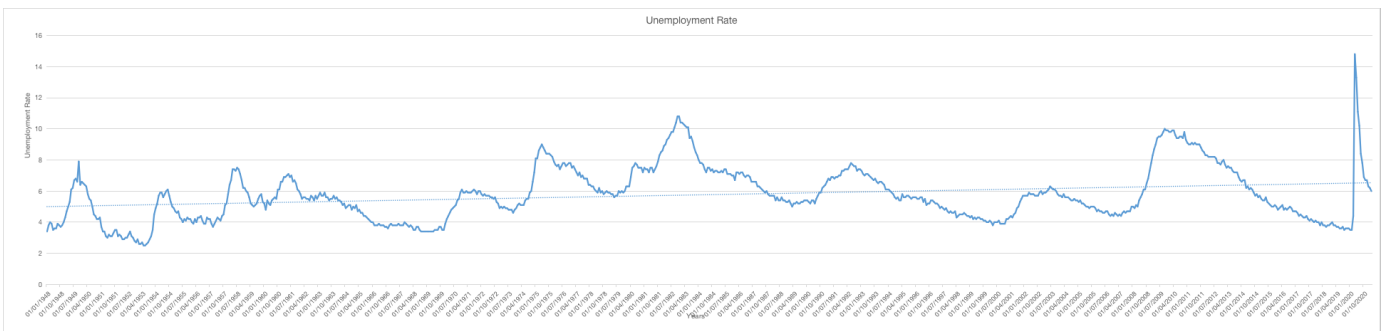
**Figure 11**



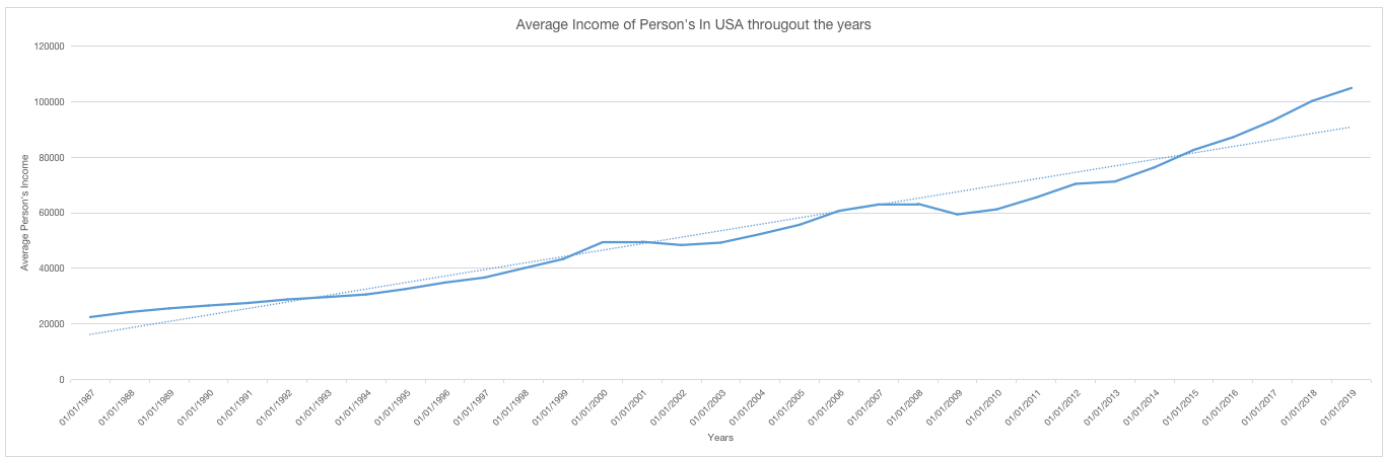
## House Supply Rate throughout the Years in US



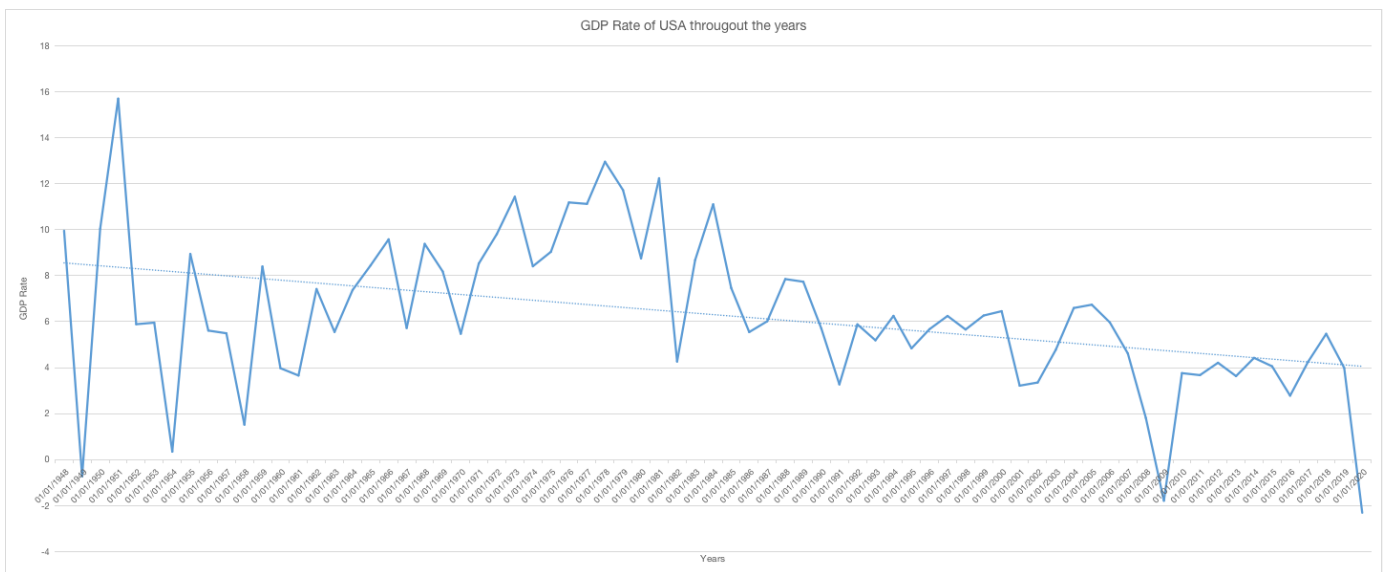
## Unemployment Rate throughout the years in US



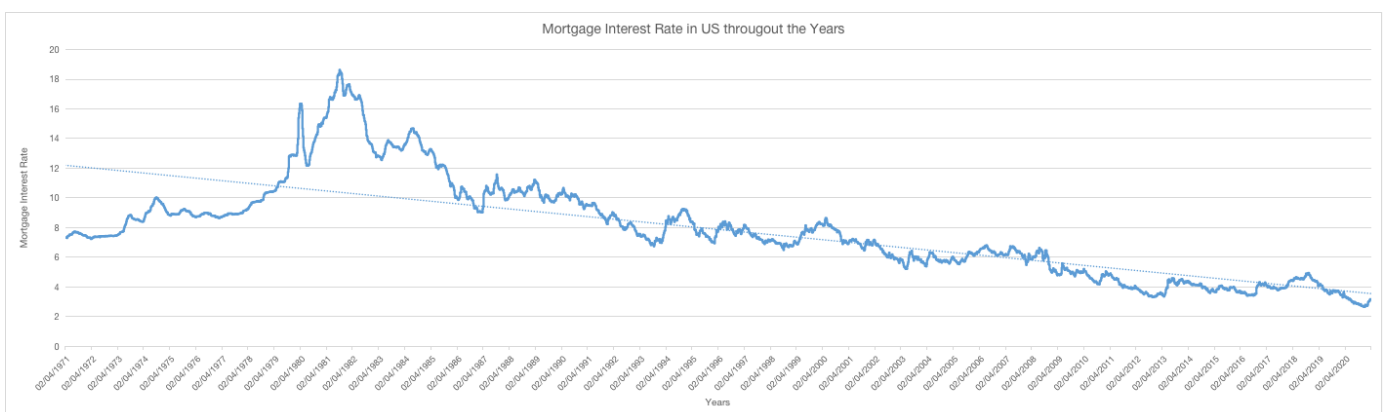
## Average Income of Person's throughout the years in US



## GDP rate throughout the years in US

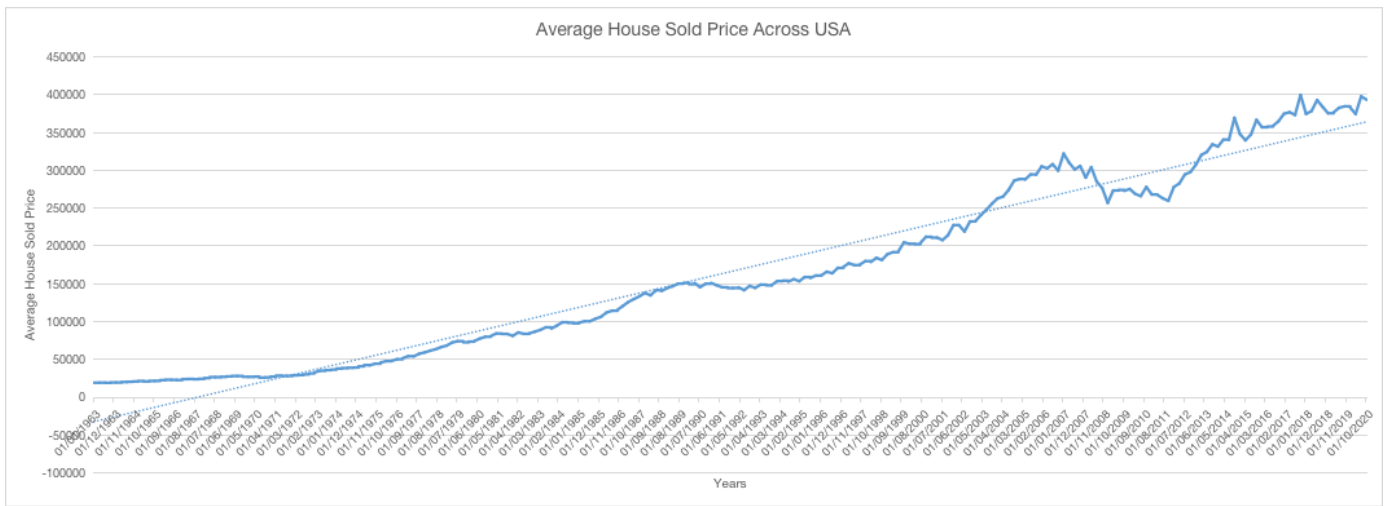


## 30 year Fixed Rate Mortgage Interest Rate Average of US throughout the Years

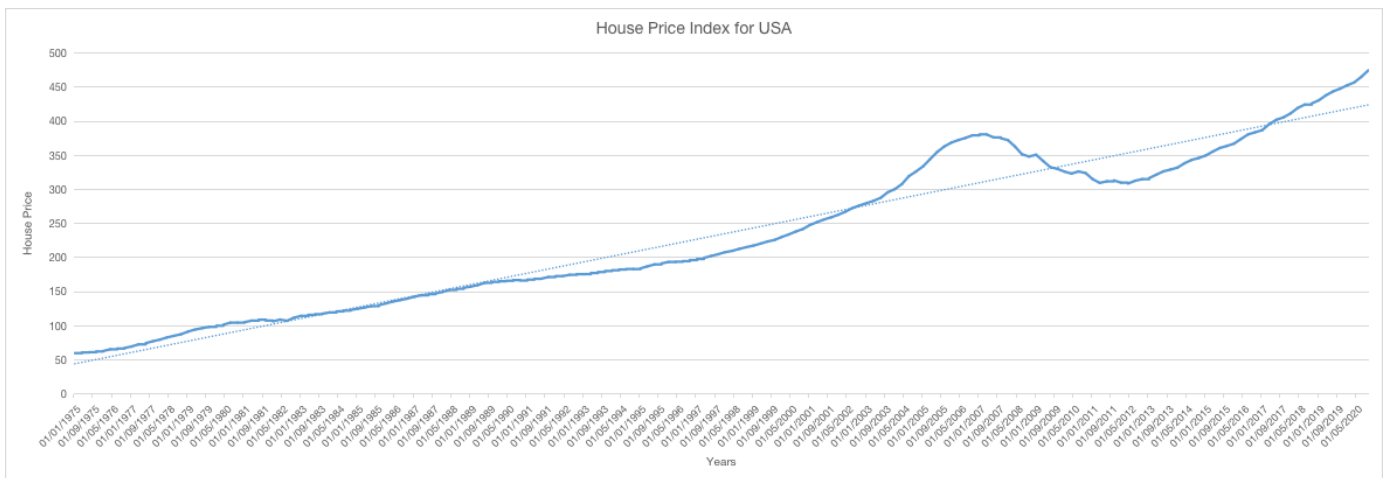


## Average House sold price in US throughout the Years





## House Price Index



### Reference

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