Analyze The Effect of Bubble Shock In The Post-Japan Asset Price Bubble Period Economy

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Abstract

We would like to analyze the effect of the shock of the asset price bubble and the fluctuation of the stock price to the macroeconomy in Japan after the Asset Price Bubble Period. In this research, we would use the OLS regression and SVAR to examine the effect of the shock of stock return and the house price variation. The goal of the paper is to see whether the bubble shock would leave a shadow in the real economic activities and how long would it sustain and to examine the effect of each shock on those macroeconomic variables. We use the employment rate, CPI, NIKKEI 225 stock index, Residential Property Price, Interest rate, and the GDP between 1990Q2 to 2017Q1 to build the model and then examine the relationship between each factor and the real economic activities' performances. In the research result, we find the house price variation shock has a significant impact on the CPI. When the shock of the house price growth rate variation increases one percent it will make the CPI decreases 0.284%. And based on the result of IRF we find the shock of stock return and the property price both do not have a persistent influence on Japan's economy. Therefore, we can conclude that the shock of stock return and the house price variation would not leave a persistent shadow on Japan's employment rate, GDP, CPI.

Keywords: Macroeconomics, SVAR, Bubble Shock, Stock Price, House Price.

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1 Overview of the Project: An Introduction

During the pandemic period, we can notice some of the countries can still make their economic system robust, which triggers me to find the reason why under such a crisis the operation of the economy or the recovery of the economy can get back on the right track so fast. We want to know an abrupt shock would bring how much damage to an area's economy and how long would it sustain.

In the past, most of the researcher focuses on the issue that financial factor's fluctuation would influence by what kind of channels like Bernanke, Ben, and Gertler(1989), Bernanke, Gertler, and Gilchrist(1999), and Kiyotaki and Moore's(1997) credit cycle model. They analyze the channel that how the financial factors can influence the macroeconomy and examine the effect. But seldom of them focus on how long the effect would continue.

Therefore, in this research, we would like to use the quarterly data in the Post-Japan asset price bubble period from 1990Q2 to 2017Q1 and use the OLS and SVAR model to measure the shock's effect and observe its duration. Compared with the other shock pertained research, I add in the stock return as one variable to measure how the shock of the stock return would influence the macroeconomy and test whether it would leave a shadow on the economic system.

2 Literature Review

In this research, we primarily want to measure the effect of the shock. The measurement has been suggested in the research of Mark Gertler and Simon Gilchrist (2018), they use the Panel VAR model to capture the shock of the financial excess premium, and the house price variation. In their research, they also found that the employment response to these shocks varies substantially across states and the balance sheet effect does not become economically significant until five quarters after the shock.

They finally construct a historical decomposition that measures the relative contribution of the housing price changes, the household balance sheet channel, and the decline of the financial condition and find the shock to the financial bond premium provides the largest effect. The deterioration in household, non-financial-firms and financial intermediation plays a significant role in the Great Recession and the overall employment contraction. Finally, they construct a historical decomposition that measures the relative contribution of the housing price changes, the household balance sheet channel, and the decline of the financial condition and find the shock to the financial bond premium provides the largest effect.

Besides the measure of the shock, we are also curious about how long would a shock leave a shadow on an area's economic system. In the paper of Bhattarai, Schwartzman, Yang(2020), they research how a bubble and the crash would influence a macroeconomy system. They use the data during the bubble period in Japan and the crash period in America. By using VAR to capture the effect of these shocks, they show that the hosing shock had a persistent effect on the employment and GDP, and the IV result implies the larger employment effect over the long run as compared to OLS estimates. They find it might happen because the local productivity shocks are relatively short-lived, so there are larger effects on the housing shock net worth losses over three years than on employment over 12 years.

Then, they turn to the effects on the local labor market and found both in the IV and the OLS result the response of the population are smoothly, but persistently. After that, they move to examine the effect on wages and productivity. In OLS and IV estimation, the results are different. The behavior of the wage seems not to react to the exogenous negative housing shock. In the productivity estimation, the OLS and IV still have different results. The OLS seems to contain the other shock which affects labor productivity. The result shows that the long-term effect of the housing crisis does not arise from productivity. The past recession literature focused on the role of household deleveraging, most of them deem it as a recovery indicator from the recession. But in this paper, the author finds even if the deleveraging can propagate the impact of the housing shock, it can not explain the continuing short-fall in employment as of 2018.

However, we also found that the fluctuation of stock may also have a great impact on the economic system. In the research of Pan (2020), he uses the vector autocorrelation (VAR) to capture the effect of the stock bubble and uses Granger Causality Test to find the stock fluctuation indeed having an impact on the macroeconomy performance.

3 Empirical Model

In the ADF test, we found the employment rate, GDP growth rate has a non-stationary problem, so we take the first difference to make them difference stationery. Before we get into the main model, we have to measure the shock of the stock return and the shock of the house price variation. We use the way that Mark Gertler and Simon Gilchrist (2018) used in their paper but change some variables. Considering the stock return, house price variation and the macroeconomic variable may have an endogenous relationship and may interact contemporarily. We use SVAR to extract the shock of stock return and the shock of house price growth rate variation We use SVAR to extract the stock return s_t on 4 lags (4 is determined by the result of Akaike Information Criterion, AIC) of itself and current and 4 lags of average real residential property prices growth rate variation ΔP_{t-i} and 4 lagged value of employment rate growth ΔE_{t-i} to capture the shock on the stock return:

$$s_t = \sum_{i=0}^{4} \alpha_i^s s_{t-i} + \sum_{i=0}^{4} \gamma_{t-i}^s \Delta P_{t-i} + \sum_{i=0}^{4} \omega_i^s \Delta E_{t-i} + \varepsilon_t \tag{1}$$

The residual ε_t provides the measure of the shock on the stock return. Similarly, in order to obtain the shock on the property market price growth rate variation we use SVAR to regress ΔP_t on 4 lags of itself and and 4 lags of stock return

s_t and 4 lagged values of employment rate growth ΔE_{t-i}:

$$\Delta P_t = \sum_{i=0}^{4} \alpha_i^p s_{t-i} + \sum_{i=0}^{4} \gamma_{t-i}^p \Delta P_{t-i} + \sum_{i=0}^{4} \omega_i^p \Delta E_{t-i} + \mu_t \tag{2}$$

The residual μ_t provides the measure of the shock on the property price growth rate variation.

Then, we change it to a matrix form and using the Wold Ordering to represent their interaction with each other. We assume after the housing market received a shock the stock market would reflect instantly, then the macroeconomy would reflect the shock following the house and the stock market. Therefore, we use the ordering in equation(3) to use SVAR to estimate the relationship between each other and extract the shock:

$$\begin{pmatrix} \Delta P_t \\ s_t \\ \Delta E_t \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} \mu_t \\ \varepsilon_t \\ e^{\Delta E_t} \end{pmatrix} \tag{3}$$

In the main model, we extend the model in Bhattarai, Schwartzman, Yang(2020), and transform the model from OLS Regression to Long Regression to precisely capture how the variation of the shock of stock and house price gradually influence the economic system. We estimate the effect of different variable, financial shock, and property market shock on the different real economic activities after the end of the Asset Price Bubble which is 1991Q4:

$$\Delta E_t - \Delta E_{1991Q4} = \beta_{0,t}(\mu_t - \mu_{1991Q4}) + \beta_{1,t}(\varepsilon_t - \varepsilon_{1991Q4}) + \beta_{2,t}(\mathrm{R}_t - \mathrm{R}_{1991Q4}) + \epsilon_t \tag{4}$$

We let $\Delta E_t - \Delta E_{1991Q4}$ stands for the growth of employment rate since 1991 The R_t is the interest rate at time t. Then, we use the same way to estimate the effect on GDP and CPI, respectively.

$$\begin{pmatrix} \Delta P_t \\ s_t \\ \Delta GDP_t \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} \mu_t \\ \varepsilon_t \\ e^{\Delta GDP_t} \end{pmatrix} \tag{5}$$

$$\Delta GDP_t - \Delta GDP_{1991Q4} = \beta_{0,t}(\mu_t - \mu_{1991Q4}) + \beta_{1,t}(\varepsilon_t - \varepsilon_{1991Q4}) + \beta_{2,t}(\mathrm{R}_t - \mathrm{R}_{1991Q4}) + \epsilon_t \tag{6}$$

$$\begin{pmatrix} \Delta P_t \\ s_t \\ CPI_t \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} \mu_t \\ \varepsilon_t \\ e^{CPI_t} \end{pmatrix} \tag{7}$$

$$\mathrm{CPI}_t - \mathrm{CPI}_{1991Q4} = \beta_{0,t}(\mu_t - \mu_{1991Q4}) + \beta_{1,t}(\varepsilon_t - \varepsilon_{1991Q4}) + \beta_{2,t}(\mathrm{R}_t - \mathrm{R}_{1991Q4}) + \epsilon_t \tag{8}$$

From the above-mentioned model, we can examine the shock of the stock return and property market price variation on the real economic activities after the end of the asset price bubble, which is 1991Q4.

4 Empirical Result

In the result of Table 1, the variation of the shock of stock return and house price growth rate variation from 1991Q4, estimated by the SVAR is not statistically significant on the variation of employment rate, GDP. growth rate But the shock of the house price growth rate variation and the interest rate is statistically significant in the CPI. When the house price growth rate variation increases one percent it will make the CPI decreases 0.284%. And it conforms to the economic intuition. when the house price growing the money will move to the housing market and the cash flow in the market will decrease and then the inflation may attenuate leading to the CPI decreasing.

	Employment	GDP	CPI
(Intercept)	-0.37905	-0.04571	0.76753
	(0.75553)	(0.25704)	(0.64203)
μ	0.13895	0.00574	-0.28427^{*}
	(0.16165)	(0.05491)	(0.13762)
ε	-0.04255	0.05961	0.03745
	(0.16018)	(0.05443)	(0.13766)
R	-0.18227	-0.08553	-0.47291^{**}
	(0.16477)	(0.05592)	(0.14062)
R^2	0.02282	0.03812	0.13524
Adj. R^2	-0.00740	0.00837	0.10850
Num. obs.	101	101	101

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 1: Order1 SVAR models.

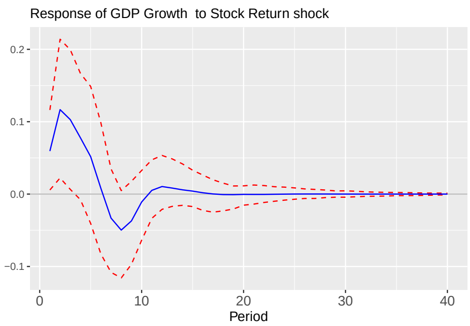
In Figure 1, we can find the IRF results are showing that the stock return shock and the property price growth rate variation shock do not have a persistent impact on the employment rate growth, GDP growth, and CPI. The shock is given to the stock return and the house price growth rate variation does not make the employment rate growth, GDP growth, and the CPI diverge from zero. All of them converge to zero in the 30 periods.

Figure 1: IRF Result

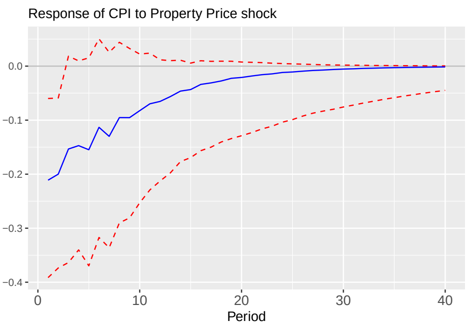
(a) Response of employment rate to μ

(b) Response of employment rate to ε

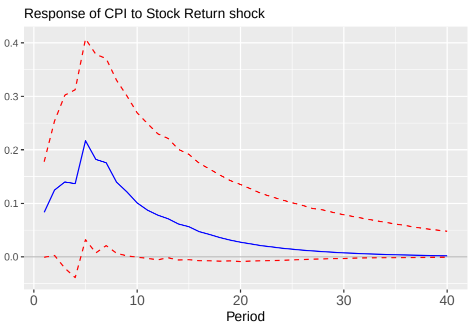
(c) Response of GDP growth rate to μ



(d) Response of GDP growth rate to ε



(e) Response of CPI to μ



(f) Response of CPI to ε

5 Robustness Check

In the robustness check process, we will change the Wold Ordering of our SVAR model. Here we assume after the stock return received a shock the housing market would reflect first then the macroeconomy would reflect the shock follow the stock and the housing market. Therefore, we use the ordering in equation(9) to use SVAR to estimate the relationship between each other and extract the shock:

$$\begin{pmatrix} s_t \\ \Delta P_t \\ \Delta E_t \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} \varepsilon_t \\ \mu_t \\ e^{\Delta E_t} \end{pmatrix} \tag{9}$$

The result is shown in Table2 and it is consistent with the result that we got in the former model. The house price growth rate variation shock is statistically significant in CPI. When the house price growth rate variation increases one percent it will make the CPI decreases 0.286%

	Employment	GDP	CPI
(Intercept)	−0.00869	−0.04571	0.76753
	(0.10325)	(0.25704)	(0.64203)
ε	0.01674	0.05989	−0.00104
	(0.02193)	(0.05449)	(0.13780)
μ	−0.00346	0.00005	-0.28672^{*}
	(0.02205)	(0.05485)	(0.13748)
R	−0.01852	−0.08553	-0.47291^{**}
	(0.02252)	(0.05592)	(0.14062)
R^2	0.01411	0.03812	0.13524
Adj. R^2	−0.01638	0.00837	0.10850
Num. obs.	101	101	101

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 2: Order2 SVAR models.

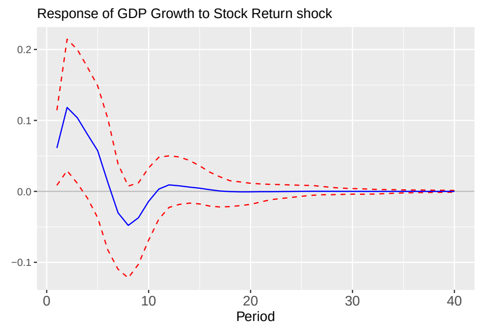
In Figure 2, we can also find the IRF results are also consistent with the former one. When a shock is given to the stock return and the house price growth rate variation does not make the employment rate growth, GDP growth, and the CPI diverge from zero. All of them converge to zero in the 30 periods.

Figure 2: IRF Result

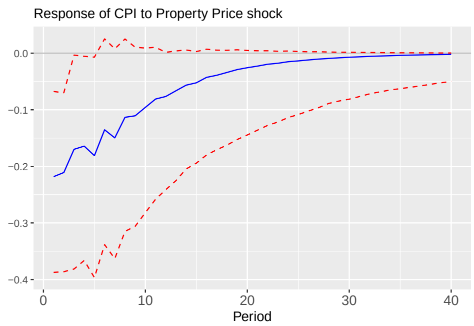
(a) Response of employment rate to μ

(b) Response of employment rate to ε

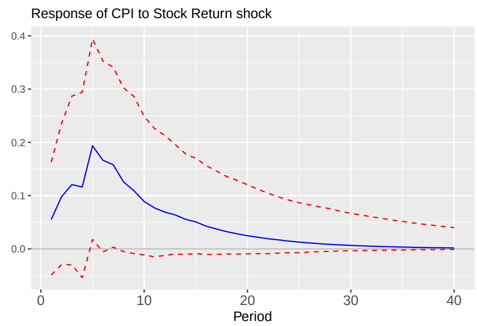
(c) Response of GDP growth rate to μ



(d) Response of GDP growth rate to ε



(e) Response of CPI to μ



(f) Response of CPI to ε

6 Conclusion

Understanding how the shock of the stock return and the house price growth rate variation interacts with the macroeconomic variable. By our experiment, we find the increase in house price variation will decrease the CPI. We can interpret the money flow into the property market and alleviate the inflation, making the CPI goes down.

For getting more deeper into the relationship between them, we have to dig into the causality between the two variables and try to control more variables that we might omit here. In addition to the shock of house price variation and stock return variable, we can add more financial related variables in the future to find whether that variable would have a great impact on the macroeconomic variable and whether they would have a persistent impact on Japan's economic system.

7 Data

CPI quarterly data is collected from OECD and its base period is 2015. Employment rate quarterly data is also from OECD but in the ADF test, we find it has a unit root problem, so I use the first-order difference of the employment rate data to make it stationary. The same issue also happens in the GDP quarterly data. Here, GDP data is using Leading Indicators OECD: Reference Series: Gross Domestic Product (GDP) and it is also non-stationary, so we also conduct first order to make it stationary. In order to examine the relationship between the stock and macroeconomy, we use the NIKKEI 225 data to take logs and conduct first-order differences to generate the stock return variable. The real residential property price data is using the growth rate of the housing price. In the model, we use the first-order difference of house price growth rate to find the shock of the variation of the house price growth rate. The interest rate data is from International Monetary Fund. The data period we choose is from 1990Q2 to 2017Q1.

Data Description	Data Source	Data Code
CPI	OECD[1]	JPNCPIALLMINMEI
Employment Rate	OECD	LREM64TTJPM156S
GDP	OECD	JPNLORSGPNOSTSAM
Interest Rates	IMF[2]	INTDSRJPM193N
NIKKEI 225 Stock Average	NIRI[3]	NIKKEI225
Real Residential Property Prices	BIS[4]	QJPR368BIS

Table 3: Data Code

Data Description	Mean	Standard Deviation	Skewness	Kurtosis
CPI	97.56728	1.800727	-0.8393283	1.814078
Employment Rate	70.17273	1.544483	1.386398	1.387362
GDP	100.0859	1.205249	-0.3684862	0.5253179
Interest Rates	0.9589506	1.472084	2.358464	4.507808
NIKKEI 225 Stock Average	15426.16	4731.343	0.4654016	0.04785951
Real Residential Property Prices	-1.753556	3.395628	1.458481	3.349841

Table 4: Data Description

[1] OECD: Organization for Economic Co-operation and Development
[2] IMF:International Monetary Fund
[3] NIRI: Nikkei Industry Research Institute
[4] BIS:Bank for International Settlements

8 Time Series Graphs

Figure 3: CPI

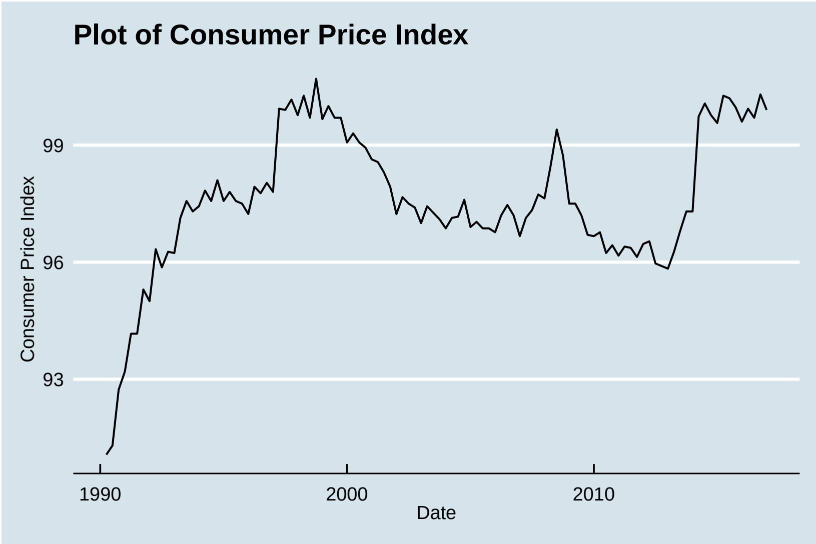


Figure 4: Employment

Figure 5: Gross Domestic Product

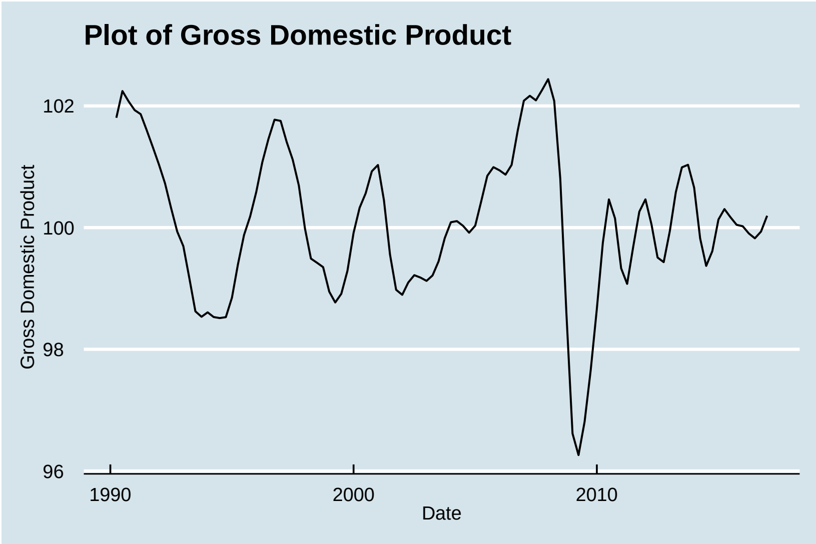


Figure 6: Interest Rates

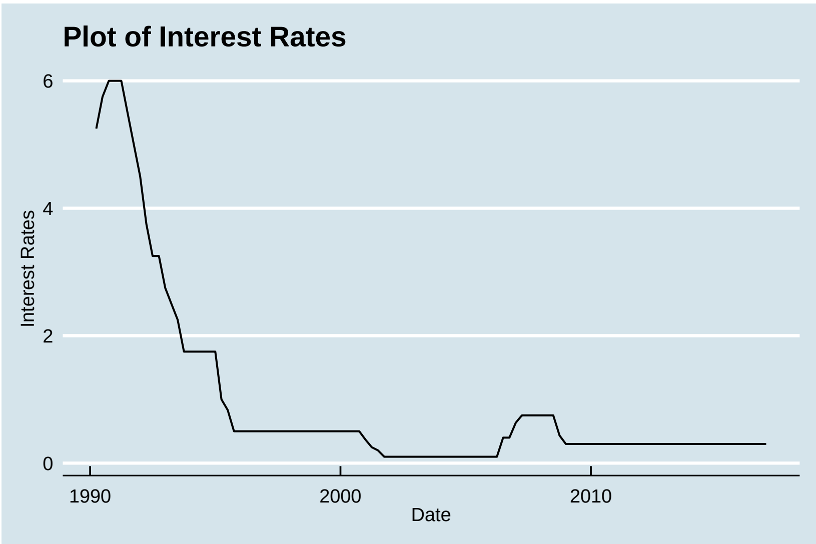


Figure 7: Plot of NIKKEI225

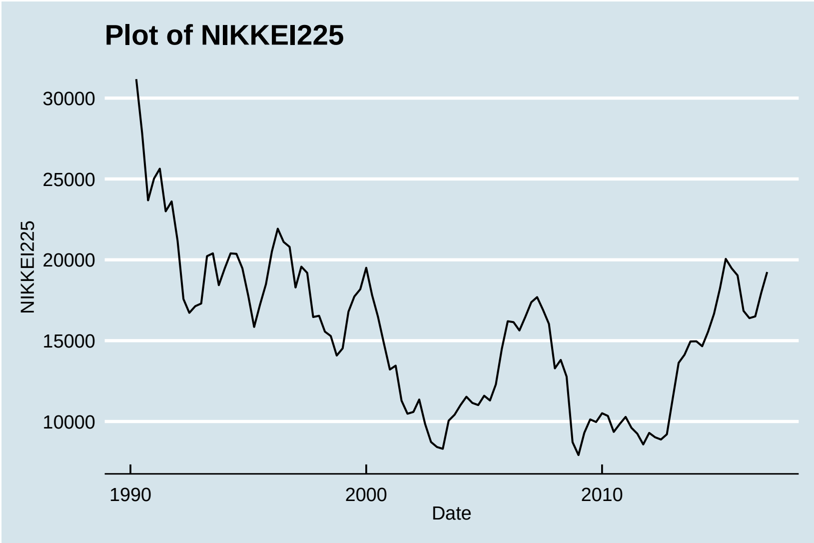
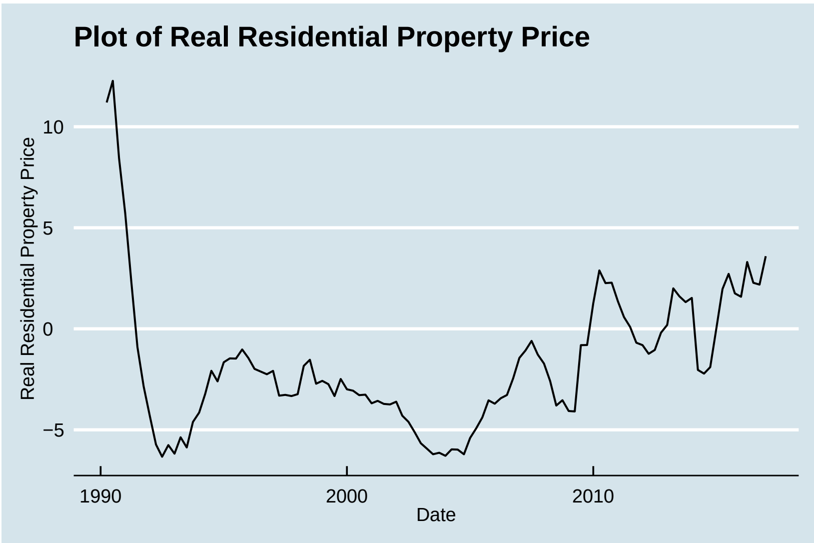


Figure 8: Real Residential Property Prices



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