The Impact of Postponing Announced Unconventional Fiscal Policy on Consumption Expenditure

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June 2017

Abstract

Unconventional fiscal policy uses announcements of future increases in consumption taxes to accelerate consumption expenditure. Under political turnover, it is not time consistent and the government can revise it before the exercise day. We exploit a unique natural experiment for an empirical test of the effect of unconventional fiscal policy and the effect of postponements on it. To balance the budget deficit, the Noda government announced in June 2012 an unexpected 3-percentage-point increase in value-added tax(VAT), effective in April 2014 and another 2-percentage-point increase, effective in October 2015. In November 2014, the Abe government announced to postpone the second tax increase to April 2017. In May 2016, a second postponement was announced by Abe government, which further delayed the tax increase to October 2019. The shock pushes consumption ahead and causes more fluctuations in consumption. However, postponing unconventional fiscal policy, though not lasting to utilize in practice, has the effect of boosting the current consumption and smoothing consumption levels in the long run.

keywords: Fiscal policy; VARX; Japan; VAT

JEL classification: C31, C50, E20, E31, E62, E65

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1 Introduction

Governments across the world strive to stimulate economies without causing a heavy budget deficit. Large stocks of sovereign debts limit the scope of fiscal stimulus, whereas the prevalent zero lower bound on nominal interest rate and inflated central bank balance sheets constrain the use of conventional monetary policy. Eggertsson and Woodford (2006) recently proposed unconventional fiscal policy as an alternative to stimulating demand by changing intertemporal prices. An unconventional fiscal policy uses announcements of future increases in consumption taxes to generate inflation expectations and accelerate consumption expenditure. It differs from the conventional fiscal stimulus or tax rebates because it offers government an option to revise the policy later. In the meanwhile, it stimulates consumption and helps government to compensate for the budget deficit.

In a recent natural experiment in Japan, the value-added tax (VAT) policy sequence displays significant time inconsistency. To handle the significant fiscal burden left by the last government as well as the aging of Japanese society, in June 2012 (2012 Q2), the lower house of Japan passed the bill proposed by Noda government to raise the consumption tax to 8% in April 2014 (2014 Q2) and to 10% in October 2015 (2015 Q4). This policy annoyed the citizens and failed the Noda government in the following election. In November 2014 (2014 Q4), to win support in the election, the Abe government announced to postpone the second tax increase to April 2017 (2017 Q2). In May 2016 (2016 Q2), a second postponement was announced by Abe government, which further delayed the tax increase to October 2019.

To demonstrate the impact of the two postponements of the tax increases, we show the time series plots of Private Final Consumption Expenditure of Japan in Figure 1 and Growth Rate of Consumer Price Index (All Items Non-Food and Non-Energy for Japan) in Figure 2. We observe different trends in both indices at separate time points between 2008 and 2016.

A significant decrease in consumption appeared in 2008 because of the worldwide

Figure 1: Private Final Consumption Expenditure in Japan
Trillions of Japanese Yen, Seasonally Adjusted

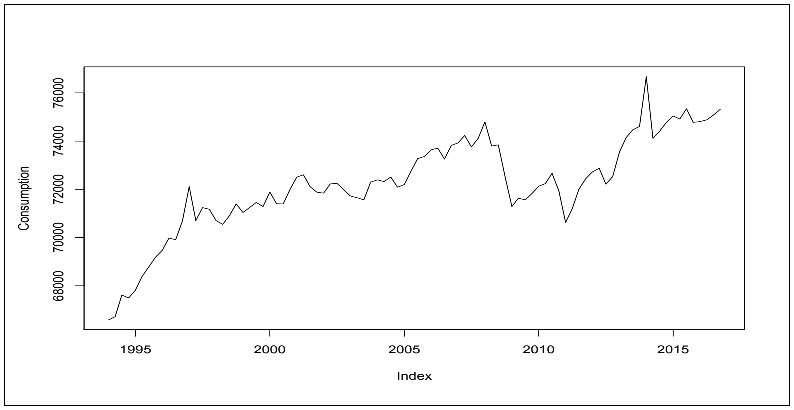
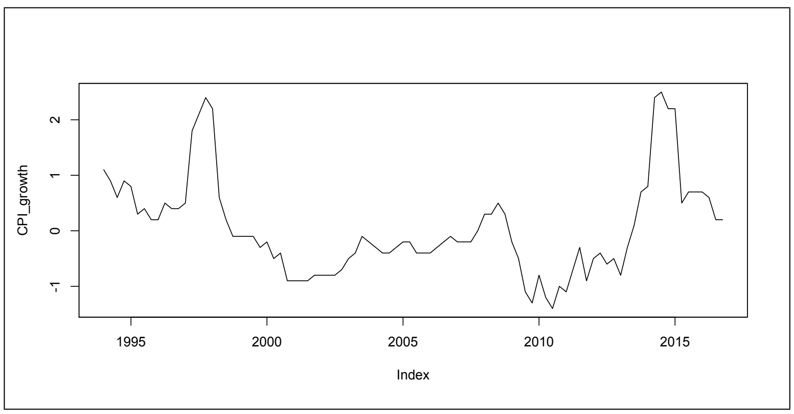


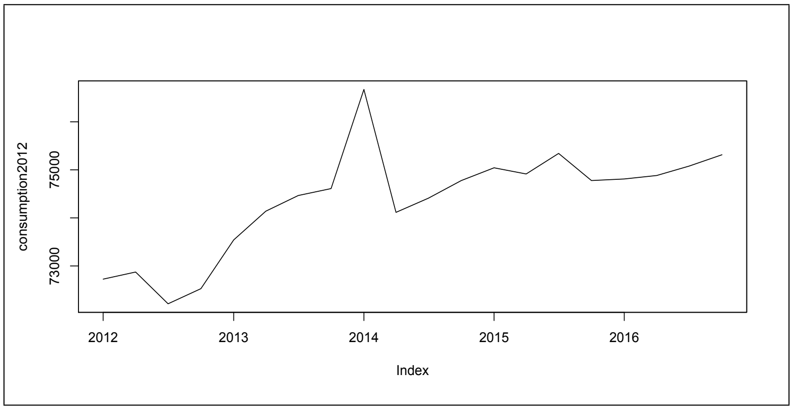
Figure 2: Growth Rate of Consumer Price Index(All Items Non-Food and Non-Energy for Japan)
Same Period Previous Year,Not Seasonally Adjusted



economic recession. The increase around 2014 followed by a sharp decrease was the outcome of the Japanese consumption tax policy. Take a closer look at Figure 1 in the period between 2012 and 2016, an increasing trend can be readily seen from 2012 Q3, soon after the announcement of VAT, to 2014 Q1, shortly before the first exercise date. The most drastic increase appeared in 2014 Q1 before the exercise date. In 2014 Q2, a decrease was observed accompanied by the first announcement of the policy sequence. The decrease was sharp but ended very soon. However, the consumption didn't go back to the same level until the first postponement was announced.

The Growth rate of CPI responded to the policy sluggishly and relative more persistently, suggesting lags in CPI with the policy. However, the overall trend of

Figure 3: Private Final Consumption Expenditure since 2012
Trillions of Japanese Yen, Seasonally Adjusted



CPI growth rate is similar to that of consumption.

Figure 4: Growth Rate of Consumer Price since 2012
Same Period Previous Year, Not Seasonally Adjusted

The unusual fluctuations in both Consumption and CPI indicate the treatment effect of Japanese unconventional fiscal policy sequence. Before the tax exercise day, Japanese people bought large stock of durable goods to avoid tax while after the tax exercise day, the consumption is stagnated. Were there no unconventional fiscal policy, the consumption trend must be smooth. Unconventional fiscal policy brings future consumption expenditure ahead while the existing of a second tax increase gives households motivation to keep consuming. The postponement of the second tax increase extends the policy duration and give households time to smooth their consumption. Were there no postponements, the consumption trend must be more fluctuated after the first exercise day of tax increase.

In this paper, we study the reaction of households when government announces a future sales tax increase but has the option to postpone it. We built a Vector Auto-regression Model (VAR) to model the Japanese economy before the existence of the unconventional fiscal policy sequence. Then we built Vector Auto-regression Models with Exogenous Variables (VARXs) to model the unconventional fiscal policy sequence. First, we built a VARX model and set the lag of exogenous variables to be zero to model the unconventional fiscal policy. Then, we built a VARX model and set the lag of exogenous variables to be non-zero to model the unexpected postponement of the unconventional fiscal policy. For each model, we predict the treatment effect of the VAT policy and the postponement.

The we find that the treatment effect of the whole unconventional fiscal policy sequence is not ideal. The pre-announcement of tax increases generates high consumption in the short time. But after the first exercise day, consumption drops sharply and does not recover at the previous level if the policy were not conducted. This phenomenon may follow from the fact that unconventional fiscal policy squeezes future consumption to the present. Once the households spend large amount on durable goods such as household appliances, cars, etc., they have no incentive to buy more of these. The replacement period of durable goods are long, thus even when they expect another tax increase in the near future, they will not store more.

We also find that the overall treatment effect of postponement is strong. The postponement of the second unconventional fiscal policy actually drags consumption to a higher level than if the policy were not postponed. This phenomenon may stem from the fact that if the policy were not postponed, the whole VAT policy sequence should have already terminated in November 2015. Households purchase durable goods on their shopping lists and do not plan to buy more in the following several years. Thus, in the prediction period, households won't spend much so that the consumption remains a low lever. Hence, postponement of the second tax increase generates persistent policy sequences and inflation expectation. This explains why the unexpected postponement by Abe government, in fact, has positive effects on

Japanese economy.

What's more, the treatment effect is weakened when the postponement is partially predicted by the households. This is because when the postponement can be anticipated, households won't bring future consumption to the execution period of the fiscal policy. If the government keeps violating his policies announced, he loses credits in the long run. As a consequence, the effect of postponement on consumption is weakened every time. This indicates that, as a policy tool, the postponement should not be used too often.

2 Literature Review

Two streams of research are relevant to this paper. One is on the effect of unconventional fiscal policy and the other is on the time consistency and optimal policy design.

Via a Ramsey taxation model, Feldstein (2002) argues that VAT induced by inflation would incentivize households to spend sooner rather than waiting and prices become substantially higher later. Hall (2011) claims that pre-announced increases in VAT generate inflation of consumer price and stimulate spending via intertemporal substitution. Correia, Farhi, Nicolini and Teles (2013) formalize these ideas in a theoretical framework with a binding zero lower bound on nominal interest rates. An increasing path of consumption taxes and a decreasing path of income taxes lead to inflation expectations, negative real interest rates, and thus stimulates consumption but does not distort production decisions. Analyzing the natural experiment in Germany (2005-2007), DAcunto, Hoang and Weber (2015) and DAcunto, Hoang and Weber (2016) find that households who expect an increase in inflation have a 8% higher reported readiness to spend on durables compared to those not. They find that the unconventional fiscal policy is successful in stimulating consumption expenditure.

Eggertsson and Woodford (2004), Eggertsson and Woodford (2006), Correia et al. (2013), DAcunto et al. (2016) show that unconventional fiscal policy is time consistent at zero bound. In other words, even if the planner were given an opportunity to revise the unconventional fiscal policy in the future, he would choose not to.

The time consistency of unconventional fiscal policy, however, is only valid when the effect of the political turnover of the current government is insignificant. Policymakers are assumed to be myopic and are concerned with the outcome within their own tenure period. Under the loose commitment of policymakers, Debortoli and Nunes (2010) show that the autocorrelation of taxes is low. Like fiscal stimulus, unconventional fiscal policy is made by a benevolent government and is periodically revised.

This paper contributes to the literature in that it studies the unconventional fiscal policy under loose commitment. First, the existing literature on unconventional fiscal policy typically measures the effect of policies ignoring the potential time inconsistency in the policies whereas this paper studies the impact of postponement in an unconventional fiscal policy. Second, the literature on time inconsistency of fiscal policies usually conducts analysis based on the capital income tax while this paper extends the concept of time inconsistency to a new dimension, i.e., the unconventional value-add-tax.

3 Model

In the absence of an unconventional fiscal policy, Galí (2015) proposes a standard New Keynesian model, in which the preference of a representative household is characterized over aggregate consumption C_t and leisure L_t. Households set up a consumption and working plan to maximize the infinite-horizon utilities:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(C_t, L_t). \tag{1}$$

With unconventional fiscal policies, Correia et al. (2013) introduces a preference shock ξ_t to the utility function of a representative household. The new utility is expressed as follows:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(C_t, L_t, \xi_t), \tag{2}$$

where the function u admits a multiplicative form,

$$u(C_t, L_t, \xi_t) = u(C_t, L_t)\xi_t. \tag{3}$$

The preference shock does not affect the marginal rate of substitution between consumption and leisure. It does, however, affect the marginal rate of substitution between consumption at time t and time $t+1$. Correia et al. (2013) suggest an equilibrium path for $\{C_t, N_t, K_t, P_t, W_t\}$, where W_t is the nominal wage.

Thus, when unconventional fiscal policy is unavailable, the economy can be characterized by Vector Auto-regression Model (VAR) as follows:

$$\begin{bmatrix} C_t \\ K_t \\ N_t \\ P_t \\ W_t \end{bmatrix} = \phi_0 + \sum_{i=1}^{p} \phi_i \begin{bmatrix} C_{t-i} \\ K_{t-i} \\ N_{t-i} \\ P_{t-i} \\ W_{t-i} \end{bmatrix} + a_t, \tag{4}$$

where p is the lag of time series $\{C_t, K_t, N_t, P_t, W_t\}$, ϕ_0 is a 5-dimensional constant vector, ϕ_i are 5×5 real-valued matrices, $\{a_t\}$ is a sequence of serially uncorrelated random vectors with mean zero and positive-definite covariance matrix $\sum_a$.

Correia et al. (2013) assume that the shocks ξ_t evolve exogenously satisfying $\xi_t/\xi_{t+1} < \beta$ for $t = 0, 1, ..., T-1$ and $\xi_t/\xi_{t+1} = 1$ for $t \geq T$, where T is the exercise day of the unconventional fiscal policy. Deviation from the path prescribed by the announced unconventional fiscal policy, under this assumption, is shown to be suboptimal.

Here, in our model, the shocks ξ_t evolve exogenously and are determined by information of the current state. The exogenously information we introduced into our original VAR model here are the expected tax increase and the expected duration of the policy treatment.

The economy, in this case, can be characterized by Vector Auto-regression Model with exogenous variables (VARX) as follows:

$$\begin{bmatrix} C_t \\ K_t \\ N_t \\ P_t \\ W_t \end{bmatrix} = \phi_0 + \sum_{i=1}^{p} \phi_i \begin{bmatrix} C_{t-i} \\ K_{t-i} \\ N_{t-i} \\ P_{t-i} \\ W_{t-i} \end{bmatrix} + B \begin{bmatrix} E[\Delta\tau]_t \\ E[T-t]_t \end{bmatrix} + a_t, \tag{5}$$

where $\Delta\tau$ is the change of VAT rate, B is a 5×2 coefficient matrix.

However, when there are postponements on unconventional fiscal policies, ξ_t does not evolves exogenously anymore. To capture the effect of postponing unconventional fiscal policy, we need to relax the exogenously assumption. We should note that revising an unconventional fiscal policy will not only change the scale of the immediate impact, but affect the duration of the policy treatment. Although the current expectation won't affect the expectation of the following period, it will consistently influence consumption decisions in the future. In other words, the time series $\{C_t, K_t, N_t, P_t, W_t\}$ exhibit lags. The economy can be characterized by VARX as follows:

$$\begin{bmatrix} C_t \\ K_t \\ N_t \\ P_t \\ W_t \end{bmatrix} = \phi_0 + \sum_{i=1}^{p} \phi_i \begin{bmatrix} C_{t-i} \\ K_{t-i} \\ N_{t-i} \\ P_{t-i} \\ W_{t-i} \end{bmatrix} + \sum_{j=0}^{s} B_j \begin{bmatrix} E[\Delta\tau]_{t-j} \\ E[T-t]_{t-j} \end{bmatrix} + a_t, \tag{6}$$

where $\Delta\tau$ is the change of VAT rate, B_j are 5×2 coefficient matrices.

We conduct structural estimation based on the constructed models above to evaluate the effects of policy treatment and postponement. We give the gaps between our predictions and real world performance.

4 Data

Data of this paper can be found in Federal Reserve Bank(2016 OECD) and Penn World Table 9.0. The policy announcement/exercise date and the rate of tax increase can be found from Wikipedia and can be verified through Ministry of Finance, JAPAN; The House of Representatives, Japan; and Ministry of Internal Affairs and Communication.

The empirical analysis is conducted using Japanese quarterly time series data from 1994 Q1 to 2016 Q4. The endogenous variables ($\{C_t, K_t, N_t, P_t, W_t\}$) are constructed using the seasonally adjusted index data of each time series. Consumption Index of Japan is calculated from Private Final Consumption Expenditure in Japan and Consumer Price Index (CPI) for Japan. We use Gross Fixed Capital Formation for Japan ($\{Kf_t\}$) to substitute $\{K_t\}$; Price Index (P_t) of Japan is represented by Consumer Price Index: Total All Items for Japan (CPI_t); Labor supply index (N_t) is represented by Monthly Hours Worked: Manufacturing for Japan; Nominal Wage(W_t) is represented by Hourly Earnings: Manufacturing for Japan; All the relevant time series can be found directly from FRED.

We assume when there are two unconventional fiscal policies in effect at the same time, short-sighted households choose to focus on the most recent one. The exogenous variables ($\{E[\Delta\tau]_t E[T-t]_t\}$) are constructed from Japanese VAT policy sequence since June 2012, when the unconventional fiscal policy was first announced in Japan. Results are presented in Table 1.

When performing regressions, we use Expected Policy Duration before Exercise Date in Years.

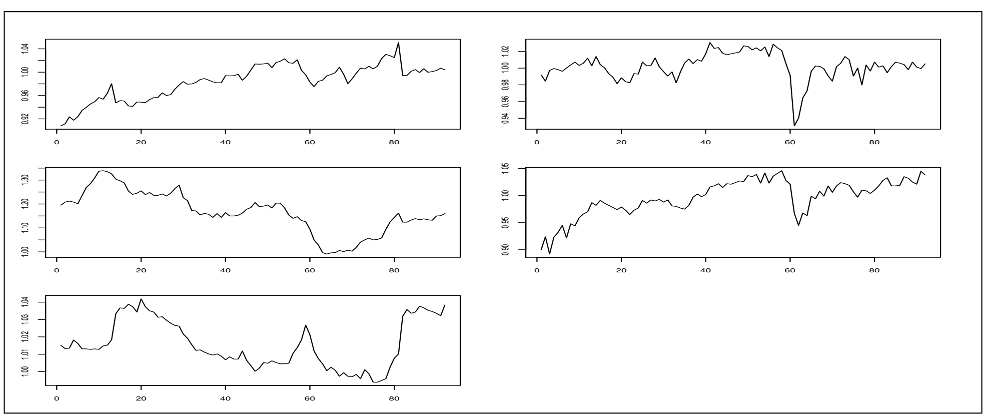
5 Main Results

Before formally implementing the model estimation, we first take a close look at the multivariate time series $\{C_t, Kf_t, N_t, CPI_t, W_t\}$, which we show in Figure 5.

Table 1: The Expectation of Households on Future VAT Rate Increase and Remaining Duration before the Exercise Date

Date t	Exercise Date $E[T]$	$E[T-t]_t$(in Months)	$E[T-t]_t$(in Years)	Expected Tax Rate Change
2012 Q3(July)	April 2014	21	1.75	3%
2012 Q4(October)	April 2014	18	1.5	3%
2013 Q1(January)	April 2014	15	1.25	3%
2013 Q2(April)	April 2014	12	1	3%
2013 Q3(July)	April 2014	9	0.75	3%
2013 Q4(October)	April 2014	6	0.5	3%
2014 Q1(January)	April 2014	3	0.25	3%
2014 Q2(April)	October 2015	18	1.5	2%
2014 Q3(July)	October 2015	15	1.25	2%
2014 Q4(October)	October 2015	12	1	2%
2015 Q1(January)	April 2017	27	2.25	2%
2015 Q2(April)	April 2017	24	2	2%
2015 Q3(July)	April 2017	21	1.75	2%
2015 Q4(October)	April 2017	18	1.5	2%
2016 Q1(January)	April 2017	15	1.25	2%
2015 Q2(April)	April 2017	12	1	2%
2015 Q3(July)	October 2019	39	3.25	2%
2015 Q4(October)	October 2019	36	3	2%

Figure 5: Plots of Multivariate Time Serieses $\{C_t, Kf_t, N_t, P_t, W_t\}$
Index 2010=1, Seasonally Adjusted



The ACF (Figure 6) and PACF (Figure 7) plots of the multivariate time series $\{C_t, Kf_t, N_t, CPI_t, W_t\}$ suggest there are lags in these time series.

Next, we'll apply these multivariate time series data into the VAR and VARX models introduced in Section 3.

Figure 6: Acf Plots of $\{C_t, Kf_t, N_t, P_t, W_t\}$

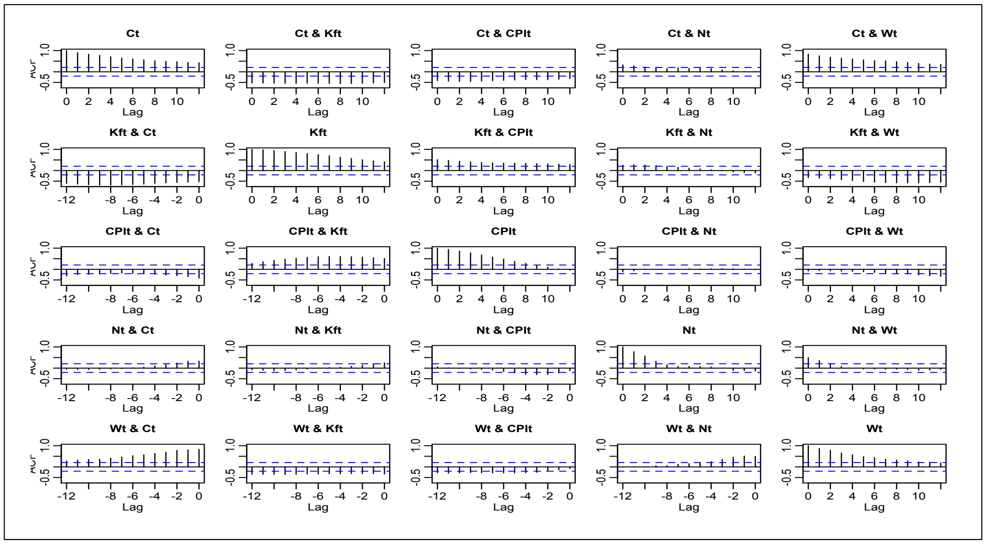
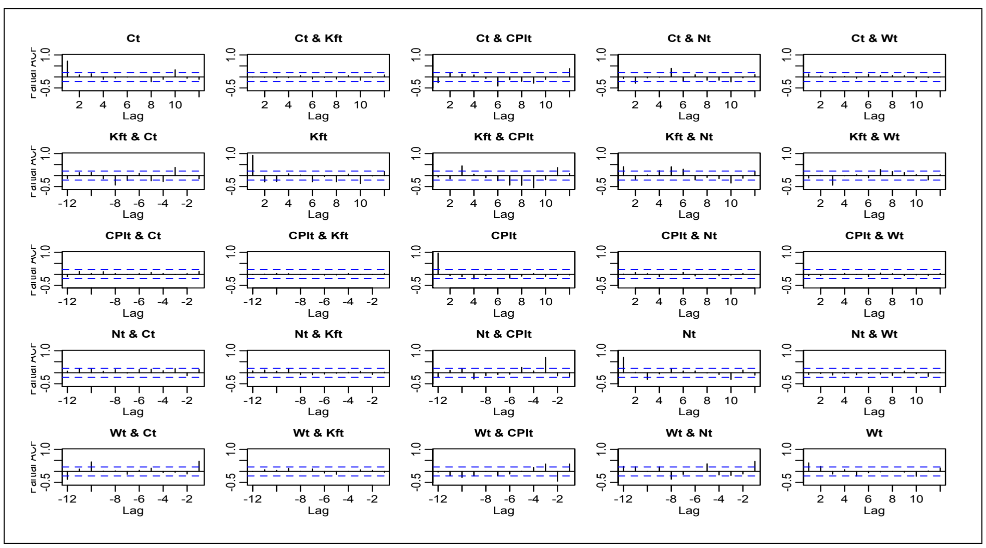


Figure 7: Pacf Plots of $\{C_t, Kf_t, N_t, P_t, W_t\}$



The Effect of Unconventional Fiscal Policy Sequence

We use the data before the first announcement of the unconventional fiscal policy (1994 Q1 - 2012 Q2) to train the VAR model.

First, by the information criteria (AIC, BIC, hq), the VAR order can be selected to be 1, 3 or 12.

Second, we refine the model and perform model checking. We find that a refined

VAR(3) model is the best fit.

$$\begin{bmatrix} C_t \\ Kf_t \\ N_t \\ CPI_t \\ W_t \end{bmatrix} = \begin{bmatrix} 1.199253 \\ 1.355681 \\ 0 \\ 1.033252 \\ 0 \end{bmatrix} + \begin{bmatrix} 0.000 & 0.0766 & -1.613 & 0.4102 & 0.0000 \\ -0.857 & 0.9889 & -1.405 & 0.8158 & 0.0000 \\ 0.223 & 0.0000 & 1.235 & -0.0945 & 0.0515 \\ 0.251 & 0.0000 & 0.000 & 0.8214 & 0.0000 \\ 0.288 & 0.0000 & 0.788 & 0.5836 & 0.2361 \end{bmatrix} \begin{bmatrix} C_{t-1} \\ Kf_{t-1} \\ N_{t-1} \\ CPI_{t-1} \\ W_{t-1} \end{bmatrix}$$
$$+ \begin{bmatrix} 0.000 & 0.000 & 0.000 & -0.252 & 0.272 \\ -0.618 & 0.000 & -0.981 & 0.000 & 0.462 \\ 0.000 & -0.040 & 0.000 & 0.000 & 0.000 \\ -0.486 & -0.121 & -1.889 & 0.214 & 0.207 \\ -0.442 & 0.000 & -1.707 & 0.000 & 0.438 \end{bmatrix} \begin{bmatrix} C_{t-2} \\ Kf_{t-2} \\ N_{t-2} \\ CPI_{t-2} \\ W_{t-2} \end{bmatrix}$$
$$+ \begin{bmatrix} 0.427 & 0.0000 & 0.768 & -0.4617 & 0.168 \\ 0.457 & 0.0000 & 1.351 & -0.5729 & 0.000 \\ -0.163 & 0.0486 & -0.270 & 0.0936 & -0.086 \\ 0.000 & 0.1837 & 1.203 & -0.4207 & 0.000 \\ 0.340 & 0.0000 & 0.857 & -0.3782 & 0.000 \end{bmatrix} \begin{bmatrix} C_{t-3} \\ Kf_{t-3} \\ N_{t-3} \\ CPI_{t-3} \\ W_{t-3} \end{bmatrix} + a_t \tag{7}$$

$$\sum_a = \begin{bmatrix} 3.147842e-05 & 2.006627e-05 & -7.212663e-06 & 7.376755e-06 & 6.340486e-06 \\ 2.006627e-05 & 1.762483e-04 & 3.649136e-06 & 3.626593e-05 & 1.868633e-05 \\ -7.212663e-06 & 3.649136e-06 & 8.818529e-06 & 7.248901e-06 & 5.661034e-06 \\ 7.376755e-06 & 3.626593e-05 & 7.248901e-06 & 5.651835e-05 & 3.563922e-05 \\ 6.340486e-06 & 1.868633e-05 & 5.661034e-06 & 3.563922e-05 & 7.267355e-05 \end{bmatrix}$$

For brevity, the model checking results are relegated to Appendix A-2.

Next, we compute 1-step to 18-step with 2012 Q2 being the forecast origin. The predictions of consumption index are presented in table 2.

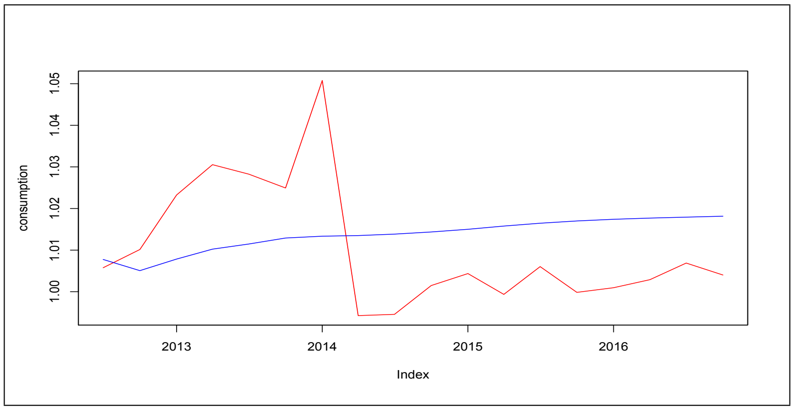
We plot the real world consumption index and the predicted consumption index and find that the unconventional fiscal policy sequence generates high consumption

Table 2: **Prediction of refined VAR(3) at Forecast Origin 2012 Q2**

Date	C_t	Kf_t	CPI_t	N_t	W_t
2012 Q3	1.008	1.055	0.998	1.003	1.018
2012 Q4	1.005	1.050	0.998	1.001	1.015
2013 Q1	1.008	1.049	0.996	1.000	1.014
2013 Q2	1.010	1.049	0.996	1.004	1.015
2013 Q3	1.011	1.048	0.996	1.007	1.017
2013 Q4	1.013	1.050	0.996	1.009	1.021
2014 Q1	1.013	1.051	0.996	1.010	1.023
2014 Q2	1.013	1.052	0.996	1.011	1.025
2014 Q3	1.014	1.053	0.996	1.010	1.025
2014 Q4	1.014	1.053	0.995	1.010	1.026
2015 Q1	1.015	1.053	0.995	1.010	1.026
2015 Q2	1.016	1.053	0.995	1.010	1.026
2015 Q3	1.016	1.053	0.995	1.010	1.027
2015 Q4	1.017	1.052	0.995	1.011	1.027
2016 Q1	1.017	1.052	0.995	1.011	1.028
2016 Q2	1.018	1.051	0.995	1.011	1.029
2016 Q3	1.018	1.050	0.995	1.011	1.029
2016 Q4	1.018	1.049	0.995	1.011	1.029

in the short term will actually reduce consumption in the long run after the first exercise date. Results are shown in Figure 8.

Figure 8: Real Consumption Index vs Predicted Consumption Index
Real Wold Value: Red; Predicted Value: Blue



We find that the treatment effect of the whole unconventional fiscal policy sequence is not ideal. The pre-announcement of tax increases generate high consumption in the short time, but after the first exercise day, consumption drops sharply and does not maintain at the same level if the policy were not conducted. This phenomenon follows from the fact that unconventional fiscal policy squeezes the future consumption to the present. After the households spend large amount on durable goods such as household appliances, cars, etc., they will not buy more. The replacement period of these durable goods are long, thus even when households expect another tax increase in the near future, they have no incentive to store more.

The Effect of Postponements

We use the data before the first postponement of the unconventional fiscal policy (1994 Q1 2014 Q4) to train the VARX model.

First, we set the lag of exogenous variables to be 0. The VAR order is selected to be either 1 or 4 by information criteria (AIC, BIC, hq).

Second, we refine the model and perform model checking. A refined VARX(4) model is the best fit.

$$\begin{bmatrix} C_t \\ Kf_t \\ N_t \\ CPI_t \\ W_t \end{bmatrix} = \begin{bmatrix} 1.001 \\ 0.9392 \\ 0 \\ 0.8469 \\ 0.3293 \end{bmatrix} + \begin{bmatrix} 0.000 & 0.000 & -1.066 & 0.366 & 0.000 \\ -0.288 & 0.988 & 0.000 & 0.204 & 0.151 \\ 0.248 & 0.000 & 1.148 & -0.069 & 0.016 \\ 0.190 & 0.096 & 0.507 & 0.589 & 0.111 \\ 0.181 & 0.000 & 1.288 & 0.458 & 0.263 \end{bmatrix} \begin{bmatrix} C_{t-1} \\ Kf_{t-1} \\ N_{t-1} \\ CPI_{t-1} \\ W_{t-1} \end{bmatrix}$$

$$+ \begin{bmatrix} -0.152 & 0.067 & -0.447 & -0.241 & 0.338 \\ -0.393 & 0.000 & -0.576 & 0.000 & 0.339 \\ 0.000 & 0.000 & 0.000 & 0.000 & 0.000 \\ -0.490 & -0.140 & -2.136 & 0.334 & 0.000 \\ -0.585 & 0.000 & -2.443 & 0.164 & 0.423 \end{bmatrix} \begin{bmatrix} C_{t-2} \\ Kf_{t-2} \\ N_{t-2} \\ CPI_{t-2} \\ W_{t-2} \end{bmatrix}$$

$$+ \begin{bmatrix} 0.301 & 0.132 & 0.000 & -0.290 & 0.000 \\ 0.075 & -0.051 & 0.000 & 0.000 & -0.383 \\ 0.000 & 0.000 & 0.325 & 0.000 & -0.074 \\ 0.274 & 0.115 & 1.143 & -0.443 & 0.000 \\ 0.000 & 0.175 & 0.000 & -0.239 & -0.117 \end{bmatrix} \begin{bmatrix} C_{t-3} \\ Kf_{t-3} \\ N_{t-3} \\ CPI_{t-3} \\ W_{t-3} \end{bmatrix}$$

$$
\begin{aligned}
&+\begin{bmatrix} 0.348 & -0.14 & 0.852 & -0.073 & 0.000 \\ 0.000 & 0.00 & 0.000 & 0.000 & 0.000 \\ -0.106 & 0.02 & -0.509 & 0.000 & 0.000 \\ 0.000 & 0.00 & 0.000 & 0.000 & 0.000 \\ 0.486 & -0.14 & 0.892 & -0.340 & 0.208 \end{bmatrix} \begin{bmatrix} C_{t-4} \\ Kf_{t-4} \\ N_{t-4} \\ CPI_{t-4} \\ W_{t-4} \end{bmatrix} \\
&+\begin{bmatrix} 1.247 & -0.020 \\ 1.745 & -0.027 \\ -0.125 & 0.003 \\ 0.000 & 0.000 \\ 0.000 & 0.000 \end{bmatrix} \begin{bmatrix} E[\Delta\tau]_t \\ E[T-t]_t \end{bmatrix} + a_t
\end{aligned} \tag{8}
$$

$$
\sum_a = \begin{bmatrix} 4e-05 & 0.00002 & -1e-05 & 1e-05 & 0e+00 \\ 2e-05 & 0.00018 & 1e-05 & 5e-05 & 2e-05 \\ -1e-05 & 0.00001 & 1e-05 & 0e+00 & 1e-05 \\ 1e-05 & 0.00005 & 0e+00 & 7e-05 & 3e-05 \\ 0e+00 & 0.00002 & 1e-05 & 3e-05 & 6e-05 \end{bmatrix}
$$

The model checking results can be found in Appendix A-2.

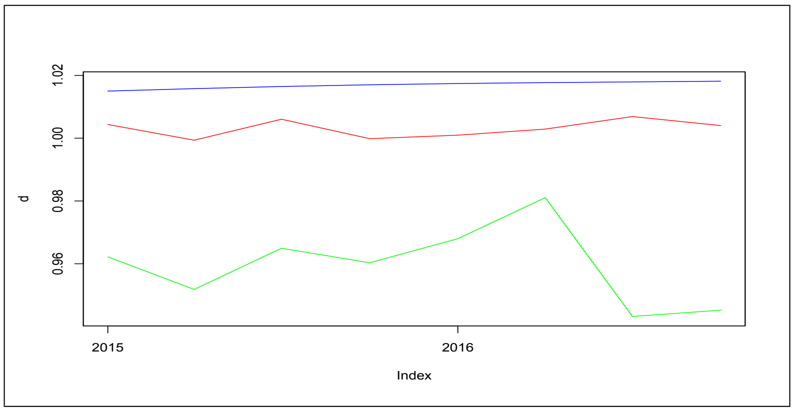
Next, we compute 1-step to 8-step prediction with 2014 Q4 being the forecast origin. Table 3 gives the prediction of consumption index.

Table 3: Prediction of refined VARX(4) at Forecast Origin 2014 Q4

Date	C_t	Kf_t	CPI_t	N_t	W_t
2015 Q1	0.96220	1.08924	1.04229	0.98412	1.01161
2015 Q2	0.95182	1.05090	1.03800	0.97611	1.00208
2015 Q3	0.96495	1.03367	1.02872	0.96073	0.99367
2015 Q4	0.96033	1.02016	1.02538	0.96578	0.97796
2016 Q1	0.96799	1.01562	1.01733	0.96524	0.97573
2016 Q2	0.98107	1.01863	1.00944	0.97240	0.96985
2016 Q3	0.94322	0.96572	1.01203	0.97977	0.98021
2016 Q4	0.94521	0.93312	1.00411	0.97933	0.98441

Plotting the real world consumption and the predicted consumption indicies, we find that the postponement of the second unconventional fiscal policy actually drags consumption to a higher level than if the policy were not postponed. If no postponement occurred, the unconventional policy sequence would drive the consumption expenditure to a level even worse. Results are shown in Figure 9.

Figure 9: Real Consumption Index vs Predicted Consumption Indicies Real Wold Value: Red; Predicted Value of VAR: Blue; Predicted Value of VARX: Green



Therefore, the postponement of the second unconventional fiscal policy actually drags consumption to a higher level than if the policy were not postponed. This phenomenon follows from the fact that if the policy were not postponed, the whole VAT policy sequence should have terminated in November 2015. Households might finish purchasing durable goods and won't buy more in the next several years. Thus, in our prediction period, households have no incentive to spend much and the consumption remains a low lever. Hence, postponing the second tax increase leads to persistent policy sequences and inflation expectation. In conclusion, the unexpected postponement have positive effects on Japanese economy.

The Effect of the Second Postponement

We use the data before the second postponement of the unconventional fiscal policy (1994 Q1 2016 Q2) to train the VARX model.

First, the orders of VAR and exogenous variables chosen by information criteria (AIC, BIC) are 4 and 3, respectively.

Second, we refine the model and perform model checking. A refined VARX(4,3) model is the best fit.

$$
\begin{bmatrix} C_t \\ Kf_t \\ N_t \\ CPI_t \\ W_t \end{bmatrix} = \begin{bmatrix} 1.4111257 \\ 2.0438760 \\ 0.1474239 \\ 1.0509043 \\ 0.2939678 \end{bmatrix}
$$

$$
+ \begin{bmatrix} 0.0000000 & 0.0000000 & -1.281892 & 0.47333858 & -0.12653567 \\ -1.0066265 & 0.9279205 & -1.531579 & 0.74009502 & 0.00000000 \\ 0.1786789 & 0.0000000 & 1.115491 & -0.07005993 & 0.04481677 \\ 0.0000000 & 0.0000000 & 0.000000 & 0.84370214 & 0.00000000 \\ 0.0000000 & 0.0000000 & 1.025184 & 0.51906586 & 0.26446274 \end{bmatrix} \begin{bmatrix} C_{t-1} \\ Kf_{t-1} \\ N_{t-1} \\ CPI_{t-1} \\ W_{t-1} \end{bmatrix}
$$

$$
+ \begin{bmatrix} -0.2106159 & 0.07034593 & -0.3028825 & -0.1148036 & 0.2753481 \\ -0.7136064 & 0.11332099 & -0.9639201 & 0.0000000 & 0.5862807 \\ 0.0000000 & -0.03079047 & 0.0000000 & 0.0000000 & 0.0000000 \\ -0.3505383 & -0.15825626 & -1.9791686 & 0.2457895 & 0.2762917 \\ -0.4426860 & 0.00000000 & -2.2287672 & 0.1824587 & 0.3770127 \end{bmatrix} \begin{bmatrix} C_{t-2} \\ Kf_{t-2} \\ N_{t-2} \\ CPI_{t-2} \\ W_{t-2} \end{bmatrix}
$$

$$
+ \begin{bmatrix} 0.0000000 & 0.1427359 & 0.000000 & -0.34036118 & 0.2142302 \\ 0.2243471 & -0.2046649 & 0.000000 & -0.14709286 & 0.0000000 \\ 0.0000000 & 0.0000000 & 0.000000 & 0.01865342 & 0.0000000 \\ 0.0000000 & 0.2119873 & 1.329709 & -0.38837754 & 0.0000000 \\ 0.0000000 & 0.1928559 & 0.000000 & -0.30058584 & 0.0000000 \end{bmatrix} \begin{bmatrix} C_{t-3} \\ Kf_{t-3} \\ N_{t-3} \\ CPI_{t-3} \\ W_{t-3} \end{bmatrix}
$$

$$
+ \begin{bmatrix} 0.5117874 & -0.1317611 & 0.6076145 & -0.32442929 & 0.1207166 \\ 0.0000000 & 0.1605871 & 0.9875062 & -0.36728412 & 0.1457284 \\ -0.1953028 & 0.0480127 & -0.2589014 & 0.00000000 & 0.0000000 \\ 0.0000000 & 0.0000000 & 0.0000000 & -0.08696387 & 0.0000000 \\ 0.4986862 & -0.1574570 & 0.9726984 & -0.36960036 & 0.1737516 \end{bmatrix} \begin{bmatrix} C_{t-4} \\ Kf_{t-4} \\ N_{t-4} \\ CPI_{t-4} \\ W_{t-4} \end{bmatrix}
$$

$$
+\begin{bmatrix} 0.683305057 & -0.013206413 \\ 0.000000000 & 0.000000000 \\ -0.509593552 & 0.005566281 \\ -0.004781916 & 0.000000000 \\ -0.183131546 & 0.006060823 \end{bmatrix} \begin{bmatrix} E[\Delta\tau]_t \\ E[T-t]_t \end{bmatrix}
$$

$$
+\begin{bmatrix} -0.6753121 & 0.011903853 \\ 0.0000000 & 0.000000000 \\ 0.4098774 & -0.002695097 \\ 0.0000000 & 0.000000000 \\ 0.0000000 & 0.000000000 \end{bmatrix} \begin{bmatrix} E[\Delta\tau]_{t-1} \\ E[T-t]_{t-1} \end{bmatrix}
$$

$$
+\begin{bmatrix} 0.0000000 & 0.005924114 \\ 0.0000000 & 0.000000000 \\ 0.2401069 & -0.002732560 \\ -0.8501817 & 0.000000000 \\ 0.0000000 & 0.000000000 \end{bmatrix} \begin{bmatrix} E[\Delta\tau]_{t-2} \\ E[T-t]_{t-2} \end{bmatrix} + \begin{bmatrix} 0.5736207 & 0 \\ 2.3049024 & 0 \\ 0.0000000 & 0 \\ 1.5084845 & 0 \\ 0.0000000 & 0 \end{bmatrix} \begin{bmatrix} E[\Delta\tau]_{t-3} \\ E[T-t]_{t-3} \end{bmatrix} + a_t \tag{9}
$$

$$
\sum_a = \begin{bmatrix} 4e-05 & 0.00002 & -1e-05 & 1e-05 & 0e+00 \\ 2e-05 & 0.00018 & 1e-05 & 5e-05 & 2e-05 \\ -1e-05 & 0.00001 & 1e-05 & 0e+00 & 1e-05 \\ 1e-05 & 0.00005 & 0e+00 & 7e-05 & 3e-05 \\ 0e+00 & 0.00002 & 1e-05 & 3e-05 & 6e-05 \end{bmatrix}
$$

The model checking results are placed in Appendix A-2

Next, we compute 1-step to 2-step prediction with 2016 Q2 being the forecast origin. The prediction of consumption index is shown in table 4.

Comparing the predicted consumption index of VARX(4,4) with the real world consumption index and the predicted consumption index of VARX(4), we find that al-

Table 4: **Prediction of refined VARX(4,3) at Forecast Origin 2016 Q2**

Date	C_t	Kf_t	CPI_t	N_t	W_t
2016 Q3	0.97814	1.15703	1.04351	1.00381	1.03879
2016 Q4	0.98702	1.17358	1.04498	0.99756	1.04706

though the second postponement of the unconventional fiscal policy, which is partially predicated by the consumers, also benefits the economic situation, its influence is not so strong as the first postponement. Results regarding the second postponement are shown in Table 5.

Table 5: **Real Consumption Index vs Predicted Consumption Indices**

Date	Real Wolrd Value	Predicted Value of VAR(3)	Predicted Value of VARX(4)	Predicted Value of VARX(4,4)
2016 Q3	1.0068883	1.017926	0.94322	0.97814
2016 Q4	1.0040159	1.018149	0.94521	0.98702

When the postponement is partially predicted by households, the treatment effect will be weakened. This is because when the postponement is anticipated, households don't have motivation to bring future consumption to the execution period of the unconventional fiscal policy. If the government keeps violating the announced policies, it loses credits to the public. Consequently, the effect of postponement is weakened every time it is made. In general, postponement of announced policies should not be persistently employed.

6 Discussion

This paper studies the effect of unconventional fiscal policy sequence on consumption using a dataset from Japan. Through a VAR model and two VARX models, we show that the unconventional fiscal policy sequence pushes consumption ahead and causes more fluctuations in consumption. However, postponing unconventional fiscal policy, though not lasting to utilize in practice, has the effect of boosting the current consumption and smoothing consumption levels in the long run.

If the data after the exercise day of the second tax increase (2019 Q4 and later) is accessible, we can study the effect of the second unconventional fiscal policy and compare with the first policy considered in this paper. This would make the analysis more complete.

As part of future work, we can focus on the theoretically modeling of the unconventional fiscal policy with postponements, incorporating the fact that postponement of policies can be anticipated by households. Another interesting direction of future work involves using Micro data to analyze the change of preference parameters of Japanese households in response to the policies, especially those parameters related to consumption.

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APPENDIX

A-1 Model Appendix

Assume that there is a representative household with preferences characterized over aggregate consumption C_t and leisure L_t ,

$$E_0 \sum_{t=0}^{\infty} \beta^t u(C_t, L_t, \xi_t), \tag{A.1.1}$$

where ξ_t is a preference shock.

As suggested by Correia et al. (2013), an equilibrium path for $\{C_t, L_t, N_t, K_t\}$, $\{p_t, P_t, W_t, U_t\}$, and $\{i_t \geq 0, \tau_t^c, \tau_t^n, \tau_t^k, s_t^I, \tau_t^d\}$ is characterized by the followings:

$$N_t = 1 - L_t, \tag{A.1.2}$$

where N_t is the total labor with total time endowment normalized to one. For households:

$$\frac{u_C(C_t, L_t, \xi_t)}{u_C(C_t, L_t, \xi_t)} = \frac{1+\tau_t^c}{1-\tau_t^n}\frac{P_t}{W_t}, \tag{A.1.3}$$

where τ_t^c is tax rate on consumption, τ_t^n is tax rate on labor income P_t is the price level and W_t is the nominal wage. It holds that

$$\frac{u_C(C_t, L_t, \xi_t)}{(1+\tau_t^c)P_t} = (1+i_t)E_t\frac{\beta u_C(C_{t+1}, L_{t+1}, \xi_{t+1})}{(1+\tau_{t+1}^c)P_{t+1}}, \tag{A.1.4}$$

where $(1 + i_t)$ is the gross nominal interest rate. We thus have

$$\frac{u_C(C_t, L_t, \xi_t)}{(1+\tau_t^c)} = E_t\frac{\beta u_C(C_{t+1}, L_{t+1}, \xi_{t+1})}{(1+\tau_{t+1}^c)}[\frac{1-s_{t+1}^I}{1-s_t^I}(1-\delta) + \frac{(1-\tau_{t+1}^k)\frac{U_{t+1}}{P_{t+1}} + \tau_{t+1}^k\delta}{1-s_t^I}], \tag{A.1.5}$$

where s_t^I is the investment tax credit, τ_t^k is the tax rate on capital income, δ is the depreciation rate and U_t is the rental cost of capital.

Assume each product is produced by a monopolist. Prices are set as in Calvo (1983). In each period, a firm is able to revise the price with probability $1 - \alpha$. For firms:

$$p_t = [(1-\alpha)p_t^{1-\theta} + \alpha p_{t-1}^{1-\theta}]^{\frac{1}{1-\theta}}, \tag{A.1.6}$$

where p_t is chosen by those firms to maximize profits net of taxes. Computation gives

$$p_t = \frac{\theta}{\theta-1}E_t\sum_{j=0}^{\infty}\eta_{t,j}\frac{W_{t+j}}{A_{t+j}F_n(\frac{K_{t+j}}{N_{t+j}})}, \tag{A.1.7}$$

where $\theta > 1$ is the elasticity of substitution between varieties, A_t is an aggregate productivity shock, F is the production function and K_t is the capital stock. Then

$$\eta_{t,j} = \frac{(\alpha\beta)^j \frac{(1-\tau^d_{t+j})u_C(t+j)}{1+\tau^c_{t+j}} (P_{t+j})^{\theta-1} Y_{t+j}}{E_t \sum_{j=0}^{\infty} (\alpha\beta)^j \frac{(1-\tau^d_{t+j})u_C(t+j)}{1+\tau^c_{t+j}} (P_{t+j})^{\theta-1} Y_{t+j}}, \tag{A.1.8}$$

where τ^d_t is the tax rate on profits.

$$C_t + G_t + K_{t+1} - (1-\theta)K_t = [\sum_{j=0}^{t+1} \varpi_j (\frac{p_{t-j}}{P_t})^{-\theta}]^{-1} A_t F(K_t, N_t) \tag{A.1.9}$$

where G_t is public consumption, ϖ_j is the share of firms that have set prices j periods before, $\varpi_j = \alpha^j(1-\alpha), j = 0, 1, 2, ..., t$. The $t+1$ period $\varpi_{t+1} = \alpha^{t+1}$ represents the share of firms that have never set prices so far.

A-2 Estimation Appendix

Model Checking for VAR

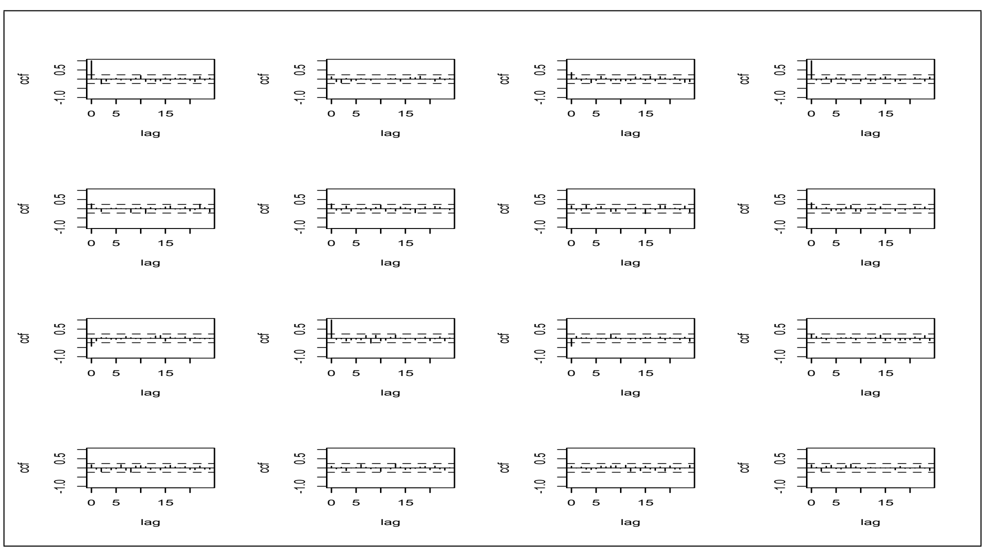


Figure 10: ccf plots of VAR(3)

From the ccf plots and the p-value plots, we find that a refined VAR(3) model is adequate to fit the data.

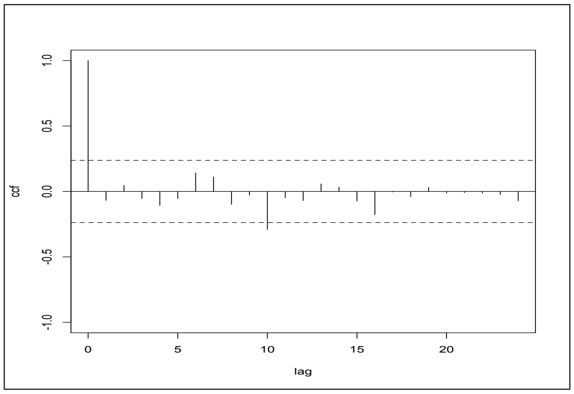


Figure 11: ccf of VAR(3) continue

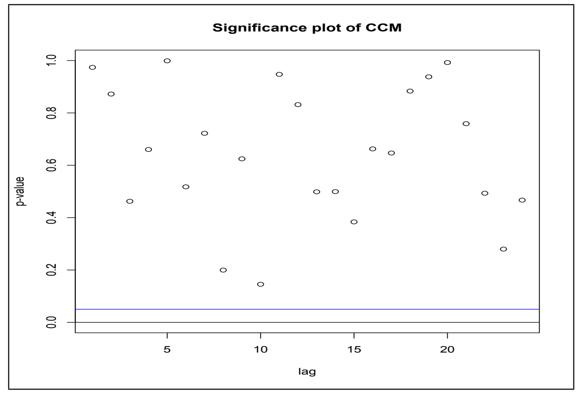


Figure 12: p-value for each ccm of VAR(3)

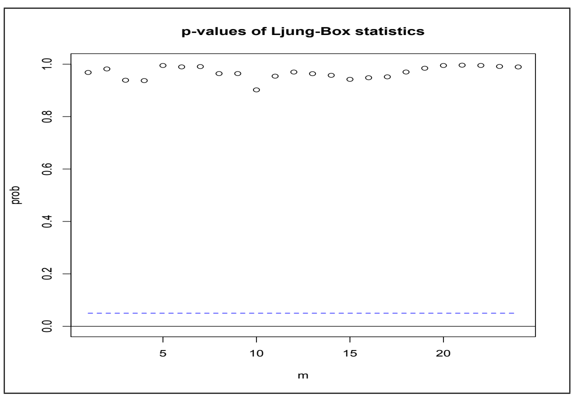


Figure 13: MQ Statiscis of VAR(3)

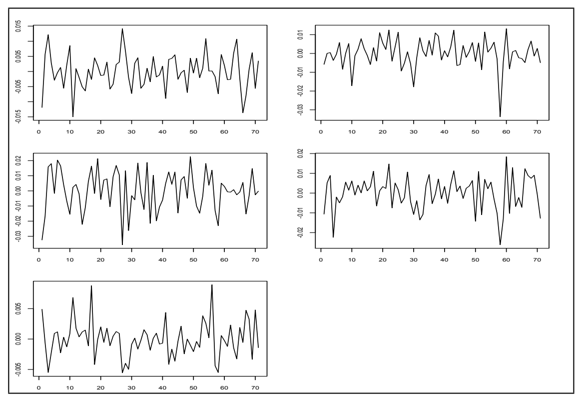


Figure 14: Residual Plots of VAR(3)

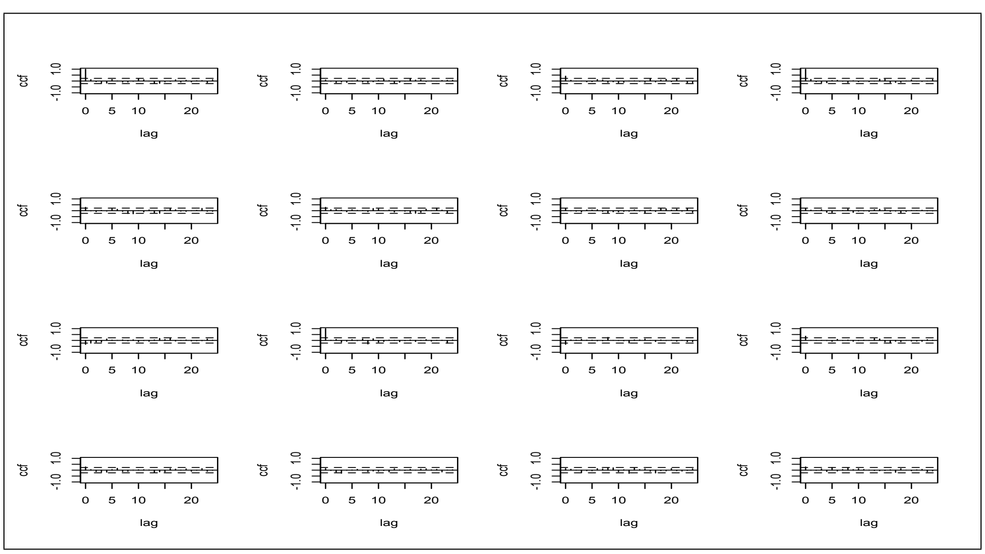
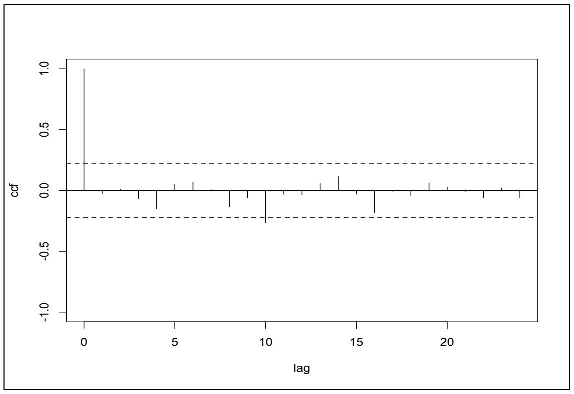


Figure 15: ccf plots of VARX(4)



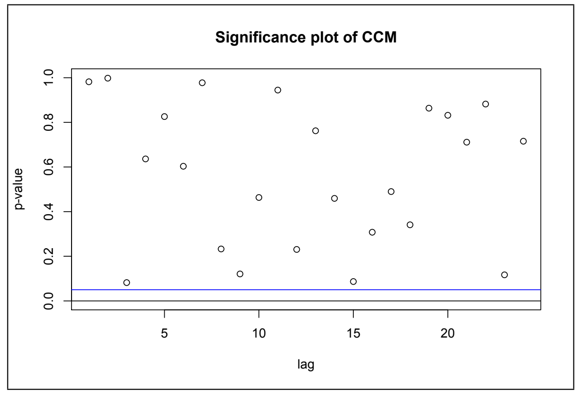
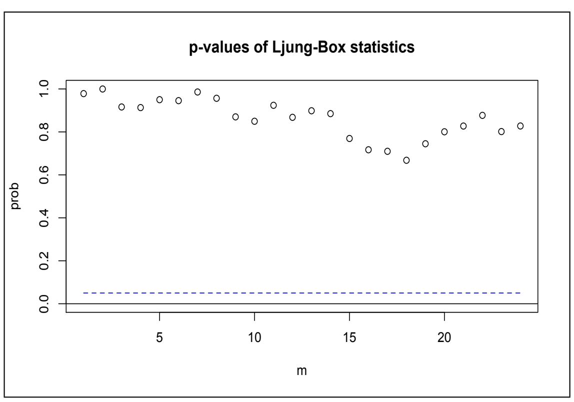


Figure 16: ccf of VARX(4) continue **Figure 17:** p-value for each ccm of VARX(4)



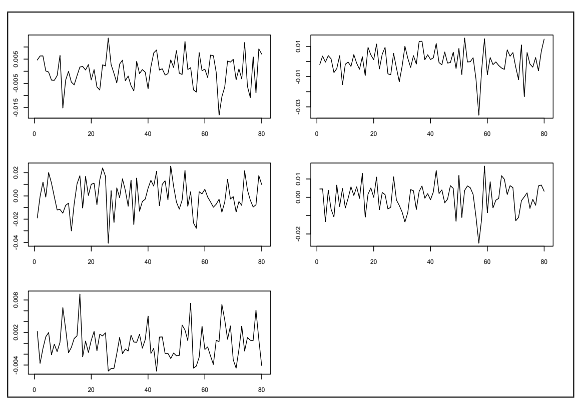


Figure 18: MQ Statiscis of VARX(4) **Figure 19:** Residual Plots of VARX(4)

Model Checking for VARX(4)

From the ccf plots and the p-value plots, we find that a refined VARX(4) model is adequate to fit the data.

Model Checking for VARX(4,3)

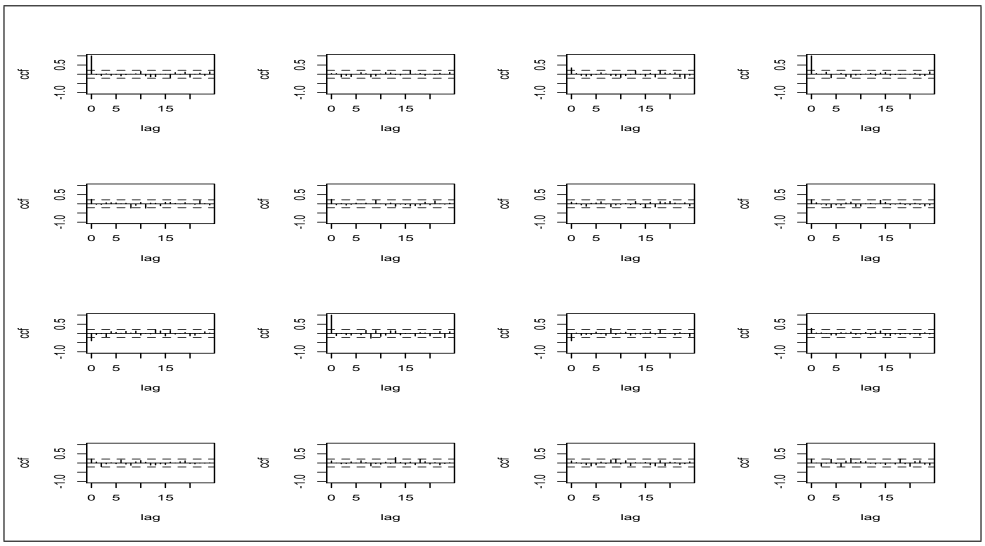
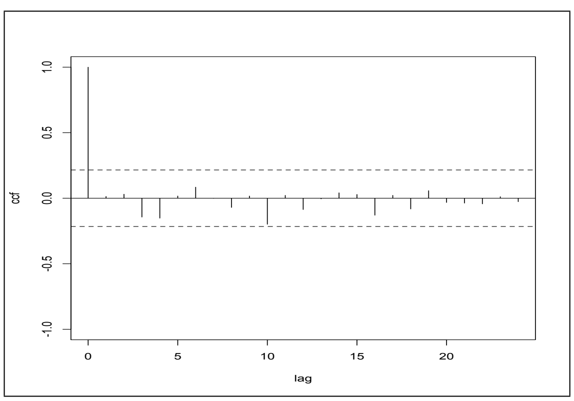


Figure 20: ccf plots of VARX(4,3)



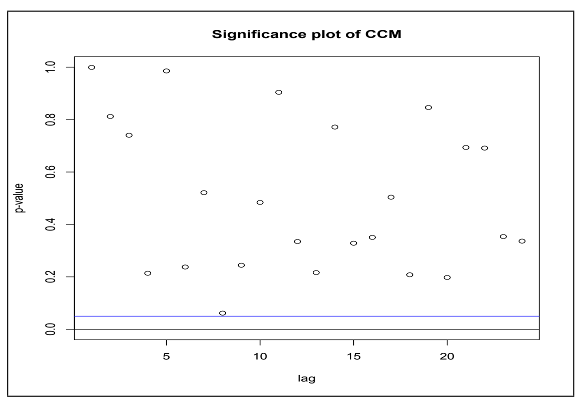


Figure 21: ccf of VARX(4,3) con. **Figure 22:** p-value for each ccm of VARX(4,3)

From the ccf plots and the p-value plots, we find that a refined VARX(4,3) model is adequate to fit the data.

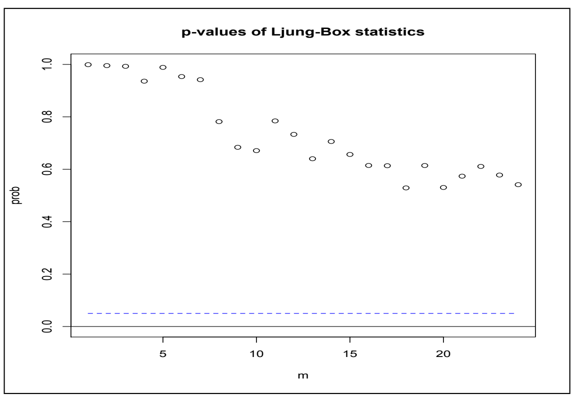


Figure 23: MQ Statiscis of VARX(4,3)

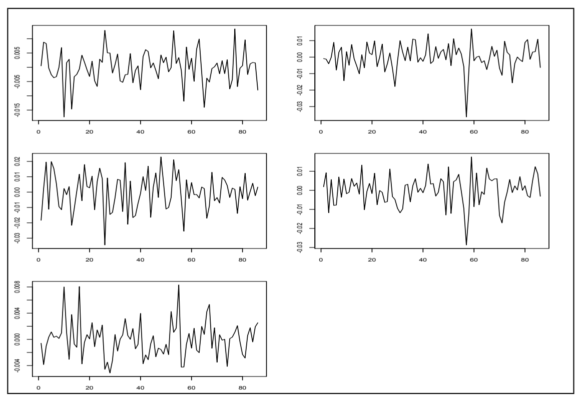


Figure 24: Residual Plots of VARX(4,3)