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Near-Rational Expectations: How Far Are Surveys from Rationality?

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Почти рациональные ожидания: насколько далеки опросы от рациональных ожиданий ?

На английском языке

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Keywords: DSGE, out of sample forecasts, survey expectations, near-rational expectations
JEL Classification: E32, E37, E47

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Near-rational expectations: how far are surveys from rationality?

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Abstract

New simple forms of deviation from rational expectations (RE) are suggested: strong near-rational expectations (SNRE) and weak near-rational expectations (WNRE). The medium-scale DSGE model is estimated with the RE, the SNRE and the WNRE. It is estimated with and without observed from the surveys expectations. The quality of out-of-sample forecasts is estimated. It is shown that near-rational concept produce the same advantages as learning without its disadvantages. However, the DSGE model with the RE and the observed expectations with measurement errors can produce results that only slightly worse than with the WNRE. The influence of the observed expectations on the forecasting quality is analyzed.

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1. Introduction

DSGE models are the key instruments of macroeconomic analysis. They are widely used by central banks and other official organizations [Tovar (2009)]. The forecasting quality of DSGE models outperforms autoregressive models and close to forecasting quality of surveys [Rubaszek and Skrzypczynski (2008); Del Negro and Schorfheide (2012)]. But there are some critics that emphasize low forecasting quality of all forecast [Edge and Gurkaynak (2010)].

Rational expectation is important assumption of DSGE models. The main version of the rational expectation assumes the full information approach. However, there are modifications such as news or sticky information. There are some papers that investigate consequences of dropping the rational expectation assumption [Ormeno and Molnar (2014); Milani and Rajbhandari (2012)]. The learning is the main alternative to the rational expectation [Milani (2012)].

Models with learning could fit data better than rational DSGE models [Slobodyan and Wouters (2012)]. But this result doesn't include information about relation between expectation from the model and expectation from some surveys.

Milani and Rajbhandari compare forecasting performance of a small-scale DSGE models with learning and with rational expectation [Milani and Rajbhandari (2012)]. The model with learning fit better than the rational version. Forecasts of inflation are better for the rational expectation model. The same is true for the long term forecasts of output growth. However, the short term forecasts of output growth are the cases where learning outperforms the rational expectation. The multivariate measures of the forecasts quality are better for the long term rational expectation. In the case of short term forecasts models with learning are slightly better (depending on the forecasting quality measures and usage of survey data). This result holds for expectations observed from surveys by the model with learning. However, the small-scale DSGE model has very poor structure (the rational expectation version have only 3 shocks and 3 state

variables), therefore additional flexibility have to improve the model regardless of flexibility source.

There is paper that use a medium-scale DSGE model and the observed inflation expectation [Ormeno and Molnar (2014)]. The model with learning fit slightly better in case of unobserved inflation expectation, and much better in case of the observed inflation expectation. However, these results is sensitive to the learning algorithm: one of alternative algorithms decrease advantage of the model with learning and other one produce advantage of the rational expectation model.

Three ideas could explain advantage of learning. The first of them is deviation of an agents' expectation from the rational expectation. The second is additional flexibility of a model with learning. The third is more realistic expectation mechanics. The third explanation is doubtful because learning algorithms allow possibility of unrestricted manipulation (uncommon shocks that greatly excess standard deviation break most learning algorithms). For example, the learning algorithm for inflation expectation wouldn't react on a huge change in the monetary policy [Ormeno and Molnar (2014)]. That is reason of usage exogenous near rational expectation in this paper. This algorithm has the first and the second explanation of learning advantage but hasn't the third one.

The remainder of the paper is organized as follows. In section 2 the DSGE models is described. Section three presents the near rational expectation algorithm in details. In section 4 dataset (including observed forecasts), estimation regimes and some estimation results would be described. Section five contains measures of forecasting quality. This section gives answers about influence of the observed expectations on forecasting quality (for variables that have or haven't observed expectations) for the DSGE model with rational and near-rational expectations. The last section is conclusions.

2. The DSGE model

The DSGE model includes four types of agents: householders, firms, government and the foreign sector. The structure of the model is presented in Figure 1. The DSGE model includes central New-Keynesian features (for example, sticky price and adjustment costs in investment). The model is similar to [Ivashchenko (2014)], but have some differences within foreign sector, taxes and some other.

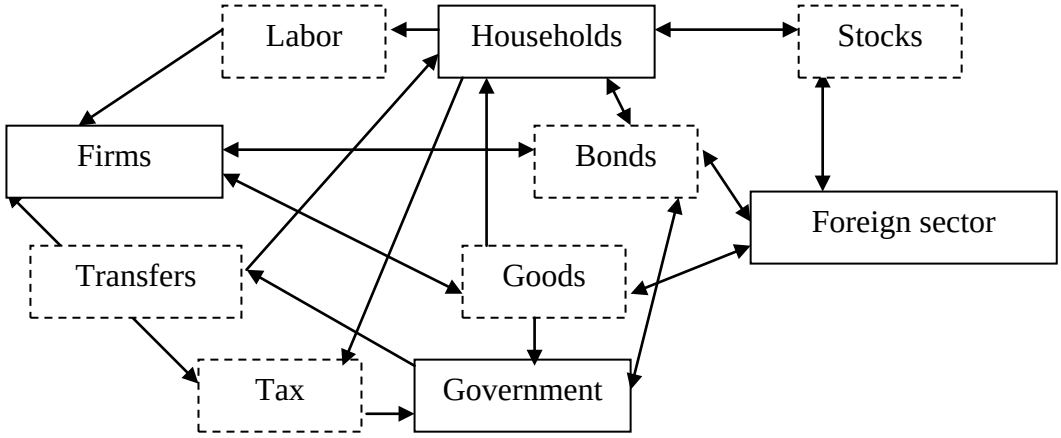


Figure.1. Structure of DSGE model

TABLE 1. The DSGE model variables

Variable	Description	Stationary variable
$B_{F,t}$	Value of bonds bought by firms in period t	$b_{F,t} = B_{F,t} / P_t Z_t$
$B_{G,t}$	Value of bonds bought by government in period t	$b_{G,t} = B_{G,t} / P_t Z_t$
$B_{H,t}$	Value of bonds bought by households in period t	$b_{H,t} = B_{H,t} / P_t Z_t$
$B_{W,t}$	Value of bonds bought by foreign sector in period t	$b_{W,t} = B_{W,t} / P_t Z_t$
C_t	Consumption at time t	$c_t = \ln(C_t / Z_t)$
D_t	Dividends at time t	$d_t = (C_t / Z_t)$
G_t	Government expenditure at time t	$g_t = \ln(G_t / Z_t)$
H_t	Habit at time t	$h_t = \ln(H_t / Z_t)$
I_t	Investments at time t	$i_t = \ln(I_t / Z_t)$
K_t	Capital at time t	$k_t = \ln(K_t / Z_t)$
L_t	Labor at time t	$l_t = \ln(L_t)$
M_t	Money stock in period t	$m_t = \ln\left(M_t / P_t Z_t\right)$
NX_t	Net export in period t	$nx_t = (NX_t / Z_t)$
P_t	Price of goods in period t	$p_t = \ln(P_t / P_{t-1})$

$P_{F,t}$	Price for goods of firm F in period t	$p_{F,t} = \ln\left(P_{F,t}/P_t\right)$
R_t	Interest rate in period t	$r_t = \ln\left(R_t\right)$
S_t	Price of stocks in period t	$s_t = \ln\left(S_t/P_t Z_t\right)$
$\tau_{L,t}$	Labor tax rate in period t	$\tau_{L,t} = \tau_{L,t}$
$\tau_{Y,t}$	Output tax rate in period t	$\tau_{Y,t} = \tau_{Y,t}$
$T_{TR,t}$	Transfer from government in period t	$\tau_{TR,t} = \ln\left(T_{TR,t}/P_t Z_t\right)$
W_t	Wage in period t	$w_t = \ln\left(W_t/P_t Z_t\right)$
$X_{H,t}$	Amount of stocks bought by householders in period t	$x_{H,t} = X_{H,t}$
$X_{W,t}$	Amount of stocks bought by foreign sector in period t	$x_{W,t} = X_{W,t}$
$Y_{D,t}$	Aggregate demand in period t	$y_{D,t} = \ln\left(Y_{D,t}/Z_t\right)$
$Y_{F,t}$	Output of firm F in period t	$y_{F,t} = \ln\left(Y_{F,t}/Z_t\right)$
$Z_{\alpha,t}$	Exogenous process corresponding to elasticity of production function	$z_{\alpha,t} = Z_{\alpha,t}$
$Z_{\beta,t}$	Exogenous process corresponding to intertemporal preferences of households	$z_{\beta,t} = \ln\left(Z_{\beta,t}/Z_{\beta,t-1}\right)$
$Z_{BF,t}$	Exogenous process corresponding to conventional level of debt pressure	$z_{BF,t} = Z_{BF,t}$
$Z_{BH,t}$	Exogenous process corresponding to stickiness of households' bond position	$z_{BH,t} = \ln\left(Z_{BH,t}/Z_t^{1-\omega_C}\right)$
$Z_{DW,t}$	Exogenous process corresponding to cash flow from foreign part of firm	$z_{DW,t} = Z_{DW,t}/(P_t Z_t)$
$Z_{G,t}$	Exogenous process corresponding to government expenditure	$z_{G,t} = \ln\left(Z_{G,t}\right)$
$Z_{I,t}$	Exogenous process corresponding to decreasing efficiency of investments	$z_{I,t} = \ln\left(Z_{I,t}\right)$
$Z_{L,t}$	Exogenous process corresponding to households' amount of labor	$z_{L,t} = \ln\left(Z_{L,t}/Z_t^{1-\omega_C}\right)$
$Z_{M,t}$	Exogenous process corresponding to liquidity preferences of households	$z_{M,t} = \ln\left(Z_{M,t}/Z_t^{-\omega_C}\right)$
$Z_{NX,t}$	Exogenous process corresponding to net export	$z_{NX,t} = Z_{NX,t}$
$Z_{P,t}$	Exogenous process corresponding to level of price stickiness	$z_{P,t} = \ln\left(Z_{P,t}\right)$
$Z_{R,t}$	Exogenous process corresponding to monetary policy	$z_{R,t} = Z_{R,t}$
$Z_{\tau,t}$	Exogenous process corresponding to taxation policy	$z_{\tau,t} = Z_{\tau,t}$
$Z_{TR,t}$	Exogenous process corresponding to transfers policy	$z_{TR,t} = Z_{TR,t}$
Z_t	Exogenous process corresponding to technological development	$z_t = \ln\left(Z_t/Z_{t-1}\right)$

2.1 Householders

Households maximize the expected sum of their discounted utility functions (1) with budget restriction (2). Householders do not own capital, but they can invest in domestic stocks and bonds as a means of saving money. The utility function consists of the propensity to consume with a habit effect, disutility of labor, money at the utility function, and disutility of bond position deviation from preferred level.

$$E\left(\sum_{t=0}^{\infty} Z_{\beta,t}\left(\begin{array}{l}\dfrac{\left(C_t - h_C H_{t-1}\right)^{1-\omega_C}}{1-\omega_C} - Z_{L,t}\dfrac{L_t^{1+\omega_L}}{1+\omega_L} \\ + Z_{M,t}\dfrac{M_t}{P_t} - Z_{BH,t}\left(\dfrac{B_{H,t}}{P_t Z_t} - \mu_B\right)^2\end{array}\right)\right) \to \max_{B,C,L,M,X} \quad (1)$$

$$P_t C_t + M_t + B_{H,t} + X_{H,t} S_t = (1-\tau_{L,t}) W_t L_t + M_{t-1} + R_{t-1} B_{H,t-1} + X_{H,t-1}\left(S_t + D_t\right) + T_{TR,t} \quad (2)$$

, where C_t is consumption in period t, L_t is labor supply is period t, M_t is money stock in period t, P_t is the price of goods in period t, $B_{H,t}$ is the value of bonds bought by householders in period t, S_t is the price of stocks in period t, X_t is the amount of stocks bought by householders in period t, τ_t is the tax rate in period t, $T_{TR,t}$ is the transfer from government in period t, R_t is the interest rate on bonds in period t, and D_t is dividends of stocks in period t.

2.2 Finished goods-producing firms

Perfectly competitive firms produce the final good Y_t using the intermediate goods $Y_{j,t}$ and the CES production technology:

$$Y_t = \left(\int_0^1 Y_{j,t}^{(\theta-1)/\theta} dj\right)^{\theta/(\theta-1)} \quad (3)$$

Profit maximization and zero profit condition for the finished goods producers imply the following price level P_t and demand function for the intermediate good, j:

$$Y_{j,t} = \left(\frac{P_{j.t}}{P_t}\right)^{-\theta} Y_t \quad (4)$$

$$P_t = \left(\int_0^1 P_{j,t}^{1-\theta} dj\right)^{1/(1-\theta)} \quad (5)$$

2.3 Intermediate goods-producing firms

Firms maximize their expected discounted utility function (6) with restrictions. The utility function consists of dividends flow and two rigidities (stickiness of bond position and price stickiness in the Rotemberg form [Lombardo and Vestin, 2008]) .Firms are working in a market with monopolistic competition; therefore, they have a demand restriction (7). The budget

restriction (8) and production function (9) is common. Restriction of capital evolution (10) contains investment rigidity.

$$E\left(\sum_{t=0}^{\infty}\left(\prod_{k=0}^{t-1}R_k\right)^{-1}\left(\begin{array}{l}D_t-P_{F,t}Y_{F,t}\mu_{FB}\left(\dfrac{B_{F,t}}{P_tZ_t}-Z_{BF,t}\right)\\-P_{F,t}Y_{F,t}Z_{P,t}\left(\dfrac{P_{F,t}}{P_{F,t-1}}-\overline{p}\right)^2-P_{F,t}Y_{F,t}Z_{FWL,t}\left(\dfrac{W_tL_t}{W_{t-1}L_{t-1}}-\overline{py}\right)^2\end{array}\right)\right)\rightarrow\max_{\substack{D,B,P,Y,\\K,I,L}} \tag{6}$$

$$Y_{F,t}=\left(\frac{P_{F,t}}{P_t}\right)^{-\theta}\left(Y_{D,t}\right) \tag{7}$$

$$D_t+P_tI_t+W_tL_t+B_{F,t}=(1-\tau_{Y,t})P_{F,t}Y_{F,t}+R_{t-1}B_{F,t-1}+Z_{DW,t} \tag{8}$$

$$Y_{F,t}=\left(Z_tL_t\right)^{Z_{\alpha,t}}\left(K_{t-1}\right)^{1-Z_{\alpha,t}} \tag{9}$$

$$K_t=(1-\delta)K_{t-1}+I_t\left(1-Z_{I,t}\left(\frac{I_t}{I_{t-1}}-\overline{y}\right)^2\right) \tag{10}$$

, where D_t is the dividends of the firm in period t, $Y_{F,t}$ is the output of firm F in period t, $P_{F,t}$ is the price for goods of firm F in period t, I_t is the demand for investments goods in period t, $Y_{D,t}$ is the aggregate demand in period t, P_t is the price level for domestic goods in period t, $B_{F,t}$ is the value of bonds bought by the firm in period t, K_t is the amount of capital used by the firm in period t, and L_t is the amount of labor used by the firm in period t.

2.4 Government, foreign sector and balance equations

The government makes its decisions according to policy rules and budgetary restrictions. The government has the following budgetary restriction:

$$P_tG_t+T_{TR,t}+B_{G,t}=\tau_{L,t}W_tL_t+\tau_{Y,t}P_{F,t}Y_{F,t}+R_{t-1}B_{G,t-1}+M_t-M_{t-1} \tag{11}$$

The monetary policy rule is as follows:

$$\ln\left(R_t\right)=\gamma_R\ln\left(R_{t-1}\right)+\left(1-\gamma_R\right)\left(\gamma_{RP}\left(\ln\left(\frac{P_t}{P_{t-1}}\right)-\overline{p}\right)+\gamma_{RY}\left(\ln\left(\frac{Y_{D,t}}{Y_{D,t-1}}\right)-\overline{y}\right)+Z_{R,t}\right) \tag{12}$$

The fiscal policy rules are as follows:

$$\ln\left(\frac{G_t}{Y_{D,t}}\right)=\gamma_G\ln\left(\frac{G_{t-1}}{Y_{D,t-1}}\right)+(1-\gamma_G)\begin{pmatrix}Z_{G,t}+\gamma_{GB}\left(\frac{B_{G,t}}{P_tY_{D,t}}-\overline{b_G}\exp\left(-\overline{y_D}\right)\right)+\\+\gamma_{GY}\left(\ln\left(\frac{Y_{D,t}}{Y_{D,t-1}}\right)-\overline{y}\right)\end{pmatrix} \tag{13}$$

$$\ln\left(\frac{T_{TR,t}}{Y_{D,t}}\right)=\gamma_{TR}\ln\left(\frac{T_{TR,t-1}}{Y_{D,t-1}}\right)+(1-\gamma_{TR})\begin{pmatrix}Z_{TR,t}+\gamma_{TRB}\left(\frac{B_{G,t}}{P_tZ_t}-\overline{b_G}\exp\left(-\overline{y_D}\right)\right)+\\+\gamma_{TRY}\left(\ln\left(\frac{Y_{D,t}}{Y_{D,t-1}}\right)-\overline{y}\right)\end{pmatrix} \tag{14}$$

$$\tau_{L,t}=\gamma_{TL}\tau_{L,t-1}+(1-\gamma_{TL})\left(\gamma_{TLB}\left(\frac{B_{G,t}}{P_tZ_t}-\overline{b_G}\exp\left(-\overline{y_D}\right)\right)+\gamma_{TLY}\left(\ln\left(\frac{Y_{D,t}}{Y_{D,t-1}}\right)-\overline{y}\right)+Z_{TL,t}\right) \tag{15}$$

$$\tau_{Y,t}=\gamma_{TY}\tau_{Y,t-1}+(1-\gamma_{TY})\left(\gamma_{TYB}\left(\frac{B_{G,t}}{P_tZ_t}-\overline{b_G}\exp\left(-\overline{y_D}\right)\right)+\gamma_{TYY}\left(\ln\left(\frac{Y_{D,t}}{Y_{D,t-1}}\right)-\overline{y}\right)+Z_{TY,t}\right) \tag{16}$$

The foreign sector is exogenous. It has a budgetary restriction (17) and is subject to an exogenous rules (18)-(19).

$$NX_tP_t+B_{W,t}+X_{W,t}S_t+Z_{DW,t}=R_{t-1}B_{W,t-1}+X_{W,t-1}(S_t+D_t) \tag{17}$$

$$\left(\frac{NX_t}{Z_t}\right)=\gamma_{NX}\left(\frac{NX_{t-1}}{Z_{t-1}}\right)+(1-\gamma_{NX})\left(\gamma_{NXB}\left(\frac{B_{W,t}}{P_tZ_t}-\overline{b_W}\right)+Z_{NX,t}\right) \tag{18}$$

$$X_{W,t}=\gamma_{XW}X_{W,t-1}+(1-\gamma_{XW})\left(\gamma_{XWB}\left(\frac{B_{W,t}}{P_tZ_t}-\overline{b_W}\right)+Z_{XW,t}\right) \tag{19}$$

The three balance restrictions are as follows: each bond should be bought by someone (20), the amount of stocks is equal to one (21), and aggregate demand consists of consumption, investments, government consumption and net exports (22). Formula (23) denotes how the habit is formed.

$$B_{H,t}+B_{F,t}+B_{G,t}+B_{W,t}=0 \tag{20}$$

$$X_{H,t}+X_{W,t}=1 \tag{21}$$

$$Y_{D,t}=C_t+I_t+G_t+NX_t \tag{22}$$

$$H_t = h_h H_{t-1} + C_t \tag{23}$$

All the exogenous processes are AR (1) with the following parameterization:

$$z_{*,t} = \eta_{0,*,t}(1-\eta_{1,*,t}) + \eta_{1,*,t} z_{*,t-1} + \varepsilon_{*,t} \tag{24}$$

3. Near-rational expectations

Usually, we compute an approximation of a rational expectation problem (a system of restrictions and first order conditions which contain expectations) solution with the perturbation method [Schmitt-Grohe and Uribe (2004)]. The near-rational expectations mean adding of exogenous mistakes to the rational expectation (25). There are two modifications of the near-rational expectations: the strong near-rational expectation (SNRE) and the weak near rational expectation (WNRE). Corresponding exogenous process $Z_{NR,t}$ has zero mean and finite variance. It is iid in case of the SNRE.

$$E_{NR,t} f\left(X_{t+1}\right) = E_t f\left(X_{t+1} + Z_{NR,t}\right) \tag{25}$$

For example, the first order condition of households with respect to amount of stocks (26) would be transformed to (27).

$$E_t \exp\left(z_{\beta,t} + (1-\omega_C) z_{Y,t+1}\right) \lambda_{HB,t+1}\left(d_{t+1} + \exp\left(s_{t+1}\right)\right) = \lambda_{HB,t} \exp\left(s_t\right) \tag{26}$$

$$\begin{aligned} &E_{NR,t} \exp\left(z_{\beta,t} + (1-\omega_C) z_{Y,t+1}\right) \lambda_{HB,t+1}\left(d_{t+1} + \exp\left(s_{t+1}\right)\right) = \lambda_{HB,t} \exp\left(s_t\right) = \\ &= E_t \exp\left(z_{\beta,t} + (1-\omega_C)\left(z_{Y,t+1} + z_{NRY,t}\right)\right)\left(\lambda_{HB,t+1} + z_{NR\lambda HB,t}\right)\left(d_{t+1} + z_{NRD,t} + \exp\left(s_{t+1} + z_{NRS,t}\right)\right) \end{aligned} \tag{27}$$

The survey of professional forecasters issued by the Federal Reserve Bank of Philadelphia is a source of observed expectations. The median forecasts are used as measure of expectations. Three expectations are observed: real GDP growth rate (obs_{YF}), GDP deflator (obs_{PF}), growth rate of nominal consumption (obs_{CF}). The equations (28)-(30) describe relation between the observed expectations and the model variables.

$$obs_{YF} = E_{NR,t} \ln(Y_{D,t+1} / Y_{D,t}) = E_t y_{D,t+1} + z_{NRYD,t} - y_{D,t} + E_t z_{Y,t+1} + z_{NRY,t} \tag{28}$$

$$obs_{PF} = E_{NR,t} \ln(P_{t+1} / P_t) = E_t p_{t+1} + z_{NRP,t} \tag{29}$$

$$obs_{CF} = E_{NR,t} \ln\left(\left(P_{t+1}C_{t+1}\right)/\left(P_t C_t\right)\right) = E_t c_{t+1} - c_t + E_t z_{Y,t+1} + z_{NRY,t} + E_t p_{t+1} + z_{NRP,t} \quad (30)$$

The observed expectations belong different types of expectations:

1. expectation that appear in many equations (obs_{PF}),
2. expectation that closely coupled with expectation of type 1 (obs_{YF}),
3. expectation that doesn't appear in models equations (obs_{CF}).

Absence of the expected consumption in the models equations is explanation of absence $z_{NRC,t}$ (this exogenous process would be equivalent to measurement errors) in the equation (30).

We don't use real-time data for simplicity. However, it creates two approaches of forecasts usage. The first is usage of one-quarter ahead forecast. It means usage of the forecast for the same quarter when forecast is done (for example, forecast for the third quarter is taken from the survey that appear in the middle of August and forecasts are done in the end of July). This approach would be called information approach. It implies that our model have information advantage due to usage of final data (for example, forecasters have to use first estimation of GDP of previous quarter). It also implies informational advantage of forecasters due to possibility of high frequency data usage (for example, they know interest rates in July when making forecast for third quarter). We don't use interest rate expectation for minimization of problem that is described in the example. The second approach is usage of two-quarters ahead forecast. It means usage of forecast for the next quarter with respect to quarter when forecast is done (for example, forecast for fourth quarter is taken from survey that appear in middle of August and forecasts are done in the end of July). It prevents forecasters from forward looking (usage of data from quarter that is forecasted), but creates higher information advantage of the model. This approach would be called dates approach. The model would be estimated with information approach and with dates approach.

4. The estimation results.

The model is estimated with USA quarterly data from 1985q1 till 2013q4. The following datasets are used: nominal personal consumption expenditures growth rate (obs_C); nominal

government consumption expenditures and gross investment growth rate (obs_G); nominal gross private domestic investment growth rate (obs_G); compensation of employees growth rate (obs_{WL}); 3-month euro-dollar deposit rate (obs_R); GDP growth rate (obs_Y); growth rate of GDP deflator (obs_P); MSCI USA gross return (obs_{STR}); sum of personal current taxes, contributions for government social insurance and current transfer receipts from persons as fraction of compensation of employees (obs_{taxL}); total receipts of government minus income sources from previous point as fraction of GDP(obs_{taxY}); total expenditures of government minus nominal government consumption expenditures and gross investment growth rate (obs_{tr}). There are observed expectations obs_{PF}, obs_{YF} and obs_{CF} that were described above. The DSGE model is estimated 15 times with the maximum likelihood method: with information approach, with dates approach and without observed expectations; with RE, SNRE and WNRE; with measurement errors for observed expectations and without them. The log-likelihood values presented at the table 2. The table 3 presents some of estimation results. Tables A1-A4 presents estimation results (see appendix).

TABLE 2. The log-likelihood of the DSGE model

	RE	SNRE	WNRE
without observed expectations (WE)	4428.98	4477.38	4506.99
with information approach without measurement errors (IAWME)	5613.14	5989.47	6071.89
with information approach with measurement errors (IAME)	5916.62	6009.72	6082.60
with dates approach without measurement errors (DAWME)	5660.16	6115.42	6163.63
with dates approach with measurement errors (DAME)	6001.17	6139.55	6191.03

The critics of rationale expectations include high persistence of exogenous technology progress [Milani (2012)]. Suggested approaches don't produce lower persistence in cases without observed expectations. Observed expectations produce much lower persistence with the RE (in IAME and DAME cases). Usage of the SNRE or the WNRE makes persistence even smaller (it also greatly increase standard deviation of $\eta_{1,Y}$).

There are parameters which standard deviation is smaller in case of deviation from rational expectation (for example $\eta_{0,TR}$). However, the same effect is produced by observed (with measurement errors) expectations.

TABLE 3. Some estimation results

	γ_{RP}		$\varepsilon_{,Y}$		$\eta_{1,Y}$		$\eta_{0,tr}$	
	value	std	value	std	value	std		
RE WE	1.12E+00	8.65E-07	2.54E-02	2.70E-03	9.69E-01	5.23E-03	-2.36E+00	1.92E+00
SNRE WE	1.11E+00	3.53E-02	1.43E-02	3.89E-03	9.60E-01	1.12E-02	-2.37E+00	3.24E-02
WNRE WE	1.11E+00	1.82E-02	1.27E-02	2.82E-03	9.53E-01	1.19E-02	-2.29E+00	2.57E-02
RE IAWME	1.49E+00	4.19E-02	2.16E-02	2.22E-03	8.55E-01	1.54E-02	-2.10E+00	1.19E+00
RE IAME	1.51E+00	1.35E-01	1.29E-02	1.98E-03	7.48E-01	4.67E-02	-2.39E+00	1.63E-02
SNRE IAWME	1.40E+00	3.86E-01	7.24E-03	7.37E-04	1.97E-01	7.05E-02	-2.38E+00	1.60E-01
SNRE IAME	1.57E+00	2.79E-01	6.43E-03	8.93E-04	2.46E-01	1.14E-01	-2.32E+00	3.20E-01
WNRE IAWME	6.58E-01	1.08E-01	6.87E-03	7.02E-04	3.37E-01	8.16E-02	-1.98E+00	6.43E-01
WNRE IAME	6.67E-01	7.88E-02	5.85E-03	7.51E-04	2.42E-01	8.91E-02	-2.39E+00	1.02E-06
RE DAWME	1.12E+00	9.46E-07	1.65E-02	1.52E-03	8.71E-01	1.25E-02	-1.78E+00	4.87E-01
RE DAME	8.53E-01	3.42E-02	6.80E-03	7.55E-04	5.35E-01	6.02E-02	-1.68E+00	2.42E-02
SNRE DAWME	6.27E-01	9.84E-02	4.50E-03	4.34E-04	2.12E-02	1.03E-01	-2.15E+00	2.89E-01
SNRE DAME	8.91E-01	1.27E-01	4.30E-03	4.37E-04	2.15E-02	1.23E-01	-1.72E+00	2.02E-01
WNRE DAWME	5.35E-01	6.57E-07	4.33E-03	3.70E-04	2.68E-02	7.18E-02	-2.35E+00	5.19E-07
WNRE DAME	8.17E-01	1.09E-01	4.17E-03	3.96E-04	1.43E-02	1.42E-01	-2.34E+00	6.96E-07

The parameter γ_{RP} values require some comments, because it is smaller than 1 in some cases (such values of response to inflation often produce breach of Blanchard-Kahn condition). However, interaction of the fiscal and the monetary policy allow to exist unique stable solution with γ_{RP}<1. There are few papers that have γ_{RP}<1 and OLS estimation (for example from 1991q1 to 2013q4) could produce γ_{RP}<1 [Hall, (2012); Ivashchenko (2014)]. However, some parameters values are insensitive to the expectation regime (for example $\eta_{0,\beta}$).

TABLE 3 (continued). Some estimation results

	$\eta_{0,\beta}$		obs_{CF}		obs_{PF}		obs_{YF}	
	value	std	value	std	value	std	value	std
RE WE	-1.78E-03	4.35E-08	-	-	-	-		
SNRE WE	-1.78E-03	3.03E-08	-	-	-	-		
WNRE WE	-1.78E-03	2.94E-08	-	-	-	-		
RE IAWME	-1.78E-03	5.01E-08	-	-	-	-		
RE IAME	-1.78E-03	4.56E-08	3.57E-03	3.59E-04	1.96E-03	1.26E-04	2.43E-03	2.13E-04
SNRE IAWME	-1.78E-03	4.96E-08	-	-	-	-	-	-
SNRE IAME	-1.78E-03	4.73E-08	1.94E-03	4.52E-04	8.80E-04	9.55E-05	3.17E-04	5.30E-03
WNRE IAWME	-1.78E-03	1.85E-08	-	-	-	-	-	-
WNRE IAME	-1.78E-03	2.15E-08	1.18E-03	4.69E-04	7.80E-04	9.00E-05	2.32E-07	2.52E-08
RE DAWME	-1.78E-03	5.54E-08	-	-	-	-	-	-
RE DAME	-1.78E-03	2.36E-08	3.55E-08	4.90E-08	2.16E-03	1.40E-04	1.83E-03	1.58E-04
SNRE DAWME	-1.78E-03	2.09E-08	-	-	-	-	-	-
SNRE DAME	-1.78E-03	2.35E-08	0.00E+00	2.13E-08	7.52E-04	7.53E-05	0.00E+00	2.13E-08
WNRE DAWME	-1.78E-03	1.97E-08	-	-	-	-	-	-
WNRE DAME	-1.78E-03	2.56E-08	1.86E-09	2.19E-08	7.70E-04	7.49E-05	1.60E-09	2.19E-08

It could be noted that standard deviations of measurement errors are small. It is smaller than RMSE of the smoothed expectation (in the case without observed expectations).

Table 4 presents RMSE of smoothed observed expectation (over dates approach, information approach and true future values). Standard deviations of obs_{CF} measurement errors are at least 2 times smaller than RMSE. Inflation expectations measurement errors are slightly

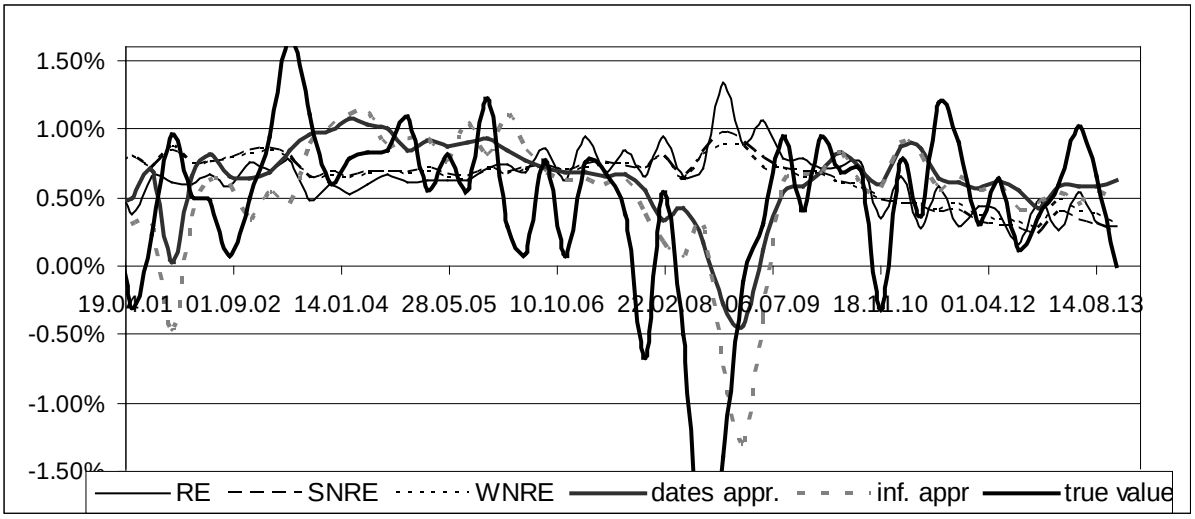
smaller than corresponding RMSE (for rational expectation). The RMSE of obs_{CF} is about two times larger than measurement errors standard deviation (for rational expectation). The SNRE and WNRE produce smaller measurement errors standard deviation while RMSE are slightly smaller.

Table 4. RMSE of smoothed observed expectation

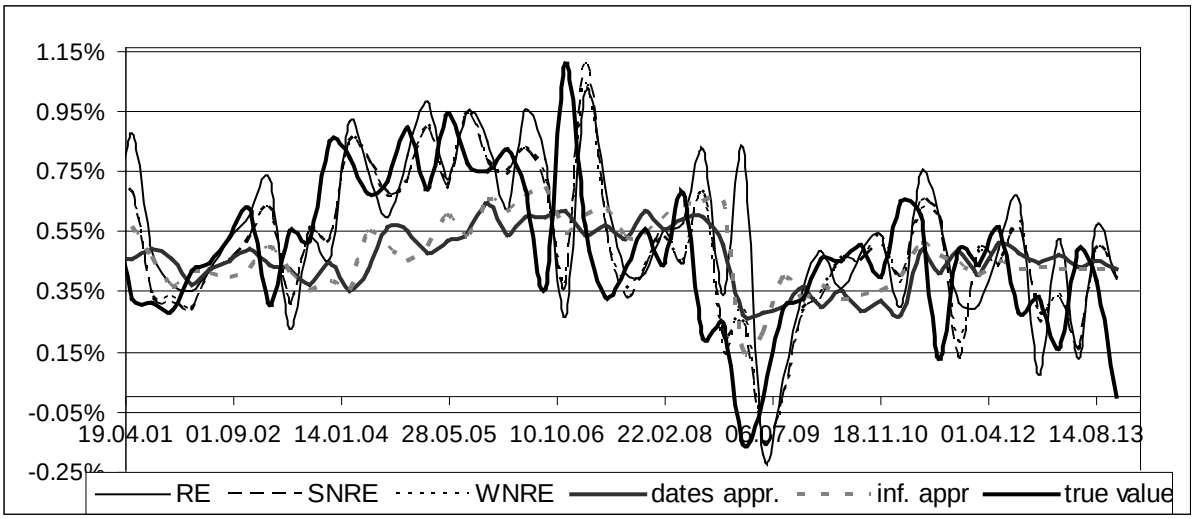
		RE	SNRE	WNRE	true value
obs_{CF}	DA	0.78%	0.79%	0.79%	0.91%
	IA	0.82%	0.82%	0.82%	0.91%
	true value	0.64%	0.62%	0.62%	0.00%
obs_{PF}	DA	0.25%	0.22%	0.21%	0.22%
	IA	0.22%	0.20%	0.19%	0.22%
	true value	0.25%	0.20%	0.20%	0.00%
obs_{YF}	DA	0.37%	0.32%	0.31%	0.55%
	IA	0.49%	0.45%	0.44%	0.60%
	true value	0.63%	0.63%	0.62%	0.00%

Pictures 2-4 presents smoothed expectation from RE WE, SNRE WE and WNRE WE models from 2001 till 2013. True future values and observed expectations (according to IA and DA) added for comparison. It could be seen that all smoothed expectation are close to each other. However, smoothed expectation of WNRE is smoother than ones from SNRE and RE models.

Picture 2. Smoothed obs_{YF} without observed expectations

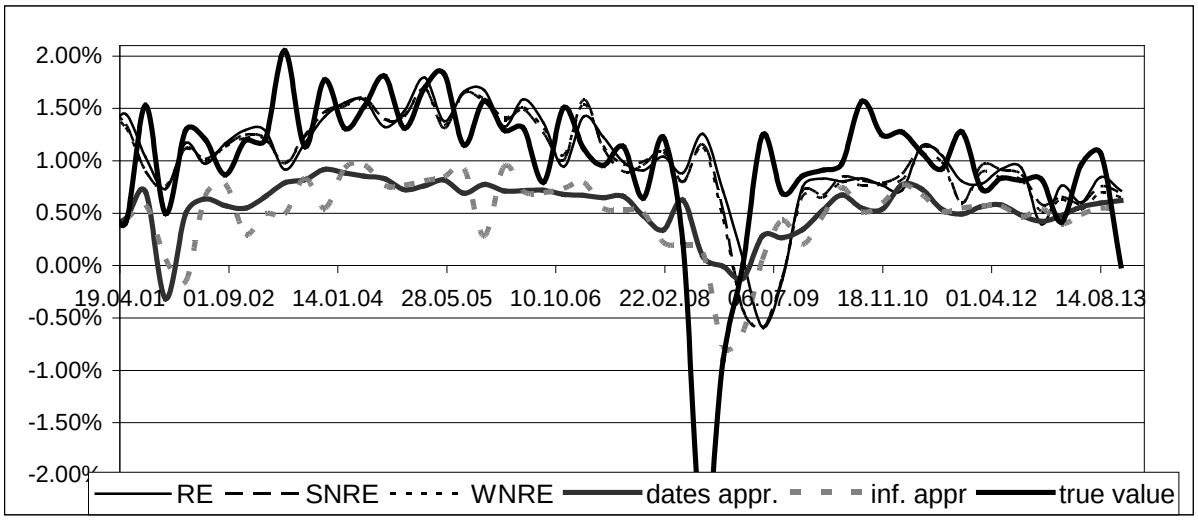


Picture 3. Smoothed obs_{PF} without observed expectations



The largest deviation of survey expectations (obs_{YF}) from the models imply expectations appear during the 2008-2009 crises. However, the deviation for inflation expectation is much smaller. The most interest situation appears with expected consumption growth: the survey expectation underestimate consumption growth while the models expectations do not do so. RMSE of the models expectations is large than deviation of the models expectation from the true future values.

Picture 3. Smoothed obs_{CF} without observed expectations



5. Forecasting.

The forecasting quality is estimated by the root-mean-square error (RMSE) for each observed variable and forecasting horizon from 1 quarter till 4 quarters. The in-sample forecasting quality presented at tables A5, A7 and A9 (see appendix). The aggregate measures of

the in-sample forecasting quality presented at the table 5. The out-of-sample forecasts presented at tables A6, A8 and A10 and aggregate measures presented at the table 6. The out-of-sample forecasts are computed for the last 22 quarters (this means the re-estimation of parameters with dataset without the last quarter (from1985Q1 until 2013Q3) and computation of forecasts; the re-estimation without 2 quarters (from1985Q1 until 2013Q2) and so on; the last re-estimation use dataset without 22 quarters (from1985Q1 until 2008Q2)).

The best in-sample forecasts is achieved by VAR (1) model (VAR (1) with dates approach according to mean RMSE and VAR (1) with information approach according to all other measures). It happens due to much larger number of parameters that produce over-fitting: the VAR (1) have 301 parameters (187 for case without observed expectations); the DSGE have from 81 till 118 parameters depending on version; the AR (1) has 42 parameters (33 for case without observed expectations).

TABLE 5. The aggregate measures of the in-sample forecasting quality

	mean RMSE	mean RMSE ex expect.	RMSE of RMSE	RMSE of RMSE ex expect.	mean of ratio RMSE to RMSE of AR (1)	mean of ratio RMSE to RMSE of AR (1) ex expect.
AR(1)	1.70%	1.70%	2.91%	2.91%	100.00%	100.00%
VAR(1)	1.57%	1.57%	2.77%	2.77%	89.62%	89.62%
RE WE	1.71%	1.71%	2.92%	2.92%	104.32%	104.32%
SNRE WE	1.70%	1.70%	2.94%	2.94%	99.64%	99.64%
WNRE WE	1.68%	1.68%	2.91%	2.91%	98.84%	98.84%
AR(1) IA	1.39%	1.70%	2.58%	2.91%	100.00%	100.00%
VAR(1) IA	1.27%	**1.55%**	**2.43%**	**2.74%**	**87.20%**	**88.02%**
RE IAWME	1.60%	1.92%	2.73%	3.08%	135.76%	125.32%
RE IAME	1.49%	1.80%	2.67%	3.00%	116.06%	109.95%
SNRE IAWME	1.45%	1.77%	2.65%	2.99%	109.42%	108.03%
SNRE IAME	1.45%	1.76%	2.65%	2.98%	108.39%	106.39%
WNRE IAWME	1.42%	1.72%	2.60%	2.93%	105.72%	104.10%
WNRE IAME	1.41%	1.72%	2.60%	2.93%	104.85%	103.02%
AR(1) DA	1.37%	1.70%	2.58%	2.91%	100.00%	100.00%
VAR(1) DA	**1.26%**	1.56%	2.44%	2.75%	88.52%	88.57%
RE DAWME	1.73%	2.10%	2.83%	3.18%	167.24%	150.83%
RE DAME	1.44%	1.76%	2.61%	2.94%	117.08%	109.26%
SNRE DAWME	1.44%	1.77%	2.61%	2.94%	113.77%	110.26%
SNRE DAME	1.43%	1.76%	2.61%	2.94%	111.69%	108.64%
WNRE DAWME	1.41%	1.74%	2.60%	2.93%	109.58%	105.78%
WNRE DAME	1.40%	1.73%	2.60%	2.93%	107.38%	104.07%

The adding of observed expectations don't increase the quality of in-sample forecast for other variables. It holds for each type of expectation and each aggregate measure.

The forecasting quality of rational expectation model without measurement errors is much worse than produced by other models. It holds for out-of-sample forecasts. It means that

deviation of surveys expectations from rational expectation is essential for model with rational expectation.

TABLE 6. The aggregate measures of the out-of-sample forecasting quality

	mean RMSE	mean RMSE ex expect.	RMSE of RMSE	RMSE of RMSE ex expect.	mean of ratio RMSE to RMSE of AR(1)	mean of ratio RMSE to RMSE of AR(1) ex expect.
AR(1)	2.14%	2.14%	3.62%	3.62%	100.00%	100.00%
VAR(1)	2.36%	2.36%	4.16%	4.16%	114.23%	114.23%
RE WE	2.09%	2.09%	3.54%	3.54%	108.04%	108.04%
SNRE WE	2.09%	2.09%	3.64%	3.64%	98.69%	98.69%
WNRE WE	2.07%	2.07%	3.56%	3.56%	**98.54%**	98.54%
AR(1) IA	1.75%	2.14%	3.21%	3.62%	100.00%	100.00%
VAR(1) IA	1.79%	2.19%	3.37%	3.80%	107.17%	107.71%
RE IAWME	1.92%	2.33%	3.35%	3.77%	129.12%	117.92%
RE IAME	1.74%	2.11%	3.14%	3.53%	109.48%	102.41%
SNRE IAWME	1.74%	2.12%	3.24%	3.65%	105.39%	101.68%
SNRE IAME	1.75%	2.13%	3.25%	3.67%	104.31%	100.88%
WNRE IAWME	1.68%	2.05%	3.12%	3.52**%**	100.26%	98.28%
WNRE IAME	1.68%	**2.05%**	**3.12%**	**3.52%**	99.38%	**97.65%**
AR(1) DA	1.72%	2.14%	3.21%	3.62%	100.00%	100.00%
VAR(1) DA	1.92%	2.38%	3.69%	4.16%	117.18%	117.17%
RE DAWME	1.98%	2.43%	3.28%	3.70%	155.59%	138.84%
RE DAME	1.73%	2.13%	3.17%	3.57%	113.34%	104.57%
SNRE DAWME	1.75%	2.16%	3.20%	3.60%	110.59%	107.32%
SNRE DAME	1.74%	2.15%	3.20%	3.61%	107.78%	105.19%
WNRE DAWME	1.68%	2.08%	3.15%	3.55%	103.84%	99.76%
WNRE DAME	**1.67%**	2.07%	3.13%	3.53%	101.63%	98.37%

The best out-of-sample forecasting quality is achieved by the WNRE model. The answer about forecasting quality of the DSGE model depends on aggregate measure. For some combination of observed variable and forecasting horizon the DSGE model is better than AR (1) for other the opposite is true. The DSGE model with the RE (except cases with observed expectation without measurement errors) outperforms AR (1) according to mean RMSE and RMSE for all variables and horizons (RMSE of RMSE). The same is holds for the WNRE. However, the answer is not clear for the SNRE (it depends on approach (information or dates) and aggregate measure).

The choice of the mean ratio of RMSE to RMSE of AR (1) as aggregate measure of the forecasting quality produces different answer about advance of the RE model. The DSGE model with the WNRE outperforms AR (1) in the most cases. The SNRE outperforms AR (1) in the case without observed expectations. The RE model does not outperform AR (1) according to this aggregate measure. Thus, we can talk about advantage of forecasting quality of the DSGE model

with the RE and the WNRE over AR (1) and VAR (1) models (for majority of aggregate measures), and equivalent quality of the DSGE with the SNRE and AR (1).

Another question is about influence of observed expectations on other variables forecasts. The first view is situation with observed variables which expectations are observed (obs_C, obs_P and obs_Y). The forecasting quality for one quarter is higher with observed expectations in almost all situations (exception is inflation with the WNRE DAWME). The situation with four quarter forecast is different: the WNRE produce advantage of observed expectation in 66% of cases; the SNRE – 50%; the RE – 33% of cases. The same picture is for mean RMSE. Thus, observed expectations increase the short term forecasting quality but this effect is much smaller within long term forecasts.

The second view is situation with all observed variables except observed expectations. The situation depends on type of rationality. The forecasting quality is lower with observed expectation in case of the RE. However, this effect is come from the long term forecast and slight improvement could be found in the sort term forecasting quality (for the cases with measurement errors). There is the same effect for the SNRE: short term forecasts are better (except case of the IAME) and long term forecasts are worse. However, the aggregate forecasting quality decrease is clearer. The WNRE produce higher short and long term forecasting quality but long term improvement is much smaller. Thus, usage of observed expectations increase short term forecasting quality and decrease long term forecasting quality (except the WNRE).

The next question is about relation between forecasting qualities of different rationality types. The best quality of forecast is produced by the WNRE. However, the SNRE doesn't outperform the RE with measurement errors. This holds for mean RMSE and RMSE for all variables and forecasting horizons. The result is different for mean ratio of RMSE to RMSE of AR (1).There is large advantage of the SNRE over RE in case without observed expectation.

This advantage became much smaller in cases with observed expectation (for variables except observed expectation advantage disappear in the DAME and the DAWME cases).

6. Conclusions.

The DSGE models are based on rational expectation hypothesis. The main alternative is learning. Models with learning fit better than models with rational expectations. However, these results are sensitive to the learning algorithm. Learning algorithms allow possibility of unrestricted manipulation. The near rational expectations (the SNRE and the WNRE) are suggested as an alternative form of deviation from the rational expectation.

The medium-scale DSGE model is created. It is estimated with the RE, the SNRE and the WNRE. The model is estimated with and without observed expectations. Existence of measurement errors of observed expectations is crucial for the model with the RE. However, standard deviations of measurement errors are small.

Suggested approaches don't produce lower persistence of technology progress (it is part of the rational expectation critics) without observed expectations. Observed expectations produce much lower persistence for each type of expectations (except the case RE without measurement errors). The distance between expectations from the model and the observed from the survey expectations is almost independent to the type of expectations (the WNRE is slightly better than the SNRE and the RE). Thus, elements of the rational expectation critics could be overcame by additional observed variables with or without the suggested approach.

The analysis of the out-of-sample forecasting quality show that observed expectations increase short term forecasting quality and decrease long term forecasting property. The influence on aggregate measures of forecasting quality depends on the type of rationality (the WNRE forecasts became better while opposite is true for the SNRE and the RE). The models could be ordered by forecasting properties (from the best to the worst) as follows: the WNRE (with or without measurement errors), the RE (with measurement errors), the SNRE (with or without measurement errors), AR(1), VAR(1) and the RE (without measurement errors).

However, this order is not dominance order and for some aggregate measures order could be slightly different.

Thus, the WNRE allow achieve advantages of deviation from rational expectation without disadvantages of the main alternatives (manipulation possibilities, sensitiveness to learning algorithms and deviation of computation technique from the conventional one). However, the rich DSGE model with the RE and observed expectations with measurement errors can produce results that only slightly worse than ones with the WNRE.

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Appendix

TABLE A1. The estimation results for the model with RE

	WE		IAWME		DAWME	
Parameter	value	std	value	std	value	std
ε_{α}	9.87E-03	9.91E-04	2.82E-02	3.32E-03	2.27E-02	2.09E-03
ε_{β}	1.50E-01	1.21E-02	1.33E-01	1.15E-02	1.28E-01	1.13E-02
ε_{BF}	3.87E+00	1.37E+00	3.40E+01	2.60E+00	4.49E+01	6.36E+00
ε_{BH}	1.31E-02	1.73E+00	2.17E-02	3.11E+00	3.64E-02	4.73E-02
ε_{DW}	5.38E+01	1.61E+00	6.51E+01	3.44E+00	1.00E+02	2.49E-05
ε_{FWL}	2.73E-04	1.92E+00	2.73E-04	6.54E+00	2.73E-04	5.96E+00
ε_{G}	3.73E-01	5.06E-02	2.93E-01	1.00E-01	6.39E-01	7.39E-02
ε_{I}	8.24E-03	1.91E+00	8.24E-03	9.92E+00	8.24E-03	1.70E+01
ε_{L}	1.10E-02	1.07E-02	9.01E-02	1.59E-02	1.13E-01	2.43E-02
ε_{M}	6.94E+00	6.02E-01	4.48E+00	3.71E-01	4.83E+00	3.42E-01
ε_{NX}	1.49E+00	8.24E-01	8.96E+00	2.93E+00	1.21E+01	1.40E+00
ε_{P}	1.02E-03	1.85E+00	1.02E-03	2.18E+01	1.02E-03	9.93E+01
ε_{R}	1.42E-02	2.07E-03	1.59E-02	2.92E-03	1.32E-02	1.93E-03
ε_{tL}	1.08E-02	2.69E-03	1.47E-01	6.31E-02	7.87E-02	2.33E-02
ε_{tr}	2.50E-01	6.86E-02	2.33E-01	6.83E-02	2.87E-01	8.77E-02
ε_{tY}	3.01E-02	4.63E-03	4.51E-02	1.86E-02	3.15E-02	3.15E-03
ε_{XW}	2.71E-01	5.62E-02	4.81E+01	4.75E+00	6.66E-01	1.63E-02
ε_{Y}	2.54E-02	2.70E-03	2.16E-02	2.22E-03	1.65E-02	1.52E-03
γ_{g}	3.52E-01	7.40E-02	5.25E-01	7.21E-02	8.88E-01	8.96E-04
γ_{gb}	3.27E+00	2.13E-06	3.03E-01	3.26E-01	3.31E+00	2.37E-06
γ_{gy}	6.72E-01	2.44E-01	-6.25E-01	3.03E-01	-5.00E+00	3.21E-06
γ_{nx}	4.28E-01	1.35E-01	7.32E-01	1.23E-01	7.47E-01	3.25E-02
γ_{nxb}	4.07E+00	2.63E-06	5.00E+00	1.72E-06	4.24E+00	3.00E-06
γ_{r}	8.56E-01	3.16E-02	8.93E-01	1.79E-02	8.66E-01	1.30E-02
γ_{rp}	1.12E+00	8.65E-07	1.49E+00	4.19E-02	1.12E+00	9.46E-07
γ_{ry}	2.33E-01	1.55E-01	3.25E-01	4.18E-01	6.70E-01	8.03E-02
γ_{tL}	6.20E-01	8.01E-02	9.65E-01	1.45E-02	9.35E-01	1.55E-02
γ_{tLb}	-1.75E+00	1.21E-06	-6.15E-01	6.98E-01	-1.40E+00	1.04E-06
γ_{tLy}	-4.30E-01	2.55E-01	5.00E+00	1.72E-06	-7.92E-01	1.70E-01
γ_{tr}	9.20E-01	2.12E-02	9.17E-01	2.23E-02	9.38E-01	1.58E-02
γ_{trb}	5.00E+00	2.17E-06	3.23E+00	1.16E+00	5.00E+00	1.66E-06
γ_{try}	-5.00E+00	2.46E-06	-5.00E+00	1.97E-06	-5.00E+00	3.21E-06
γ_{tY}	9.45E-01	7.83E-03	9.57E-01	1.70E-02	9.13E-01	3.39E-04
γ_{tYb}	1.31E+00	9.68E-07	1.01E+00	8.83E-02	1.30E+00	9.91E-07
γ_{tYy}	1.81E+00	6.66E-01	2.57E+00	8.05E-01	5.00E+00	1.66E-06
γ_{xw}	9.86E-01	5.43E-03	9.96E-01	9.19E-06	9.97E-01	5.72E-07
γ_{xwb}	3.11E-02	1.04E-07	9.53E-02	2.89E-02	3.52E-02	1.05E-07
h_{C}	3.12E-01	1.16E-07	3.12E-01	6.77E-08	3.12E-01	1.04E-07
h_{h}	3.43E-01	7.06E-08	3.43E-01	7.56E-08	3.43E-01	1.28E-07
μ_{F}	-1.13E-07	7.50E-01	5.09E-03	3.09E-01	-2.70E-03	5.09E-02
μ_{H}	6.03E+00	3.87E-06	1.59E+01	3.69E+00	8.41E+00	5.85E-06
$\eta_{0,\alpha}$	4.25E-01	1.63E-07	4.25E-01	2.66E-07	4.25E-01	1.95E-07
$\eta_{0,\beta}$	-1.78E-03	4.35E-08	-1.78E-03	5.01E-08	-1.78E-03	5.54E-08
$\eta_{0,BF}$	-5.06E-05	4.64E-08	-1.60E-03	6.27E-02	-8.64E-03	4.12E-02
$\eta_{0,BH}$	4.99E-04	2.16E-01	-1.43E-03	2.98E-01	1.12E-03	5.42E-02
$\eta_{0,DW}$	6.99E+00	4.47E-06	6.98E+00	2.77E-03	6.99E+00	4.59E-06
$\eta_{0,FWL}$	6.21E+00	3.99E-06	5.96E+00	9.49E-02	5.92E+00	4.16E-06
$\eta_{0,G}$	-1.51E+00	3.69E-07	-1.51E+00	3.48E-07	-1.51E+00	5.32E-07
$\eta_{0,I}$	1.86E+00	9.04E-01	2.00E+01	5.09E-06	1.78E+01	1.68E+00

$\eta_{0,L}$	-1.57E+01	1.89E-05	-1.57E+01	3.37E-06	-1.57E+01	1.10E-05
$\eta_{0,M}$	-1.34E+01	3.99E-06	-1.34E+01	3.20E-06	-1.34E+01	3.02E-06
$\eta_{0,NX}$	1.56E+01	3.09E-06	1.56E+01	3.10E-06	1.56E+01	4.95E-06
$\eta_{0,P}$	1.10E+01	7.02E-06	1.09E+01	8.45E-05	1.09E+01	7.14E-06
$\eta_{0,R}$	1.15E-02	3.28E-08	1.15E-02	4.52E-08	1.15E-02	4.42E-08
$\eta_{0,tL}$	3.10E-01	6.36E-08	3.10E-01	6.43E-08	3.10E-01	1.48E-07
$\eta_{0,tr}$	-2.36E+00	1.92E+00	-2.10E+00	1.19E+00	-1.78E+00	4.87E-01
$\eta_{0,tY}$	1.11E-01	2.71E-08	1.11E-01	2.88E-08	1.11E-01	2.18E-08
$\eta_{0,XW}$	7.54E-01	6.47E-07	7.54E-01	7.39E-07	7.54E-01	9.26E-07
$\eta_{0,Y}$	6.86E-03	2.74E-08	6.86E-03	2.90E-08	6.86E-03	2.74E-08
$\eta_{1,\alpha}$	8.88E-01	1.06E-02	9.50E-01	5.32E-03	9.37E-01	4.73E-03
$\eta_{1,\beta}$	9.78E-01	2.24E-03	9.12E-01	8.30E-03	9.09E-01	7.72E-04
$\eta_{1,BF}$	8.81E-01	4.91E-02	8.94E-01	3.96E-02	8.67E-01	1.37E-02
$\eta_{1,BH}$	6.30E-05	1.97E+00	-1.36E-03	2.28E+00	8.32E-04	6.03E-02
$\eta_{1,DW}$	9.23E-01	1.07E-02	8.18E-01	6.02E-02	9.05E-01	6.40E-03
$\eta_{1,FWL}$	8.99E-02	7.29E-01	7.90E-01	1.69E+00	-5.92E-01	3.48E-01
$\eta_{1,G}$	9.77E-01	3.55E-03	9.43E-01	2.05E-02	8.92E-01	1.45E-02
$\eta_{1,I}$	3.83E-04	5.93E-01	7.56E-03	4.09E-01	-9.12E-05	7.67E-02
$\eta_{1,L}$	-5.82E-01	3.86E-01	1.65E-01	7.27E-02	3.27E-01	5.98E-02
$\eta_{1,M}$	9.78E-01	1.94E-03	9.35E-01	5.82E-03	9.34E-01	1.08E-03
$\eta_{1,NX}$	-1.44E-01	2.46E-01	-3.62E-01	1.64E-01	-3.62E-01	1.27E-01
$\eta_{1,P}$	-2.60E-02	6.58E-01	-1.20E-02	5.08E-01	-7.56E-02	4.33E-02
$\eta_{1,R}$	4.42E-01	1.07E-01	3.41E-01	8.95E-02	3.72E-01	8.14E-02
$\eta_{1,tL}$	-3.38E-01	1.05E-01	-3.10E-01	9.17E-02	-3.00E-01	9.51E-02
$\eta_{1,tr}$	-1.63E-01	9.32E-02	-1.95E-01	9.36E-02	-2.60E-01	8.33E-02
$\eta_{1,tY}$	-4.10E-01	8.98E-02	-3.39E-01	9.54E-02	-1.97E-01	6.49E-02
$\eta_{1,XW}$	9.94E-01	5.27E-03	9.97E-01	3.87E-07	9.88E-01	3.01E-04
$\eta_{1,Y}$	9.69E-01	5.23E-03	8.55E-01	1.54E-02	8.71E-01	1.25E-02
ω_C	3.25E+00	1.07E-06	3.25E+00	9.03E-07	3.25E+00	9.90E-07
ω_L	6.55E+00	1.34E-06	6.55E+00	1.34E-06	6.55E+00	2.21E-06
δ	1.83E-02	7.98E-08	1.83E-02	8.20E-08	1.83E-02	5.20E-08
θ	6.04E+00	1.91E-06	6.04E+00	1.57E-06	6.04E+00	1.50E-06

TABLE A2. The estimation results for the model with SNRE

	WE		IAWME		DAWME	
Parameter	value	std	value	std	value	std
ε_α	1.13E-02	2.67E-03	3.53E-02	8.99E-03	9.70E-02	5.14E-02
ε_β	1.17E-01	1.43E-02	1.07E-01	1.49E-02	4.90E-02	4.12E-03
ε_{BF}	3.23E+00	9.74E-01	1.00E+02	1.65E-05	5.30E+01	1.92E+00
ε_{BH}	2.74E-03	1.30E+00	1.60E-03	3.07E+00	1.18E-03	4.35E-01
ε_{DW}	5.86E+01	1.50E+00	4.19E+01	3.57E+00	1.00E+02	1.90E-05
ε_{FWL}	2.73E-04	2.88E+00	9.77E-04	4.84E+00	2.02E-03	5.22E-01
ε_G	3.01E-01	9.48E-02	2.09E-01	7.06E-02	2.18E-01	4.87E-02
ε_I	1.48E-03	1.01E+00	2.15E-03	1.14E+01	4.71E-04	4.25E-01
ε_L	4.20E+00	1.49E+00	3.35E-04	1.32E+01	3.66E+00	9.96E-01
ε_M	5.85E+00	4.42E-01	6.31E+00	9.43E-01	1.51E+01	1.39E+00
ε_{NRc}	2.82E-01	2.24E+00	1.13E-03	5.26E+00	1.58E-03	2.43E-01
ε_{NRdF}	4.32E-04	1.82E+00	9.44E-04	5.02E+00	6.98E-03	1.51E-01
ε_{NRiF}	5.53E-02	1.53E-02	7.82E-02	2.53E+00	3.37E-03	6.72E-02
ε_{NRl}	3.10E-04	1.42E+00	2.78E-01	9.22E-01	4.28E-01	5.02E-01
ε_{NRLFB}	4.09E+00	2.80E+00	1.05E-03	5.83E+00	3.85E-03	2.18E-01
ε_{NRLFK}	2.27E-01	1.85E+00	2.61E+00	8.12E+01	5.23E-04	2.01E-01
ε_{NRLFP}	3.29E-03	1.48E+00	3.06E-02	6.54E+00	1.83E-03	1.18E-01
ε_{NRLHB}	0.00E+00	3.45E-08	2.33E-07	4.65E-08	3.36E-10	3.74E-08
ε_{NRp}	1.05E-03	2.46E-04	7.53E-04	8.14E-05	4.79E-04	8.92E-05

ε_{NRs}	4.17E-02	7.68E-03	5.16E-02	7.35E-03	2.02E-02	1.54E-02
ε_{NRw}	1.37E-04	3.45E-08	2.41E-01	9.83E-01	3.27E-01	6.25E-01
ε_{NRyD}	1.87E-03	1.60E+00	9.38E-04	8.53E-04	3.86E-08	3.74E-08
$\varepsilon_{NRz\alpha}$	2.28E-03	1.43E+00	4.95E+01	4.91E+03	2.03E-02	1.31E-01
ε_{NRzFWL}	7.33E-03	1.88E+00	1.49E-03	5.20E+00	9.06E-03	1.51E-01
ε_{NRzI}	3.55E-03	1.65E+00	2.35E-03	2.21E+03	8.96E-02	1.68E-01
ε_{NRzP}	1.96E-03	1.27E+00	6.08E-04	4.19E+04	8.98E-04	1.03E-01
ε_{NRzY}	3.56E-08	3.45E-08	2.85E-03	2.60E-04	2.04E-03	1.43E-04
ε_{NX}	1.93E+00	8.41E-01	2.17E+01	6.00E+00	3.47E+01	1.38E+00
ε_{P}	1.29E-01	2.50E+00	7.35E-04	1.09E+05	2.35E-03	4.72E-01
ε_{R}	1.73E-02	3.55E-03	2.13E-02	4.61E-03	2.10E-02	4.39E-03
ε_{tL}	9.17E-03	1.13E-03	9.69E-03	2.09E-03	6.84E-02	2.10E-02
ε_{tr}	2.51E-01	4.53E-02	3.47E-01	1.59E-01	4.19E-01	1.72E-01
ε_{tY}	3.43E-02	4.20E-03	3.23E-02	1.23E-02	1.88E-02	4.18E-03
ε_{XW}	4.13E-01	2.02E-01	3.23E+01	3.67E+01	1.00E+02	1.91E-05
ε_{Y}	1.43E-02	3.89E-03	7.24E-03	7.37E-04	4.50E-03	4.34E-04
γ_{q}	3.15E-01	6.26E-03	4.31E-01	7.23E-02	9.30E-01	1.85E-02
γ_{qb}	3.15E+00	7.30E-02	3.48E+00	3.60E-01	1.49E+00	1.82E-01
γ_{qy}	5.51E-01	6.33E-03	-2.67E-01	3.14E-02	-5.00E+00	9.65E-07
γ_{nx}	5.27E-01	9.54E-02	4.12E-01	1.49E-01	9.42E-01	7.42E-03
γ_{nxb}	5.00E+00	1.23E-06	5.00E+00	1.38E-06	3.24E-01	4.01E-02
γ_{r}	9.04E-01	1.93E-02	9.25E-01	1.41E-02	9.06E-01	2.10E-02
γ_{rp}	1.11E+00	3.53E-02	1.40E+00	3.86E-01	6.27E-01	9.84E-02
γ_{ry}	8.95E-01	2.05E-02	1.08E+00	1.57E-01	7.43E-01	1.67E-01
γ_{tL}	5.49E-01	1.15E-02	5.96E-01	6.08E-02	9.21E-01	2.57E-02
γ_{tLb}	-1.46E+00	3.47E-02	-1.65E+00	2.40E-01	-8.61E-02	3.06E-02
γ_{tLy}	-3.90E-01	1.06E-02	-5.46E-03	2.89E-02	3.29E+00	6.23E-01
γ_{tr}	9.20E-01	1.29E-02	9.40E-01	2.76E-02	9.50E-01	1.93E-02
γ_{trb}	5.00E+00	1.23E-06	5.00E+00	1.38E-06	-2.14E+00	4.12E-01
γ_{try}	-5.00E+00	8.66E-07	-5.00E+00	1.61E-06	-5.00E+00	9.65E-07
γ_{tY}	9.52E-01	4.57E-03	9.49E-01	2.06E-02	9.29E-01	1.26E-02
γ_{tYb}	1.29E+00	2.55E-02	1.37E+00	4.20E-01	4.82E-01	5.62E-02
γ_{tYy}	2.53E+00	6.74E-02	1.96E+00	4.78E-01	2.71E-01	1.40E-01
γ_{xw}	9.94E-01	3.84E-03	9.99E-01	3.11E-07	9.98E-01	2.19E-07
γ_{xwb}	1.28E-01	2.83E-02	2.12E+00	1.24E+00	1.78E-02	3.88E-03
h_{C}	3.12E-01	6.35E-08	3.12E-01	6.39E-08	3.12E-01	5.03E-08
h_{h}	3.43E-01	6.83E-08	3.43E-01	7.38E-08	3.43E-01	4.35E-08
μ_{F}	-1.57E+00	3.08E+00	-1.87E-02	1.93E-01	4.75E-04	5.88E-02
μ_{H}	9.34E+00	1.42E-01	2.42E+01	2.62E+00	4.29E-04	1.43E-07
$\eta_{0,\alpha}$	4.25E-01	1.61E-07	4.25E-01	2.87E-07	4.25E-01	1.10E-07
$\eta_{0,\beta}$	-1.78E-03	3.03E-08	-1.78E-03	4.96E-08	-1.78E-03	2.09E-08
$\eta_{0,BF}$	-9.63E-01	2.27E-02	-4.25E-03	2.54E-02	-2.00E+01	3.85E-06
$\eta_{0,BH}$	2.95E-03	3.93E-03	-8.57E-03	1.49E-02	-2.76E-02	1.34E-07
$\eta_{0,DW}$	6.98E+00	6.75E-03	6.94E+00	1.52E-02	6.89E+00	9.33E-03
$\eta_{0,FWL}$	7.84E+00	8.32E-02	9.06E+00	7.13E-01	7.69E+00	2.43E-01
$\eta_{0,G}$	-1.51E+00	3.20E-07	-1.51E+00	3.18E-07	-1.51E+00	1.43E-07
$\eta_{0,I}$	1.25E+01	2.67E-01	2.00E+01	3.67E-06	2.00E+01	3.86E-06
$\eta_{0,L}$	-1.57E+01	3.04E-06	-1.57E+01	2.99E-06	-1.57E+01	2.16E-06
$\eta_{0,M}$	-1.34E+01	3.62E-06	-1.34E+01	2.96E-06	-1.34E+01	3.73E-06
$\eta_{0,NX}$	1.56E+01	2.98E-06	1.56E+01	2.98E-06	1.56E+01	3.94E-06
$\eta_{0,P}$	1.99E+01	6.83E-01	1.70E+01	2.28E+00	1.59E+01	3.80E-01
$\eta_{0,R}$	1.15E-02	3.09E-08	1.15E-02	4.02E-08	1.15E-02	2.15E-08
$\eta_{0,tL}$	3.10E-01	6.30E-08	3.10E-01	6.44E-08	3.10E-01	8.43E-08
$\eta_{0,tr}$	-2.37E+00	3.24E-02	-2.38E+00	1.60E-01	-2.15E+00	2.89E-01

$\eta_{0,tY}$	1.11E-01	2.84E-08	1.11E-01	2.75E-08	1.11E-01	3.57E-08
$\eta_{0,XW}$	7.54E-01	5.71E-07	7.55E-01	5.98E-07	7.55E-01	5.80E-07
$\eta_{0,Y}$	6.86E-03	2.68E-08	6.86E-03	2.67E-08	6.86E-03	2.51E-08
$\eta_{1,\alpha}$	9.04E-01	2.16E-02	9.71E-01	6.85E-03	9.99E-01	2.19E-07
$\eta_{1,\beta}$	9.78E-01	4.51E-03	9.70E-01	6.81E-03	8.06E-01	2.45E-02
$\eta_{1,BF}$	8.70E-01	4.70E-02	9.94E-01	8.25E-04	7.72E-01	6.36E-02
$\eta_{1,BH}$	4.01E-02	1.22E+00	1.10E-03	6.79E+00	-1.65E-01	3.01E-01
$\eta_{1,DW}$	9.31E-01	1.72E-02	9.33E-01	2.95E-02	9.91E-01	2.18E-03
$\eta_{1,FWL}$	-1.19E-02	3.17E-01	3.38E-02	5.14E-01	-6.84E-01	7.96E-01
$\eta_{1,G}$	9.72E-01	1.08E-02	9.48E-01	2.28E-02	4.68E-01	8.18E-02
$\eta_{1,I}$	9.28E-04	2.66E-01	1.17E-03	9.39E-01	-7.92E-03	2.09E-01
$\eta_{1,L}$	9.93E-01	4.61E-03	9.71E-01	2.65E+01	9.70E-01	7.75E-03
$\eta_{1,M}$	9.81E-01	3.54E-03	9.87E-01	2.10E-03	9.97E-01	2.19E-07
$\eta_{1,NX}$	-1.59E-01	1.99E-01	8.77E-01	5.38E-02	2.50E-01	8.39E-02
$\eta_{1,P}$	-1.42E-03	2.72E-01	-4.05E-03	1.00E-01	-2.28E-04	1.52E-01
$\eta_{1,R}$	3.47E-01	8.24E-02	3.29E-01	8.43E-02	4.41E-01	9.11E-02
$\eta_{1,tL}$	-3.09E-01	1.04E-01	-3.55E-01	1.03E-01	-2.45E-01	9.69E-02
$\eta_{1,tr}$	-1.60E-01	9.29E-02	-1.43E-01	9.45E-02	-1.40E-01	1.04E-01
$\eta_{1,tY}$	-4.01E-01	8.75E-02	-4.08E-01	9.48E-02	-5.34E-01	9.48E-02
$\eta_{1,XW}$	9.48E-01	4.62E-02	9.91E-01	1.40E-02	9.98E-01	2.19E-07
$\eta_{1,Y}$	9.60E-01	1.12E-02	1.97E-01	7.05E-02	2.12E-02	1.03E-01
ω_C	3.25E+00	5.83E-07	3.25E+00	1.85E-06	3.25E+00	4.64E-07
ω_L	6.55E+00	1.28E-06	6.55E+00	1.28E-06	6.55E+00	8.98E-07
δ	1.83E-02	6.35E-08	1.83E-02	7.19E-08	1.83E-02	2.92E-08
θ	6.04E+00	1.06E-06	6.04E+00	1.40E-06	6.04E+00	1.37E-06

TABLE A3. The estimation results for the model with WNRE

	WE		IAWME		DAWME	
Parameter	value	std	value	std	value	std
ε_{α}	1.14E-02	2.32E-03	1.24E-01	5.23E-02	1.12E-01	3.37E-02
ε_{β}	3.31E-02	1.24E-02	5.22E-02	4.39E-03	5.16E-02	4.03E-03
ε_{BF}	2.92E+00	1.59E+00	1.00E+02	1.88E-05	2.79E+00	8.70E-01
ε_{BH}	2.93E-03	2.27E+00	2.60E-03	3.24E-01	1.54E-03	4.40E-01
ε_{DW}	5.31E+01	2.31E+00	5.89E+01	8.36E-01	7.38E+00	9.13E-01
ε_{FWL}	2.73E-04	3.90E+00	1.06E-03	1.52E-01	3.46E-03	6.24E-01
ε_{G}	2.62E-01	1.02E-01	1.96E-01	5.65E-02	1.97E-01	2.40E-02
ε_{I}	3.47E-03	3.59E+00	4.71E-04	1.69E-01	1.11E-03	2.72E-01
ε_{L}	3.14E+00	1.42E+00	3.51E+00	7.98E-01	3.58E+00	7.89E-01
ε_{M}	3.17E+00	6.29E-01	9.49E+00	2.20E+00	1.71E+01	8.76E-01
ε_{NRc}	1.28E-03	3.41E+00	2.02E-03	2.21E-01	1.58E-03	3.41E-01
ε_{NRdF}	9.02E-04	3.97E+00	1.00E+02	1.89E-05	1.37E-03	7.77E-01
ε_{NRiF}	2.50E-02	7.61E-02	1.95E-02	1.74E-02	8.64E-03	8.13E-03
ε_{NRl}	2.30E-04	3.57E-08	1.53E-01	2.51E-01	4.16E-01	7.17E-01
ε_{NRLFB}	1.49E+01	2.34E+02	8.57E+01	1.58E+00	6.67E-03	4.41E-01
ε_{NRLFK}	5.18E-01	2.65E+00	2.01E-05	3.18E-08	4.31E-01	2.45E-01
ε_{NRLFP}	6.65E-03	4.65E+00	5.33E-04	2.38E-01	1.14E-03	6.02E-01
ε_{NRLHB}	0	3.57E-08	5.27E-09	3.18E-08	3.36E-10	3.29E-08
ε_{NRp}	8.86E-04	2.54E-04	7.48E-04	1.09E-04	3.20E-04	6.16E-05
ε_{NRs}	1.64E-01	8.96E-02	1.36E-01	1.31E-01	1.35E-01	3.65E-02
ε_{NRw}	2.11E+00	2.49E+00	1.65E-01	2.81E-01	3.17E-01	9.42E-01
ε_{NRyD}	2.04E-03	1.07E+02	2.06E-03	5.28E-04	7.27E-09	3.29E-08
$\varepsilon_{NRz\alpha}$	1.84E-03	2.51E+00	1.21E-04	3.18E-08	2.60E-04	5.71E-01
ε_{NRzFWL}	8.83E-03	2.32E+05	5.48E-04	1.85E-01	8.88E-03	3.18E-01
ε_{NRzI}	3.35E-03	3.46E+04	8.77E-04	1.73E-01	1.75E-01	6.50E-01
ε_{NRzP}	2.56E-03	9.91E+04	1.03E-03	1.69E-01	8.97E-04	5.55E-01

ε_{NRzY}	2.53E-07	3.57E-08	3.77E-03	3.82E-04	2.71E-03	2.43E-04
ε_{NX}	2.07E+00	7.33E-01	2.05E+01	1.61E+00	3.03E+01	1.33E+00
ε_{P}	1.64E-03	3.35E+01	3.18E-02	1.72E-01	2.05E-03	4.11E-01
ε_{R}	1.69E-02	3.50E-03	1.99E-02	3.93E-03	2.15E-02	3.29E-03
ε_{tL}	9.14E-03	1.18E-03	1.02E-02	3.35E-03	7.53E-02	8.47E-03
ε_{tr}	2.52E-01	6.56E-02	2.65E-01	8.43E-02	4.27E-01	4.69E-02
ε_{tY}	3.38E-02	7.65E-03	3.85E-02	8.43E-03	1.71E-02	1.89E-03
ε_{XW}	4.29E-01	2.11E-01	2.33E+01	1.61E+00	7.55E+01	1.06E+00
ε_{Y}	1.27E-02	2.82E-03	6.87E-03	7.02E-04	4.33E-03	3.70E-04
γ_{g}	3.18E-01	7.69E-03	2.38E-01	4.86E-02	9.29E-01	1.58E-07
γ_{gb}	3.18E+00	5.07E-02	1.67E+00	2.65E-01	1.42E+00	5.93E-07
γ_{gy}	5.78E-01	1.85E-02	-4.39E-03	5.15E-02	-4.99E+00	8.16E-07
γ_{nx}	5.15E-01	9.51E-02	8.83E-01	2.38E-02	9.36E-01	2.19E-07
γ_{nxb}	5.00E+00	1.11E-06	2.95E-01	7.95E-03	3.18E-01	7.64E-08
γ_{r}	9.03E-01	1.92E-02	9.12E-01	1.90E-02	9.07E-01	1.56E-07
γ_{rp}	1.11E+00	1.82E-02	6.58E-01	1.08E-01	5.35E-01	6.57E-07
γ_{ry}	8.65E-01	1.84E-02	8.82E-01	2.36E-01	7.69E-01	1.58E-07
γ_{tL}	5.49E-01	1.45E-02	6.17E-01	1.13E-01	9.24E-01	2.06E-07
γ_{tLb}	-1.51E+00	6.26E-02	-8.92E-01	1.75E-01	1.24E-01	4.52E-08
γ_{tLy}	-3.77E-01	1.05E-02	-3.21E-01	1.47E-01	3.22E+00	1.29E-06
γ_{tr}	9.20E-01	2.07E-02	9.26E-01	2.14E-02	9.50E-01	6.28E-07
γ_{trb}	5.00E+00	1.11E-06	5.00E+00	9.60E-07	-3.10E+00	5.40E-07
γ_{try}	-5.00E+00	8.89E-07	-5.00E+00	9.47E-07	-5.00E+00	9.52E-07
γ_{tY}	9.52E-01	1.12E-02	9.59E-01	8.94E-03	9.17E-01	1.50E-07
γ_{tYb}	1.30E+00	1.74E-02	8.28E-01	1.09E-01	5.27E-01	9.75E-08
γ_{tYy}	2.50E+00	3.47E-02	2.97E+00	9.31E-01	6.56E-01	1.21E-07
γ_{xw}	9.93E-01	4.00E-03	9.95E-01	4.30E-03	9.93E-01	4.26E-07
γ_{xwb}	8.94E-02	3.70E-02	8.75E-02	3.93E-02	1.13E-01	3.21E-08
h_{C}	3.12E-01	6.34E-08	3.12E-01	4.70E-08	3.12E-01	6.09E-08
h_{h}	3.43E-01	6.91E-08	3.43E-01	6.08E-08	3.43E-01	6.67E-08
μ_{F}	-3.72E-01	5.87E-01	2.11E+00	2.46E+00	-5.41E-04	2.16E-08
μ_{H}	1.04E+01	1.37E-01	1.19E-04	3.18E-08	1.02E-03	6.36E-08
$\eta_{0,\alpha}$	4.25E-01	1.05E-07	4.25E-01	1.00E-07	4.25E-01	1.10E-07
$\eta_{0,\beta}$	-1.78E-03	2.94E-08	-1.78E-03	1.85E-08	-1.78E-03	1.97E-08
$\eta_{0,BF}$	-1.29E+00	1.88E-02	-2.00E+01	3.74E-06	-2.00E+01	3.89E-06
$\eta_{0,BH}$	1.32E-02	5.40E-03	3.93E-02	9.93E-02	-1.08E-03	3.87E-08
$\eta_{0,DW}$	6.99E+00	7.11E-03	6.92E+00	1.28E-02	6.89E+00	1.17E-06
$\eta_{0,FWL}$	7.44E+00	7.00E-02	7.29E+00	3.76E-01	7.76E+00	1.22E-06
$\eta_{0,G}$	-1.51E+00	3.24E-07	-1.51E+00	2.16E-07	-1.51E+00	2.58E-07
$\eta_{0,I}$	8.25E+00	7.47E-02	9.68E+00	2.06E+00	1.96E+01	5.66E-06
$\eta_{0,L}$	-1.57E+01	3.04E-06	-1.57E+01	2.15E-06	-1.57E+01	2.64E-06
$\eta_{0,M}$	-1.34E+01	4.53E-06	-1.34E+01	3.01E-06	-1.34E+01	4.29E-06
$\eta_{0,NX}$	1.56E+01	2.99E-06	1.56E+01	7.22E-07	1.56E+01	2.63E-06
$\eta_{0,P}$	1.88E+01	4.74E-01	1.47E+01	7.31E-01	1.59E+01	2.51E-06
$\eta_{0,R}$	1.15E-02	2.75E-08	1.15E-02	1.82E-08	1.15E-02	1.96E-08
$\eta_{0,tL}$	3.10E-01	6.45E-08	3.10E-01	7.98E-08	3.10E-01	1.13E-07
$\eta_{0,tr}$	-2.29E+00	2.57E-02	-1.98E+00	6.43E-01	-2.35E+00	5.19E-07
$\eta_{0,tY}$	1.11E-01	2.88E-08	1.11E-01	3.94E-08	1.11E-01	2.09E-08
$\eta_{0,XW}$	7.54E-01	5.73E-07	7.54E-01	6.44E-07	7.55E-01	2.87E-07
$\eta_{0,Y}$	6.86E-03	2.58E-08	6.86E-03	3.36E-08	6.86E-03	2.52E-08
$\eta_{1,\alpha}$	9.06E-01	1.74E-02	9.99E-01	1.95E-07	9.99E-01	3.09E-07
$\eta_{1,\beta}$	9.36E-01	2.58E-02	7.81E-01	3.18E-02	8.06E-01	1.87E-02
$\eta_{1,BF}$	8.73E-01	8.20E-02	9.98E-01	1.95E-07	6.42E-01	5.99E-01
$\eta_{1,BH}$	6.75E-03	4.12E+00	6.07E-04	2.57E-01	-1.69E-01	5.45E-01

$\eta_{1,DW}$	9.30E-01	1.56E-02	9.92E-01	4.17E-03	8.55E-01	4.24E-01
$\eta_{1,FWL}$	1.18E-01	1.14E+00	-1.32E-02	3.93E-01	-1.63E-03	4.36E-01
$\eta_{1,G}$	9.66E-01	1.72E-02	9.57E-01	1.43E-02	4.16E-01	6.45E-02
$\eta_{1,I}$	1.24E-03	9.87E-01	-1.67E-03	4.07E-01	-6.82E-03	2.86E-01
$\eta_{1,L}$	9.90E-01	7.14E-03	9.68E-01	7.05E-03	9.70E-01	6.67E-03
$\eta_{1,M}$	9.75E-01	5.86E-03	9.96E-01	7.20E-04	9.97E-01	2.07E-07
$\eta_{1,NRc}$	-3.92E-04	3.91E+00	-1.86E-03	2.16E-01	-6.98E-03	2.37E-01
$\eta_{1,NRdF}$	5.08E-04	2.55E+00	9.86E-01	4.52E-01	1.38E-03	3.68E-01
$\eta_{1,NRiF}$	-6.26E-01	3.11E-01	-6.26E-01	3.64E-01	-7.10E-01	3.13E-01
$\eta_{1,NRl}$	1.63E-03	4.27E+00	-7.53E-04	5.36E-02	-9.42E-04	3.82E-03
$\eta_{1,NRLFB}$	1.64E-03	2.56E+00	-6.68E-01	7.83E-01	1.64E-03	1.64E-01
$\eta_{1,NRLFK}$	-6.22E-01	4.53E-01	8.75E-04	3.46E-01	8.36E-01	9.65E-02
$\eta_{1,NRLFP}$	2.70E-03	3.72E+00	-1.95E-03	1.52E-01	-3.52E-04	3.48E-01
$\eta_{1,NRLHB}$	2.43E-05	2.62E+00	8.58E-02	1.85E-01	1.73E-01	7.71E-01
$\eta_{1,NRp}$	-3.46E-01	2.02E-01	3.87E-01	1.89E-01	-4.66E-01	1.59E-01
$\eta_{1,NRs}$	9.84E-01	1.62E-02	9.77E-01	1.51E-01	9.72E-01	1.96E-02
$\eta_{1,NRw}$	1.11E-03	1.58E-03	-3.86E-03	4.55E-02	-6.32E-04	6.72E-03
$\eta_{1,NRyD}$	1.85E-03	4.48E+00	4.97E-02	1.73E-01	1.12E-04	5.47E-01
$\eta_{1,NRz\alpha}$	2.02E-03	2.03E+00	3.86E-02	2.01E-01	-5.95E-04	1.22E-01
$\eta_{1,NRzFWL}$	-1.63E-04	3.83E+00	-1.43E-03	2.33E-01	-9.96E-05	1.76E-01
$\eta_{1,NRzI}$	-1.85E-04	2.40E+00	-5.10E-04	2.29E-01	5.48E-04	1.30E-01
$\eta_{1,NRzP}$	4.87E-05	3.61E+00	1.29E-03	3.25E-01	-6.16E-04	4.47E-01
$\eta_{1,NRzY}$	-1.61E-04	2.88E+00	4.91E-01	6.12E-02	3.77E-01	4.49E-02
$\eta_{1,NX}$	-1.08E-01	1.68E-01	3.75E-01	1.08E-01	2.23E-01	4.71E-02
$\eta_{1,P}$	-2.05E-04	7.58E-01	-6.13E-03	1.42E-01	-5.41E-04	5.18E-01
$\eta_{1,R}$	3.36E-01	7.95E-02	3.76E-01	9.38E-02	4.46E-01	7.91E-02
$\eta_{1,tL}$	-3.08E-01	1.05E-01	-3.51E-01	1.24E-01	-1.79E-01	9.66E-02
$\eta_{1,tr}$	-1.57E-01	9.34E-02	-1.84E-01	2.03E-01	-1.36E-01	9.75E-02
$\eta_{1,tY}$	-4.08E-01	8.78E-02	-4.59E-01	8.99E-02	-4.75E-01	9.44E-02
$\eta_{1,XW}$	9.71E-01	2.97E-02	9.94E-01	4.24E-03	9.98E-01	2.07E-07
$\eta_{1,Y}$	9.53E-01	1.19E-02	3.37E-01	8.16E-02	2.68E-02	7.18E-02
ω_C	3.25E+00	5.73E-07	3.25E+00	4.60E-07	3.25E+00	5.46E-07
ω_L	6.55E+00	1.28E-06	6.55E+00	9.11E-07	6.55E+00	1.15E-06
δ	1.83E-02	4.91E-08	1.83E-02	3.93E-08	1.83E-02	2.54E-08
θ	6.04E+00	1.05E-06	6.04E+00	6.19E-06	6.04E+00	6.15E-07

TABLE A4. The estimation results for the model with measurement errors

	RE IAME		RE DAME		SNRE IAME	
Parameter	value	std	value	std	value	std
ε_α	1.22E-02	9.19E-03	1.92E-01	4.22E-02	3.33E-02	1.06E-02
ε_β	2.12E-01	2.68E-02	5.30E-02	4.48E-03	1.03E-01	1.70E-02
ε_{BF}	1.00E+02	2.11E-05	5.49E+01	1.38E+00	1.00E+02	2.52E-05
ε_{BH}	7.19E-02	2.47E+00	8.30E-04	1.42E+00	2.47E-03	5.18E-01
ε_{DW}	9.14E+01	2.34E+00	1.00E+02	1.81E-05	4.05E+01	1.76E+00
ε_{FWL}	1.01E-03	1.99E+00	2.37E-03	2.55E+00	9.77E-04	8.22E-01
ε_G	2.86E-01	9.88E-02	2.19E-01	3.39E-02	1.94E-01	5.85E-02
ε_I	1.31E-03	1.95E+00	5.20E-03	1.63E+00	2.65E-03	3.27E-01
ε_L	1.56E+01	1.96E+00	1.92E+00	4.08E-01	2.38E+00	1.30E+00
ε_M	7.79E+00	1.18E+00	4.23E+01	1.35E+00	5.67E+00	8.78E-01
ε_{NRc}	-	-	-	-	3.35E-02	8.43E-01
ε_{NRdF}	-	-	-	-	1.13E-03	4.62E-01
ε_{NRiF}	-	-	-	-	7.74E-02	9.09E-02
ε_{NRl}	-	-	-	-	2.47E-01	1.08E+00
ε_{NRLFB}	-	-	-	-	5.45E-04	8.13E-01
ε_{NRLFK}	-	-	-	-	2.73E+00	1.93E+00

ε_{NRLFP}	-	-	-	-	1.07E-02	4.01E-01
ε_{NRLHB}	-	-	-	-	2.70E-09	7.41E-08
ε_{NRp}	-	-	-	-	1.71E-09	7.41E-08
ε_{NRs}	-	-	-	-	5.31E-02	7.33E-03
ε_{NRw}	-	-	-	-	2.48E-01	1.08E+00
ε_{NRyD}	-	-	-	-	3.80E-04	4.68E-03
$\varepsilon_{NRz\alpha}$	-	-	-	-	5.60E+01	1.95E+00
ε_{NRzFWL}	-	-	-	-	3.55E-03	4.35E-01
ε_{NRzI}	-	-	-	-	4.16E-05	7.41E-08
ε_{NRzP}	-	-	-	-	7.29E-04	4.43E-01
ε_{NRzY}	-	-	-	-	2.81E-03	2.64E-04
ε_{NX}	2.46E+01	1.71E+00	2.67E+01	1.99E+00	2.28E+01	1.94E+00
ε_{P}	6.97E-04	2.08E+00	1.37E-02	2.37E+00	4.12E-03	9.60E-01
ε_{R}	2.24E-02	3.77E-03	1.92E-02	4.22E-03	2.16E-02	4.58E-03
ε_{tL}	1.97E-02	2.32E-03	1.90E-01	7.72E-02	9.74E-03	2.41E-03
ε_{tr}	3.42E-01	4.31E-02	4.30E-01	7.77E-02	3.44E-01	1.52E-01
ε_{tY}	3.96E-02	6.74E-03	1.70E-02	3.55E-03	3.30E-02	5.86E-03
ε_{XW}	5.92E+01	2.08E+00	1.00E+02	1.81E-05	4.20E+01	1.94E+00
ε_{Y}	1.29E-02	1.98E-03	6.80E-03	7.55E-04	6.43E-03	8.93E-04
obs_{CF}	3.57E-03	3.59E-04	3.55E-08	4.90E-08	1.94E-03	4.52E-04
obs_{PF}	1.96E-03	1.26E-04	2.16E-03	1.40E-04	8.80E-04	9.55E-05
obs_{YF}	2.43E-03	2.13E-04	1.83E-03	1.58E-04	3.17E-04	5.30E-03
γ_{g}	5.71E-01	6.34E-03	9.35E-01	8.83E-03	4.12E-01	4.84E-02
γ_{gb}	4.87E+00	4.15E-02	1.39E+00	2.57E-02	3.25E+00	1.91E-01
γ_{gv}	-2.03E-01	4.30E-03	-5.00E+00	1.37E-06	-2.73E-01	4.85E-02
γ_{nx}	9.10E-01	1.56E-02	9.15E-01	1.27E-02	4.16E-01	1.15E-01
γ_{nxb}	3.42E+00	9.91E-01	3.36E-01	9.05E-03	5.00E+00	1.44E-06
γ_{r}	9.27E-01	6.26E-03	9.14E-01	1.76E-02	9.27E-01	1.30E-02
γ_{rp}	1.51E+00	1.35E-01	8.53E-01	3.42E-02	1.57E+00	2.79E-01
γ_{ry}	1.20E+00	1.16E-02	9.14E-01	8.77E-07	1.13E+00	7.90E-02
γ_{tL}	7.82E-01	1.40E-02	9.72E-01	1.10E-02	5.96E-01	7.65E-02
γ_{tLb}	-2.13E+00	4.04E-02	3.07E-01	8.38E-03	-1.65E+00	1.81E-01
γ_{tLy}	8.57E-02	8.44E-04	4.90E+00	5.26E-02	-4.26E-02	1.36E-02
γ_{tr}	9.39E-01	4.27E-03	9.50E-01	9.13E-03	9.39E-01	2.67E-02
γ_{trb}	5.00E+00	1.70E-06	-1.55E+00	4.06E-02	5.00E+00	1.44E-06
γ_{try}	-5.00E+00	1.83E-06	-4.97E+00	4.99E-06	-5.00E+00	3.38E-06
γ_{tY}	9.60E-01	5.88E-03	9.24E-01	1.26E-02	9.51E-01	8.53E-03
γ_{tYb}	2.23E+00	1.05E-01	4.59E-01	1.62E-02	1.39E+00	1.14E-01
γ_{tYy}	3.05E+00	2.15E-02	6.56E-01	9.64E-03	2.09E+00	2.10E-01
γ_{xw}	9.98E-01	3.63E-07	9.98E-01	2.67E-07	9.99E-01	2.90E-07
γ_{xwb}	5.61E-01	2.41E-01	1.78E-02	1.07E-03	2.52E+00	8.81E-01
h_{C}	3.12E-01	6.84E-08	3.12E-01	6.80E-08	3.12E-01	1.10E-07
h_{h}	3.43E-01	8.33E-08	3.43E-01	7.22E-08	3.43E-01	1.57E-07
μ_{F}	-3.90E-01	2.55E-01	-6.20E-04	2.70E-03	-1.31E-02	1.98E-01
μ_{H}	1.91E+00	2.03E-02	1.15E-03	3.24E-03	1.74E+01	1.58E+00
$\eta_{0,\alpha}$	4.25E-01	1.82E-07	4.25E-01	1.67E-07	4.25E-01	1.78E-07
$\eta_{0,\beta}$	-1.78E-03	4.56E-08	-1.78E-03	2.36E-08	-1.78E-03	4.73E-08
$\eta_{0,BF}$	-2.41E-03	1.06E-03	-1.96E+01	1.09E-01	-4.25E-03	2.41E-02
$\eta_{0,BH}$	-2.57E-02	4.47E-03	-6.95E-02	9.21E-08	-1.78E-02	1.85E-02
$\eta_{0,DW}$	6.94E+00	2.14E-02	6.92E+00	1.37E-02	6.93E+00	8.73E-03
$\eta_{0,FWL}$	9.05E+00	8.12E-02	7.54E+00	9.44E-02	9.07E+00	4.08E-01
$\eta_{0,G}$	-1.51E+00	3.71E-07	-1.51E+00	3.32E-07	-1.51E+00	1.48E-06
$\eta_{0,I}$	2.00E+01	4.88E-06	2.00E+01	3.76E-06	2.00E+01	5.56E-06
$\eta_{0,L}$	-1.57E+01	7.82E-06	-1.57E+01	4.21E-07	-1.57E+01	3.63E-05

$\eta_{0,M}$	-1.34E+01	6.02E-06	-1.34E+01	3.21E-06	-1.34E+01	3.94E-05
$\eta_{0,NX}$	1.56E+01	3.35E-06	1.56E+01	3.16E-06	1.56E+01	5.36E-06
$\eta_{0,P}$	1.98E+01	2.59E-01	1.95E+01	1.34E-01	1.71E+01	7.01E-01
$\eta_{0,R}$	1.15E-02	3.15E-08	1.15E-02	2.72E-08	1.15E-02	3.47E-08
$\eta_{0,tL}$	3.10E-01	6.13E-08	3.10E-01	6.30E-08	3.10E-01	1.96E-07
$\eta_{0,tr}$	-2.39E+00	1.63E-02	-1.68E+00	2.42E-02	-2.32E+00	3.20E-01
$\eta_{0,tY}$	1.11E-01	3.01E-08	1.11E-01	2.79E-08	1.11E-01	5.36E-08
$\eta_{0,XW}$	7.55E-01	6.06E-07	7.54E-01	5.69E-07	7.55E-01	6.42E-07
$\eta_{0,Y}$	6.86E-03	2.46E-08	6.86E-03	2.76E-08	6.86E-03	2.45E-08
$\eta_{1,\alpha}$	9.46E-01	3.53E-02	9.99E-01	2.67E-07	9.76E-01	9.13E-03
$\eta_{1,\beta}$	9.86E-01	2.70E-03	7.38E-01	3.13E-02	9.72E-01	7.65E-03
$\eta_{1,BF}$	9.94E-01	9.16E-04	7.70E-01	5.30E-02	9.95E-01	7.79E-04
$\eta_{1,BH}$	9.97E-01	3.63E-07	2.45E-03	2.08E+00	2.13E-03	8.86E-01
$\eta_{1,DW}$	9.85E-01	8.00E-03	9.92E-01	1.42E-03	9.45E-01	3.01E-02
$\eta_{1,FWL}$	3.25E-03	1.64E+00	3.84E-02	3.47E-01	-2.19E-03	4.02E-01
$\eta_{1,G}$	9.46E-01	2.34E-02	4.33E-01	6.79E-02	9.46E-01	1.90E-02
$\eta_{1,I}$	4.07E-04	8.72E-01	-7.56E-04	3.34E-01	2.93E-03	1.74E-01
$\eta_{1,L}$	9.96E-01	1.52E-03	9.43E-01	1.03E-02	9.77E-01	2.03E-02
$\eta_{1,M}$	9.87E-01	2.25E-03	9.98E-01	2.67E-07	9.86E-01	2.34E-03
$\eta_{1,NX}$	2.74E-01	9.38E-02	3.02E-01	8.26E-02	8.78E-01	2.75E-02
$\eta_{1,P}$	1.35E-03	4.60E-01	1.31E-03	2.30E-01	-1.21E-03	1.05E-01
$\eta_{1,R}$	3.43E-01	8.54E-02	3.47E-01	7.86E-02	3.18E-01	8.53E-02
$\eta_{1,tL}$	-3.63E-01	9.99E-02	-2.66E-01	8.95E-02	-3.48E-01	1.04E-01
$\eta_{1,tr}$	-1.45E-01	9.32E-02	-1.27E-01	9.45E-02	-1.43E-01	9.56E-02
$\eta_{1,tY}$	-4.59E-01	8.48E-02	-5.56E-01	9.15E-02	-4.15E-01	8.90E-02
$\eta_{1,XW}$	9.95E-01	1.29E-03	9.98E-01	2.67E-07	9.92E-01	4.26E-03
$\eta_{1,Y}$	7.48E-01	4.67E-02	5.35E-01	6.02E-02	2.46E-01	1.14E-01
ω_C	3.25E+00	2.70E-06	3.25E+00	1.89E-07	3.25E+00	1.20E-05
ω_L	6.55E+00	1.42E-06	6.55E+00	8.48E-07	6.55E+00	2.27E-06
δ	1.83E-02	6.51E-08	1.83E-02	4.65E-08	1.83E-02	1.34E-07
θ	6.04E+00	2.15E-06	6.04E+00	1.45E-06	6.04E+00	2.38E-06

TABLE A4 (continued). The estimation results for the model with measurement errors

	SNRE DAME		WNRE IAME		WNRE DAME	
Parameter	value	std	value	std	value	std
ε_{α}	9.99E-02	4.22E-02	1.42E-01	4.46E-02	1.01E-01	3.16E-02
ε_{β}	4.68E-02	4.02E-03	4.90E-02	4.30E-03	4.83E-02	4.21E-03
ε_{BF}	4.80E+01	2.03E+00	1.00E+02	1.90E-05	3.83E+00	8.30E-01
ε_{BH}	1.28E-02	1.72E-01	5.26E-03	1.15E+00	5.95E-04	8.56E-01
ε_{DW}	1.00E+02	2.02E-05	6.01E+01	1.13E+00	7.06E-05	2.19E-08
ε_{FWL}	2.02E-03	3.67E-01	5.72E-04	1.05E+00	2.77E-03	3.88E-01
ε_{G}	2.10E-01	3.93E-02	1.96E-01	4.47E-02	1.71E-01	2.14E-02
ε_{I}	4.56E-03	6.54E-01	2.06E-03	7.83E-01	2.67E-02	4.13E-01
ε_{L}	3.72E+00	9.24E-01	3.93E+00	9.59E-01	3.87E+00	4.25E-01
ε_{M}	8.57E+00	1.01E+00	1.02E+01	1.16E+00	7.50E+00	8.63E-01
ε_{NRc}	1.05E-03	1.65E-01	2.02E-03	1.15E+00	1.58E-03	4.46E-01
ε_{NRdF}	1.13E-03	3.20E-01	1.00E+02	1.90E-05	1.67E-05	2.19E-08
ε_{NRiF}	6.43E-06	2.13E-08	2.44E-02	1.32E-02	1.46E-02	1.56E-02
ε_{NRl}	3.30E-01	3.90E-01	1.50E-01	8.34E-01	3.03E-01	1.14E+00
ε_{NRLFB}	6.88E-03	1.19E-01	7.34E-02	1.16E+00	1.03E-01	6.33E-01
ε_{NRLFK}	1.04E-04	2.13E-08	3.59E-06	2.52E-08	3.64E-01	1.86E-01
ε_{NRLFP}	1.28E-03	2.35E-01	1.89E-03	1.11E+00	2.34E-02	4.74E-01
ε_{NRLHB}	3.36E-10	2.13E-08	3.29E-10	2.52E-08	3.36E-10	2.19E-08
ε_{NRp}	3.21E-09	2.13E-08	2.75E-09	2.52E-08	3.03E-10	2.19E-08
ε_{NRs}	2.25E-02	1.45E-02	1.40E-01	6.45E-02	1.43E-01	5.28E-02

ε_{NRw}	3.66E-01	5.50E-01	1.60E-01	7.82E-01	3.37E-01	1.03E+00
ε_{NRyD}	9.08E-09	2.13E-08	1.59E-03	5.28E-04	1.57E-09	2.19E-08
$\varepsilon_{NRz\alpha}$	8.29E-04	3.00E-01	5.61E-04	1.17E+00	8.58E-04	6.59E-01
ε_{NRzFWL}	1.27E-02	1.15E-01	5.48E-04	1.18E+00	2.24E-03	8.95E-01
ε_{NRzI}	8.58E-02	1.52E-01	8.77E-04	1.18E+00	2.55E+00	1.29E+00
ε_{NRzP}	1.90E-03	3.45E-01	1.03E-03	1.18E+00	8.97E-04	8.79E-01
ε_{NRzY}	2.04E-03	1.45E-04	3.69E-03	3.55E-04	2.70E-03	2.55E-04
ε_{NX}	3.32E+01	1.70E+00	1.98E+01	1.16E+00	2.45E+01	1.50E+00
ε_{P}	4.69E-03	4.79E-01	3.70E-02	1.18E+00	1.24E-03	6.11E-01
ε_{R}	2.05E-02	4.57E-03	2.03E-02	2.75E-03	2.10E-02	3.37E-03
ε_{tL}	7.49E-02	1.97E-02	1.02E-02	1.16E-03	8.63E-02	1.32E-02
ε_{tr}	4.12E-01	1.53E-01	2.69E-01	2.86E-02	4.26E-01	4.78E-02
ε_{tY}	1.52E-02	4.06E-03	3.79E-02	3.21E-03	9.93E-03	1.43E-03
ε_{XW}	1.00E+02	2.02E-05	3.07E+01	1.18E+00	1.00E+02	1.81E-05
ε_{Y}	4.30E-03	4.37E-04	5.85E-03	7.51E-04	4.17E-03	3.96E-04
obs_{CF}	0.00E+00	2.13E-08	1.18E-03	4.69E-04	1.86E-09	2.19E-08
obs_{PF}	7.52E-04	7.53E-05	7.80E-04	9.00E-05	7.70E-04	7.49E-05
obs_{YF}	0.00E+00	2.13E-08	2.32E-07	2.52E-08	1.60E-09	2.19E-08
γ_{q}	9.27E-01	1.57E-02	2.36E-01	9.30E-08	9.13E-01	1.93E-07
γ_{qb}	1.46E+00	1.03E-01	1.67E+00	2.88E-07	1.30E+00	3.76E-07
γ_{qy}	-5.00E+00	9.64E-07	-2.59E-02	4.76E-08	-5.00E+00	8.63E-07
γ_{nx}	9.43E-01	8.08E-03	8.80E-01	1.73E-07	9.19E-01	8.70E-07
γ_{nxb}	3.26E-01	2.25E-02	2.90E-01	6.04E-08	2.96E-01	1.81E-07
γ_{r}	9.09E-01	2.26E-02	9.12E-01	1.69E-07	9.10E-01	3.27E-07
γ_{rp}	8.91E-01	1.27E-01	6.67E-01	7.88E-02	8.17E-01	1.09E-01
γ_{ry}	8.24E-01	2.96E-01	8.89E-01	1.54E-07	8.29E-01	3.63E-07
γ_{tL}	9.29E-01	1.85E-02	6.16E-01	3.28E-07	9.35E-01	2.21E-07
γ_{tLb}	-9.08E-03	9.55E-03	-8.98E-01	3.61E-07	5.66E-01	1.74E-07
γ_{tLy}	3.45E+00	2.95E-01	-2.98E-01	6.97E-08	3.62E+00	6.98E-07
γ_{tr}	9.50E-01	1.81E-02	9.27E-01	1.56E-07	9.51E-01	2.46E-07
γ_{trb}	-2.82E+00	6.08E-01	5.00E+00	1.56E-06	-5.00E+00	8.11E-07
γ_{try}	-5.00E+00	9.63E-07	-5.00E+00	1.33E-06	-5.00E+00	1.64E-06
γ_{tY}	9.14E-01	1.92E-02	9.58E-01	2.11E-07	8.66E-01	1.33E-07
γ_{tYb}	4.66E-01	4.15E-02	8.16E-01	1.58E-07	5.87E-01	1.82E-07
γ_{tYy}	2.87E-02	4.51E-02	2.83E+00	9.67E-07	3.58E-01	7.20E-08
γ_{xw}	9.98E-01	2.07E-07	9.95E-01	4.15E-07	9.91E-01	9.62E-07
γ_{xwb}	2.04E-02	3.87E-03	1.13E-01	2.76E-08	3.32E-01	1.54E-07
h_{C}	3.12E-01	6.98E-08	3.12E-01	5.59E-08	3.12E-01	6.13E-08
h_{h}	3.43E-01	7.63E-08	3.43E-01	6.13E-08	3.43E-01	6.70E-08
μ_{F}	8.93E-04	3.84E-02	3.30E+00	5.38E-07	1.97E-03	9.60E-08
μ_{H}	8.15E-04	1.91E-03	4.96E-04	3.27E-08	9.37E-04	8.53E-08
$\eta_{0,\alpha}$	4.25E-01	9.82E-08	4.25E-01	9.80E-08	4.25E-01	1.06E-07
$\eta_{0,\beta}$	-1.78E-03	2.35E-08	-1.78E-03	2.15E-08	-1.78E-03	2.56E-08
$\eta_{0,BF}$	-2.00E+01	3.85E-06	-2.00E+01	3.35E-06	-2.00E+01	3.42E-06
$\eta_{0,BH}$	-6.48E-02	2.07E-02	3.54E-02	4.30E-08	-7.43E-03	3.82E-08
$\eta_{0,DW}$	6.88E+00	8.45E-03	6.91E+00	1.17E-06	6.89E+00	1.07E-06
$\eta_{0,FWL}$	8.01E+00	2.86E-01	7.32E+00	1.20E-06	8.05E+00	1.84E-06
$\eta_{0,G}$	-1.51E+00	1.32E-07	-1.51E+00	2.67E-07	-1.51E+00	2.60E-07
$\eta_{0,I}$	2.00E+01	4.12E-06	9.34E+00	9.84E-07	2.00E+01	3.42E-06
$\eta_{0,L}$	-1.57E+01	6.99E-07	-1.57E+01	2.24E-06	-1.57E+01	2.15E-06
$\eta_{0,M}$	-1.34E+01	3.48E-06	-1.34E+01	3.25E-06	-1.34E+01	3.69E-06
$\eta_{0,NX}$	1.56E+01	3.24E-06	1.56E+01	2.31E-06	1.56E+01	2.14E-06
$\eta_{0,P}$	1.62E+01	7.36E-01	1.48E+01	2.38E-06	1.62E+01	3.91E-06
$\eta_{0,R}$	1.15E-02	2.76E-08	1.15E-02	2.15E-08	1.15E-02	2.51E-08

$\eta_{0,tL}$	3.10E-01	6.42E-08	3.10E-01	9.98E-08	3.10E-01	7.16E-08
$\eta_{0,tr}$	-1.72E+00	2.02E-01	-2.39E+00	1.02E-06	-2.34E+00	6.96E-07
$\eta_{0,tY}$	1.11E-01	3.19E-08	1.11E-01	3.24E-08	1.11E-01	3.55E-08
$\eta_{0,XW}$	7.55E-01	5.70E-07	7.54E-01	2.93E-07	7.55E-01	2.28E-07
$\eta_{0,Y}$	6.86E-03	2.80E-08	6.86E-03	2.70E-08	6.86E-03	3.03E-08
$\eta_{1,\alpha}$	9.99E-01	2.07E-07	9.99E-01	2.58E-07	9.99E-01	2.29E-07
$\eta_{1,\beta}$	8.13E-01	2.26E-02	7.94E-01	2.56E-02	8.09E-01	2.08E-02
$\eta_{1,BF}$	7.93E-01	5.72E-02	9.98E-01	2.46E-07	7.25E-01	2.04E-01
$\eta_{1,BH}$	-9.19E-01	1.32E+00	5.08E-03	1.15E+00	4.36E-02	3.54E-01
$\eta_{1,DW}$	9.91E-01	1.53E-03	9.93E-01	3.03E-03	6.40E-02	4.51E-01
$\eta_{1,FWL}$	7.81E-01	1.26E+00	7.57E-03	1.65E-01	-6.38E-04	1.84E-01
$\eta_{1,G}$	4.69E-01	7.72E-02	9.58E-01	1.06E-02	4.57E-01	6.33E-02
$\eta_{1,I}$	-1.42E-03	2.23E-01	-6.32E-04	2.42E-01	3.64E-04	3.99E-01
$\eta_{1,L}$	9.71E-01	6.83E-03	9.72E-01	6.15E-03	9.72E-01	3.44E-03
$\eta_{1,M}$	9.96E-01	4.62E-04	9.97E-01	2.46E-07	9.96E-01	4.58E-04
$\eta_{1,NRc}$	-	-	-3.64E-03	1.17E+00	-4.32E-03	3.50E-01
$\eta_{1,NRdF}$	-	-	9.84E-01	1.35E-01	1.60E-04	1.74E-01
$\eta_{1,NRiF}$	-	-	-6.27E-01	2.17E-01	-6.87E-01	5.34E-01
$\eta_{1,NRI}$	-	-	3.84E-03	5.04E-02	7.17E-04	7.45E-03
$\eta_{1,NRLFB}$	-	-	-7.44E-01	1.18E+00	-5.23E-04	1.86E-01
$\eta_{1,NRLFK}$	-	-	-2.22E-04	1.17E+00	8.81E-01	6.71E-02
$\eta_{1,NRLFP}$	-	-	-1.94E-03	1.18E+00	-7.08E-05	3.33E-01
$\eta_{1,NRLHB}$	-	-	2.99E-01	3.23E-07	1.40E-01	2.78E-01
$\eta_{1,NRp}$	-	-	8.94E-01	1.10E-06	8.14E-01	9.23E-01
$\eta_{1,NRs}$	-	-	9.79E-01	4.08E-02	9.75E-01	2.21E-02
$\eta_{1,NRw}$	-	-	-4.50E-04	3.95E-02	7.12E-04	6.14E-03
$\eta_{1,NRyD}$	-	-	-1.57E-02	1.85E-01	2.11E-03	2.96E-01
$\eta_{1,NRz\alpha}$	-	-	-1.57E-01	1.18E+00	3.87E-04	1.99E-01
$\eta_{1,NRzFWL}$	-	-	-1.70E-03	1.18E+00	4.33E-04	3.67E-01
$\eta_{1,NRzI}$	-	-	-5.24E-04	1.12E+00	2.53E-03	2.57E-01
$\eta_{1,NRzP}$	-	-	1.85E-03	1.17E+00	4.69E-03	6.16E-01
$\eta_{1,NRzY}$	-	-	4.20E-01	6.64E-02	3.69E-01	4.51E-02
$\eta_{1,NX}$	2.04E-01	1.04E-01	3.66E-01	4.48E-02	2.51E-01	5.37E-02
$\eta_{1,P}$	-2.03E-04	2.28E-01	-4.62E-03	2.19E-01	1.55E-03	3.63E-01
$\eta_{1,R}$	4.11E-01	9.62E-02	3.82E-01	7.68E-02	4.15E-01	8.76E-02
$\eta_{1,tL}$	-2.60E-01	1.05E-01	-3.47E-01	9.64E-02	-1.97E-01	1.47E-01
$\eta_{1,tr}$	-1.56E-01	1.16E-01	-1.80E-01	9.46E-02	-1.49E-01	1.02E-01
$\eta_{1,tY}$	-5.34E-01	9.43E-02	-4.56E-01	8.31E-02	-4.93E-01	1.12E-01
$\eta_{1,XW}$	9.98E-01	2.07E-07	9.95E-01	6.08E-04	9.98E-01	2.52E-07
$\eta_{1,Y}$	2.15E-02	1.23E-01	2.42E-01	8.91E-02	1.43E-02	1.42E-01
ω_C	3.25E+00	2.19E-07	3.25E+00	5.83E-07	3.25E+00	5.11E-07
ω_L	6.55E+00	2.66E-07	6.55E+00	1.03E-06	6.55E+00	8.89E-07
δ	1.83E-02	2.53E-08	1.83E-02	2.44E-08	1.83E-02	2.53E-08
θ	6.04E+00	1.32E-06	6.04E+00	1.95E-06	6.04E+00	9.16E-07

TABLE A5. RMSE of in-sample forecasts of the models with information approach

Variable-horizon	AR (1)	VAR (1)	RE IAWME	RE IAME	SNRE IAWME	SNRE IAME	WNRE IAWME	WNRE IAME
$obs_C(t+1)$	0.59%	0.50%	0.96%	0.83%	0.95%	0.91%	0.88%	0.86%
$obs_G(t+1)$	0.85%	0.73%	0.88%	0.91%	0.87%	0.85%	0.86%	0.85%
$obs_I(t+1)$	2.93%	1.93%	4.98%	2.95%	3.03%	2.98%	3.09%	3.06%
$obs_P(t+1)$	0.18%	0.16%	0.22%	0.20%	0.22%	0.20%	0.22%	0.20%
$obs_R(t+1)$	0.13%	0.10%	0.12%	0.12%	0.12%	0.12%	0.12%	0.12%
$obs_{STR}(t+1)$	8.61%	7.62%	8.72%	8.86%	9.38%	9.45%	8.65%	8.67%
$obs_{taxL}(t+1)$	0.71%	0.61%	0.67%	0.66%	0.65%	0.65%	0.62%	0.62%

$obs_{taxY}(t+1)$	0.25%	0.23%	0.25%	0.23%	0.23%	0.23%	0.23%	0.23%
$obs_{tr}(t+1)$	2.27%	2.04%	2.29%	2.36%	2.30%	2.31%	2.27%	2.27%
$obs_{WL}(t+1)$	0.82%	0.56%	2.07%	1.13%	0.95%	0.94%	0.76%	0.74%
$obs_{Y}(t+1)$	0.54%	0.46%	0.60%	0.57%	0.58%	0.58%	0.59%	0.59%
$obs_{PF}(t+1)$	0.10%	0.08%	0.42%	0.18%	0.11%	0.11%	0.10%	0.10%
$obs_{YF}(t+1)$	0.27%	0.18%	0.31%	0.29%	0.35%	0.35%	0.31%	0.32%
$obs_{CF}(t+1)$	0.28%	0.23%	0.51%	0.47%	0.37%	0.40%	0.34%	0.34%
$obs_{C}(t+2)$	0.62%	0.58%	1.10%	0.85%	0.92%	0.89%	0.84%	0.82%
$obs_{G}(t+2)$	0.87%	0.76%	0.98%	0.97%	0.91%	0.89%	0.87%	0.87%
$obs_{I}(t+2)$	3.06%	2.67%	3.61%	3.16%	3.17%	3.13%	3.21%	3.20%
$obs_{P}(t+2)$	0.19%	0.17%	0.39%	0.22%	0.23%	0.21%	0.24%	0.22%
$obs_{R}(t+2)$	0.21%	0.16%	0.20%	0.19%	0.21%	0.20%	0.21%	0.21%
$obs_{STR}(t+2)$	8.64%	8.19%	8.73%	8.90%	8.68%	8.67%	8.67%	8.68%
$obs_{taxL}(t+2)$	0.83%	0.67%	0.80%	0.82%	0.78%	0.78%	0.73%	0.73%
$obs_{taxY}(t+2)$	0.29%	0.27%	0.32%	0.28%	0.28%	0.28%	0.28%	0.28%
$obs_{tr}(t+2)$	2.35%	2.27%	2.44%	2.40%	2.33%	2.34%	2.31%	2.32%
$obs_{WL}(t+2)$	0.84%	0.73%	2.57%	1.15%	0.97%	0.97%	0.82%	0.82%
$obs_{Y}(t+2)$	0.57%	0.54%	0.60%	0.60%	0.61%	0.61%	0.61%	0.61%
$obs_{PF}(t+2)$	0.13%	0.11%	0.25%	0.20%	0.13%	0.13%	0.13%	0.13%
$obs_{YF}(t+2)$	0.33%	0.27%	0.33%	0.35%	0.37%	0.37%	0.37%	0.38%
$obs_{CF}(t+2)$	0.31%	0.26%	0.53%	0.47%	0.39%	0.42%	0.35%	0.37%
$obs_{C}(t+3)$	0.63%	0.59%	1.26%	1.01%	0.99%	0.97%	0.88%	0.86%
$obs_{G}(t+3)$	0.87%	0.77%	0.93%	1.00%	0.93%	0.90%	0.87%	0.87%
$obs_{I}(t+3)$	3.13%	2.87%	3.40%	3.15%	3.20%	3.16%	3.24%	3.22%
$obs_{P}(t+3)$	0.21%	0.19%	0.26%	0.23%	0.24%	0.23%	0.25%	0.23%
$obs_{R}(t+3)$	0.28%	0.22%	0.28%	0.26%	0.28%	0.28%	0.28%	0.28%
$obs_{STR}(t+3)$	8.67%	8.53%	8.72%	8.91%	8.68%	8.68%	8.67%	8.68%
$obs_{taxL}(t+3)$	1.00%	0.79%	1.00%	1.05%	0.98%	0.98%	0.90%	0.90%
$obs_{taxY}(t+3)$	0.35%	0.33%	0.40%	0.35%	0.33%	0.33%	0.34%	0.34%
$obs_{tr}(t+3)$	2.38%	2.31%	2.35%	2.37%	2.34%	2.34%	2.32%	2.32%
$obs_{WL}(t+3)$	0.86%	0.77%	1.02%	1.15%	0.98%	0.98%	0.84%	0.84%
$obs_{Y}(t+3)$	0.60%	0.55%	0.59%	0.62%	0.62%	0.62%	0.62%	0.62%
$obs_{PF}(t+3)$	0.15%	0.13%	0.27%	0.20%	0.14%	0.14%	0.15%	0.14%
$obs_{YF}(t+3)$	0.35%	0.31%	0.35%	0.37%	0.38%	0.38%	0.39%	0.39%
$obs_{CF}(t+3)$	0.32%	0.28%	0.60%	0.52%	0.42%	0.44%	0.40%	0.42%
$obs_{C}(t+4)$	0.65%	0.61%	1.28%	1.04%	0.98%	0.97%	0.83%	0.81%
$obs_{G}(t+4)$	0.88%	0.78%	0.92%	1.02%	0.94%	0.91%	0.88%	0.87%
$obs_{I}(t+4)$	3.14%	2.98%	3.36%	3.17%	3.17%	3.15%	3.19%	3.19%
$obs_{P}(t+4)$	0.22%	0.20%	0.30%	0.25%	0.26%	0.24%	0.26%	0.25%
$obs_{R}(t+4)$	0.35%	0.26%	0.35%	0.33%	0.35%	0.34%	0.35%	0.35%
$obs_{STR}(t+4)$	8.70%	8.64%	8.73%	8.92%	8.70%	8.69%	8.69%	8.70%
$obs_{taxL}(t+4)$	1.17%	0.86%	1.20%	1.30%	1.19%	1.19%	1.08%	1.09%
$obs_{taxY}(t+4)$	0.41%	0.38%	0.49%	0.40%	0.38%	0.38%	0.39%	0.39%
$obs_{tr}(t+4)$	2.39%	2.35%	2.39%	2.39%	2.36%	2.36%	2.36%	2.36%
$obs_{WL}(t+4)$	0.87%	0.79%	1.20%	1.17%	0.98%	0.98%	0.85%	0.85%
$obs_{Y}(t+4)$	0.60%	0.58%	0.61%	0.64%	0.62%	0.62%	0.62%	0.62%
$obs_{PF}(t+4)$	0.16%	0.13%	0.26%	0.21%	0.16%	0.15%	0.16%	0.15%
$obs_{YF}(t+4)$	0.36%	0.33%	0.36%	0.38%	0.38%	0.38%	0.40%	0.40%
$obs_{CF}(t+4)$	0.32%	0.29%	0.59%	0.52%	0.43%	0.44%	0.42%	0.43%
mean of RMSE	1.39%	1.27%	1.60%	1.49%	1.45%	1.45%	1.42%	1.41%
RMSE of RMSE	2.58%	2.43%	2.73%	2.67%	2.65%	2.65%	2.60%	2.60%
mean of RMSE ex expect.	1.70%	1.55%	1.92%	1.80%	1.77%	1.76%	1.72%	1.72%
RMSE of RMSE _ ex expect.	2.91%	2.74%	3.08%	3.00%	2.99%	2.98%	2.93%	2.93%

median of RMSE	0.60%	0.55%	0.64%	0.65%	0.63%	0.63%	0.62%	0.62%
median of RMSE ex expect.	0.83%	0.64%	0.97%	0.99%	0.93%	0.91%	0.84%	0.83%

TABLE A6. RMSE of out-of-sample forecasts of the models with information approach

Variable-horizon	AR (1)	VAR (1)	RE IAWME	RE IAME	SNRE IAWME	SNRE IAME	WNRE IAWME	WNRE IAME
$obs_C(t+1)$	0.97%	0.88%	0.79%	0.90%	0.90%	0.98%	0.85%	0.89%
$obs_G(t+1)$	1.18%	1.17%	1.11%	1.12%	1.12%	1.11%	1.12%	1.10%
$obs_I(t+1)$	4.40%	3.27%	5.79%	4.12%	4.09%	4.11%	4.29%	4.29%
$obs_P(t+1)$	0.22%	0.23%	0.20%	0.24%	0.21%	0.20%	0.20%	0.20%
$obs_R(t+1)$	0.09%	0.16%	0.11%	0.09%	0.11%	0.11%	0.12%	0.12%
$obs_{STR}(t+1)$	12.64%	12.66%	12.62%	12.19%	13.69%	13.89%	12.15%	12.16%
$obs_{taxL}(t+1)$	0.79%	0.90%	0.84%	0.78%	0.75%	0.76%	0.73%	0.73%
$obs_{taxY}(t+1)$	0.47%	0.49%	0.45%	0.41%	0.42%	0.42%	0.41%	0.41%
$obs_{tr}(t+1)$	2.82%	2.64%	3.14%	3.03%	2.93%	2.91%	2.80%	2.71%
$obs_{WL}(t+1)$	1.44%	0.89%	2.68%	1.24%	1.21%	1.20%	1.07%	1.06%
$obs_Y(t+1)$	0.75%	0.82%	0.71%	0.74%	0.82%	0.81%	0.84%	0.84%
$obs_{PF}(t+1)$	0.12%	0.12%	0.36%	0.19%	0.12%	0.11%	0.11%	0.11%
$obs_{YF}(t+1)$	0.39%	0.31%	0.40%	0.43%	0.55%	0.55%	0.46%	0.46%
$obs_{CF}(t+1)$	0.31%	0.36%	0.48%	0.39%	0.44%	0.42%	0.42%	0.40%
$obs_C(t+2)$	1.10%	1.07%	1.03%	1.02%	1.00%	1.00%	0.98%	0.95%
$obs_G(t+2)$	1.32%	1.11%	1.36%	1.39%	1.32%	1.28%	1.22%	1.21%
$obs_I(t+2)$	5.00%	4.54%	5.65%	4.68%	4.84%	4.88%	4.92%	4.92%
$obs_P(t+2)$	0.25%	0.25%	0.39%	0.26%	0.26%	0.24%	0.25%	0.24%
$obs_R(t+2)$	0.15%	0.26%	0.19%	0.15%	0.19%	0.18%	0.21%	0.21%
$obs_{STR}(t+2)$	12.14%	13.22%	12.45%	12.15%	12.03%	11.99%	12.05%	12.06%
$obs_{taxL}(t+2)$	1.21%	1.17%	1.25%	1.13%	1.07%	1.08%	0.99%	1.00%
$obs_{taxY}(t+2)$	0.45%	0.52%	0.56%	0.45%	0.44%	0.44%	0.44%	0.44%
$obs_{tr}(t+2)$	2.73%	2.62%	3.08%	2.91%	2.72%	2.72%	2.65%	2.63%
$obs_{WL}(t+2)$	1.39%	1.34%	2.18%	1.39%	1.31%	1.32%	1.31%	1.31%
$obs_Y(t+2)$	0.86%	0.87%	0.80%	0.83%	0.86%	0.86%	0.88%	0.87%
$obs_{PF}(t+2)$	0.16%	0.14%	0.33%	0.22%	0.14%	0.14%	0.15%	0.14%
$obs_{YF}(t+2)$	0.56%	0.54%	0.52%	0.56%	0.59%	0.59%	0.58%	0.58%
$obs_{CF}(t+2)$	0.40%	0.48%	0.54%	0.51%	0.47%	0.49%	0.44%	0.45%
$obs_C(t+3)$	0.71%	0.75%	0.90%	0.81%	0.80%	0.81%	0.62%	0.62%
$obs_G(t+3)$	1.35%	1.05%	1.35%	1.47%	1.36%	1.31%	1.20%	1.19%
$obs_I(t+3)$	4.72%	4.60%	5.05%	4.41%	4.59%	4.58%	4.59%	4.59%
$obs_P(t+3)$	0.27%	0.28%	0.39%	0.31%	0.27%	0.26%	0.27%	0.26%
$obs_R(t+3)$	0.21%	0.33%	0.29%	0.21%	0.27%	0.26%	0.30%	0.29%
$obs_{STR}(t+3)$	8.83%	9.96%	8.87%	8.63%	8.62%	8.64%	8.67%	8.67%
$obs_{taxL}(t+3)$	1.45%	1.38%	1.61%	1.43%	1.36%	1.37%	1.19%	1.19%
$obs_{taxY}(t+3)$	0.48%	0.62%	0.62%	0.51%	0.48%	0.48%	0.48%	0.48%
$obs_{tr}(t+3)$	2.37%	2.69%	2.32%	2.19%	2.18%	2.17%	2.12%	2.07%
$obs_{WL}(t+3)$	1.44%	1.37%	1.59%	1.35%	1.34%	1.34%	1.34%	1.35%
$obs_Y(t+3)$	0.63%	0.72%	0.62%	0.64%	0.61%	0.62%	0.62%	0.62%
$obs_{PF}(t+3)$	0.17%	0.15%	0.32%	0.22%	0.15%	0.13%	0.15%	0.14%
$obs_{YF}(t+3)$	0.53%	0.61%	0.53%	0.55%	0.54%	0.54%	0.53%	0.53%
$obs_{CF}(t+3)$	0.31%	0.39%	0.55%	0.46%	0.42%	0.42%	0.37%	0.37%
$obs_C(t+4)$	0.52%	0.52%	0.83%	0.75%	0.79%	0.78%	0.50%	0.48%
$obs_G(t+4)$	1.34%	1.02%	1.31%	1.50%	1.38%	1.32%	1.18%	1.17%
$obs_I(t+4)$	3.56%	3.88%	4.04%	3.36%	3.35%	3.32%	3.29%	3.30%
$obs_P(t+4)$	0.28%	0.30%	0.40%	0.32%	0.27%	0.27%	0.27%	0.27%
$obs_R(t+4)$	0.26%	0.41%	0.37%	0.27%	0.34%	0.32%	0.38%	0.37%
$obs_{STR}(t+4)$	7.65%	9.06%	7.59%	7.30%	7.43%	7.51%	7.47%	7.48%

$obs_{taxL}(t+4)$	1.63%	1.59%	1.90%	1.73%	1.65%	1.67%	1.41%	1.41%
$obs_{taxY}(t+4)$	0.47%	0.66%	0.78%	0.53%	0.50%	0.50%	0.48%	0.49%
$obs_{tr}(t+4)$	2.42%	2.58%	2.30%	2.32%	2.23%	2.23%	2.21%	2.19%
$obs_{WL}(t+4)$	0.91%	0.89%	1.52%	1.14%	0.91%	0.93%	0.86%	0.86%
$obs_{Y}(t+4)$	0.41%	0.58%	0.50%	0.49%	0.43%	0.43%	0.42%	0.42%
$obs_{PF}(t+4)$	0.15%	0.11%	0.28%	0.20%	0.13%	0.12%	0.13%	0.12%
$obs_{YF}(t+4)$	0.34%	0.41%	0.36%	0.38%	0.31%	0.32%	0.30%	0.31%
$obs_{CF}(t+4)$	0.17%	0.22%	0.47%	0.40%	0.39%	0.38%	0.27%	0.27%
mean of RMSE	1.75%	1.79%	1.92%	1.74%	1.74%	1.75%	1.68%	**1.68%**
RMSE of RMSE	3.21%	3.37%	3.35%	3.14%	3.24%	3.25%	3.12%	**3.12%**
mean of RMSE ex expect.	2.14%	2.19%	2.33%	2.11%	2.12%	2.13%	2.05%	**2.05%**
RMSE of RMSE ex expect.	3.62%	3.80%	3.77%	3.53%	3.65%	3.67%	3.52%	**3.52%**
median of RMSE	0.73%	0.78%	0.79%	0.76%	0.79%	0.80%	0.68%	**0.67%**
median of RMSE ex expect.	1.14%	**0.96%**	1.18%	1.12%	1.03%	1.04%	0.98%	0.98%

TABLE A7. RMSE of in-sample forecasts of the models with dates approach

Variable-horizon	AR (1)	VAR (1)	RE DAWME	RE DAME	SNRE DAWME	SNRE DAME	WNRE DAWME	WNRE DAME
$obs_{C}(t+1)$	0.59%	0.48%	0.91%	0.91%	0.92%	0.91%	0.90%	0.89%
$obs_{G}(t+1)$	0.85%	0.73%	1.15%	0.87%	0.92%	0.89%	0.86%	0.86%
$obs_{I}(t+1)$	2.93%	1.93%	5.77%	3.03%	3.05%	3.05%	3.05%	3.05%
$obs_{P}(t+1)$	0.18%	0.16%	0.22%	0.20%	0.22%	0.21%	0.22%	0.21%
$obs_{R}(t+1)$	0.13%	0.10%	0.13%	0.12%	0.12%	0.12%	0.12%	0.12%
$obs_{STR}(t+1)$	8.61%	7.66%	8.78%	8.65%	8.67%	8.68%	8.66%	8.65%
$obs_{taxL}(t+1)$	0.71%	0.62%	0.68%	0.68%	0.68%	0.67%	0.68%	0.67%
$obs_{taxY}(t+1)$	0.25%	0.23%	0.38%	0.26%	0.25%	0.25%	0.24%	0.23%
$obs_{tr}(t+1)$	2.27%	2.03%	2.27%	2.39%	2.38%	2.37%	2.32%	2.29%
$obs_{WL}(t+1)$	0.82%	0.57%	2.35%	0.83%	0.78%	0.79%	0.76%	0.74%
$obs_{Y}(t+1)$	0.54%	0.47%	0.55%	0.57%	0.58%	0.58%	0.58%	0.58%
$obs_{PF}(t+1)$	0.09%	0.08%	0.45%	0.19%	0.09%	0.09%	0.09%	0.09%
$obs_{YF}(t+1)$	0.18%	0.14%	0.31%	0.23%	0.26%	0.26%	0.21%	0.21%
$obs_{CF}(t+1)$	0.17%	0.14%	0.45%	0.25%	0.26%	0.25%	0.25%	0.24%
$obs_{C}(t+2)$	0.62%	0.58%	1.09%	0.88%	0.85%	0.85%	0.84%	0.85%
$obs_{G}(t+2)$	0.87%	0.76%	1.36%	0.95%	1.06%	1.02%	0.91%	0.91%
$obs_{I}(t+2)$	3.06%	2.72%	3.88%	3.20%	3.21%	3.22%	3.20%	3.19%
$obs_{P}(t+2)$	0.19%	0.17%	0.40%	0.22%	0.24%	0.22%	0.24%	0.22%
$obs_{R}(t+2)$	0.21%	0.17%	0.23%	0.20%	0.20%	0.20%	0.20%	0.20%
$obs_{STR}(t+2)$	8.64%	8.27%	8.80%	8.68%	8.65%	8.65%	8.66%	8.66%
$obs_{taxL}(t+2)$	0.83%	0.66%	0.89%	0.82%	0.82%	0.81%	0.81%	0.79%
$obs_{taxY}(t+2)$	0.29%	0.27%	0.68%	0.35%	0.34%	0.33%	0.29%	0.28%
$obs_{tr}(t+2)$	2.35%	2.30%	2.43%	2.43%	2.42%	2.41%	2.36%	2.34%
$obs_{WL}(t+2)$	0.84%	0.73%	2.99%	0.87%	0.84%	0.84%	0.84%	0.82%
$obs_{Y}(t+2)$	0.57%	0.55%	0.68%	0.61%	0.61%	0.61%	0.61%	0.61%
$obs_{PF}(t+2)$	0.11%	0.10%	0.26%	0.20%	0.11%	0.11%	0.11%	0.11%
$obs_{YF}(t+2)$	0.22%	0.20%	0.26%	0.26%	0.27%	0.27%	0.26%	0.26%
$obs_{CF}(t+2)$	0.19%	0.17%	0.49%	0.25%	0.26%	0.25%	0.25%	0.25%
$obs_{C}(t+3)$	0.63%	0.59%	1.25%	0.97%	0.87%	0.87%	0.86%	0.86%
$obs_{G}(t+3)$	0.87%	0.77%	1.56%	0.98%	1.12%	1.07%	0.91%	0.91%
$obs_{I}(t+3)$	3.13%	2.93%	3.60%	3.20%	3.23%	3.22%	3.23%	3.21%
$obs_{P}(t+3)$	0.21%	0.19%	0.27%	0.23%	0.25%	0.23%	0.25%	0.23%
$obs_{R}(t+3)$	0.28%	0.22%	0.31%	0.27%	0.28%	0.28%	0.28%	0.28%
$obs_{STR}(t+3)$	8.67%	8.59%	8.75%	8.68%	8.67%	8.67%	8.68%	8.67%

$obs_{taxL}(t+3)$	1.00%	0.79%	1.24%	1.00%	1.01%	0.99%	0.98%	0.96%
$obs_{taxY}(t+3)$	0.35%	0.33%	1.03%	0.46%	0.45%	0.43%	0.35%	0.34%
$obs_{tr}(t+3)$	2.38%	2.32%	2.40%	2.43%	2.44%	2.44%	2.35%	2.35%
$obs_{WL}(t+3)$	0.86%	0.77%	1.13%	0.89%	0.85%	0.86%	0.86%	0.84%
$obs_{Y}(t+3)$	0.60%	0.56%	0.64%	0.62%	0.62%	0.62%	0.62%	0.61%
$obs_{PF}(t+3)$	0.13%	0.11%	0.28%	0.20%	0.14%	0.12%	0.14%	0.12%
$obs_{YF}(t+3)$	0.23%	0.22%	0.28%	0.27%	0.28%	0.27%	0.27%	0.27%
$obs_{CF}(t+3)$	0.20%	0.18%	0.53%	0.29%	0.30%	0.29%	0.30%	0.29%
$obs_{C}(t+4)$	0.65%	0.61%	1.28%	0.92%	0.83%	0.84%	0.83%	0.83%
$obs_{G}(t+4)$	0.88%	0.78%	1.75%	0.99%	1.16%	1.11%	0.91%	0.91%
$obs_{I}(t+4)$	3.14%	3.00%	3.39%	3.18%	3.21%	3.20%	3.21%	3.18%
$obs_{P}(t+4)$	0.22%	0.20%	0.30%	0.25%	0.27%	0.25%	0.27%	0.25%
$obs_{R}(t+4)$	0.35%	0.27%	0.39%	0.34%	0.34%	0.34%	0.34%	0.34%
$obs_{STR}(t+4)$	8.70%	8.62%	8.74%	8.69%	8.70%	8.69%	8.70%	8.69%
$obs_{taxL}(t+4)$	1.17%	0.89%	1.59%	1.19%	1.20%	1.17%	1.15%	1.12%
$obs_{taxY}(t+4)$	0.41%	0.38%	1.46%	0.60%	0.60%	0.58%	0.42%	0.40%
$obs_{tr}(t+4)$	2.39%	2.35%	2.55%	2.46%	2.46%	2.47%	2.37%	2.36%
$obs_{WL}(t+4)$	0.87%	0.79%	1.34%	0.91%	0.87%	0.87%	0.86%	0.85%
$obs_{Y}(t+4)$	0.60%	0.58%	0.64%	0.63%	0.62%	0.62%	0.62%	0.62%
$obs_{PF}(t+4)$	0.14%	0.12%	0.28%	0.22%	0.14%	0.13%	0.15%	0.13%
$obs_{YF}(t+4)$	0.24%	0.23%	0.27%	0.28%	0.28%	0.28%	0.28%	0.28%
$obs_{CF}(t+4)$	0.20%	0.19%	0.55%	0.30%	0.33%	0.32%	0.33%	0.32%
mean of RMSE	1.37%	1.26%	1.73%	1.44%	1.44%	1.43%	1.41%	1.40%
RMSE of RMSE	2.58%	2.44%	2.83%	2.61%	2.61%	2.61%	2.60%	2.60%
mean of RMSE ex expect.	1.70%	1.56%	2.10%	1.76%	1.77%	1.76%	1.74%	1.73%
RMSE of RMSE ex expect.	2.91%	2.75%	3.18%	2.94%	2.94%	2.94%	2.93%	2.93%
median of RMSE	0.60%	0.56%	0.90%	0.66%	0.65%	0.65%	0.65%	0.64%
median of RMSE ex expect.	0.83%	0.64%	1.25%	0.88%	0.85%	0.86%	0.85%	0.84%

TABLE A8. RMSE of out-of-sample forecasts of the models with dates approach

Variable-horizon	AR (1)	VAR (1)	RE DAWME	RE DAME	SNRE DAWME	SNRE DAME	WNRE DAWME	WNRE DAME
$obs_{C}(t+1)$	0.97%	0.88%	0.78%	0.78%	0.96%	0.96%	0.96%	0.95%
$obs_{G}(t+1)$	1.18%	1.16%	1.26%	1.11%	1.17%	1.11%	1.04%	1.01%
$obs_{I}(t+1)$	4.40%	3.28%	5.99%	4.28%	4.39%	4.45%	4.42%	4.37%
$obs_{P}(t+1)$	0.22%	0.23%	0.21%	0.24%	0.21%	0.20%	0.22%	0.21%
$obs_{R}(t+1)$	0.09%	0.17%	0.13%	0.10%	0.12%	0.11%	0.12%	0.12%
$obs_{STR}(t+1)$	12.64%	13.81%	11.66%	12.13%	12.50%	12.56%	12.53%	12.20%
$obs_{taxL}(t+1)$	0.79%	0.91%	0.83%	0.82%	0.81%	0.81%	0.77%	0.78%
$obs_{taxY}(t+1)$	0.47%	0.51%	0.56%	0.46%	0.48%	0.47%	0.43%	0.44%
$obs_{tr}(t+1)$	2.82%	2.82%	2.68%	3.05%	3.00%	3.02%	2.98%	2.83%
$obs_{WL}(t+1)$	1.44%	0.96%	2.65%	1.08%	1.13%	1.14%	1.06%	1.06%
$obs_{Y}(t+1)$	0.75%	0.84%	0.68%	0.80%	0.83%	0.83%	0.84%	0.84%
$obs_{PF}(t+1)$	0.09%	0.09%	0.41%	0.19%	0.09%	0.08%	0.08%	0.08%
$obs_{YF}(t+1)$	0.22%	0.22%	0.39%	0.31%	0.36%	0.36%	0.28%	0.28%
$obs_{CF}(t+1)$	0.18%	0.24%	0.46%	0.22%	0.24%	0.24%	0.24%	0.23%
$obs_{C}(t+2)$	1.10%	1.22%	0.97%	0.90%	0.92%	0.92%	0.94%	0.94%
$obs_{G}(t+2)$	1.32%	1.09%	1.96%	1.32%	1.45%	1.35%	1.15%	1.12%
$obs_{I}(t+2)$	5.00%	4.75%	5.39%	4.91%	5.04%	5.03%	4.98%	4.94%
$obs_{P}(t+2)$	0.25%	0.25%	0.43%	0.26%	0.25%	0.23%	0.26%	0.23%
$obs_{R}(t+2)$	0.15%	0.27%	0.25%	0.19%	0.21%	0.20%	0.20%	0.20%
$obs_{STR}(t+2)$	12.14%	14.67%	11.67%	12.15%	12.13%	12.12%	12.17%	12.07%

$obs_{taxL}(t+2)$	1.21%	1.25%	1.29%	1.19%	1.17%	1.17%	1.14%	1.15%
$obs_{taxY}(t+2)$	0.45%	0.55%	0.95%	0.56%	0.60%	0.58%	0.47%	0.48%
$obs_{tr}(t+2)$	2.73%	2.87%	2.91%	2.93%	2.80%	2.81%	2.70%	2.64%
$obs_{WL}(t+2)$	1.39%	1.41%	2.87%	1.33%	1.32%	1.31%	1.36%	1.33%
$obs_{Y}(t+2)$	0.86%	0.96%	0.93%	0.85%	0.87%	0.87%	0.87%	0.87%
$obs_{PF}(t+2)$	0.11%	0.11%	0.27%	0.21%	0.11%	0.09%	0.11%	0.10%
$obs_{YF}(t+2)$	0.32%	0.36%	0.41%	0.36%	0.39%	0.39%	0.37%	0.37%
$obs_{CF}(t+2)$	0.21%	0.25%	0.39%	0.25%	0.26%	0.26%	0.26%	0.26%
$obs_{C}(t+3)$	0.71%	0.85%	0.77%	0.60%	0.63%	0.63%	0.62%	0.62%
$obs_{G}(t+3)$	1.35%	1.05%	2.25%	1.39%	1.54%	1.43%	1.12%	1.10%
$obs_{I}(t+3)$	4.72%	5.75%	5.09%	4.59%	4.69%	4.66%	4.64%	4.60%
$obs_{P}(t+3)$	0.27%	0.28%	0.35%	0.31%	0.26%	0.25%	0.27%	0.25%
$obs_{R}(t+3)$	0.21%	0.36%	0.38%	0.27%	0.30%	0.29%	0.29%	0.29%
$obs_{STR}(t+3)$	8.83%	10.93%	8.63%	8.80%	8.75%	8.75%	8.35%	8.66%
$obs_{taxL}(t+3)$	1.45%	1.54%	1.73%	1.46%	1.44%	1.43%	1.40%	1.40%
$obs_{taxY}(t+3)$	0.48%	0.67%	1.41%	0.65%	0.71%	0.68%	0.48%	0.47%
$obs_{tr}(t+3)$	2.37%	2.76%	2.28%	2.36%	2.37%	2.40%	2.25%	2.22%
$obs_{WL}(t+3)$	1.44%	1.46%	1.37%	1.29%	1.35%	1.33%	1.39%	1.36%
$obs_{Y}(t+3)$	0.63%	0.95%	0.69%	0.61%	0.62%	0.62%	0.62%	0.62%
$obs_{PF}(t+3)$	0.14%	0.13%	0.29%	0.21%	0.13%	0.12%	0.14%	0.12%
$obs_{YF}(t+3)$	0.30%	0.39%	0.38%	0.33%	0.36%	0.36%	0.35%	0.34%
$obs_{CF}(t+3)$	0.20%	0.25%	0.40%	0.26%	0.25%	0.24%	0.26%	0.25%
$obs_{C}(t+4)$	0.52%	0.71%	0.71%	0.49%	0.49%	0.49%	0.48%	0.48%
$obs_{G}(t+4)$	1.34%	1.03%	2.53%	1.44%	1.66%	1.54%	1.09%	1.06%
$obs_{I}(t+4)$	3.56%	4.76%	3.75%	3.36%	3.44%	3.42%	3.38%	3.34%
$obs_{P}(t+4)$	0.28%	0.30%	0.39%	0.32%	0.28%	0.26%	0.28%	0.27%
$obs_{R}(t+4)$	0.26%	0.47%	0.49%	0.34%	0.37%	0.35%	0.36%	0.36%
$obs_{STR}(t+4)$	7.65%	9.36%	7.94%	7.68%	7.56%	7.57%	7.39%	7.47%
$obs_{taxL}(t+4)$	1.63%	1.86%	2.23%	1.66%	1.64%	1.62%	1.58%	1.57%
$obs_{taxY}(t+4)$	0.47%	0.71%	2.06%	0.86%	0.96%	0.91%	0.48%	0.48%
$obs_{tr}(t+4)$	2.42%	2.53%	2.67%	2.51%	2.40%	2.44%	2.25%	2.23%
$obs_{WL}(t+4)$	0.91%	0.99%	1.47%	0.95%	0.85%	0.86%	0.89%	0.88%
$obs_{Y}(t+4)$	0.41%	0.79%	0.51%	0.42%	0.43%	0.43%	0.43%	0.42%
$obs_{PF}(t+4)$	0.13%	0.11%	0.27%	0.20%	0.13%	0.11%	0.13%	0.11%
$obs_{YF}(t+4)$	0.20%	0.29%	0.25%	0.24%	0.27%	0.27%	0.26%	0.25%
$obs_{CF}(t+4)$	0.14%	0.22%	0.37%	0.24%	0.21%	0.21%	0.22%	0.22%
mean of RMSE	1.72%	1.92%	1.98%	1.73%	1.75%	1.74%	1.68%	1.67%
RMSE of RMSE	3.21%	3.69%	3.28%	3.17%	3.20%	3.20%	3.15%	3.13%
mean of RMSE ex expect.	2.14%	2.38%	2.43%	2.13%	2.16%	2.15%	2.08%	2.07%
RMSE of RMSE ex expect.	3.62%	4.16%	3.70%	3.57%	3.60%	3.61%	3.55%	3.53%
median of RMSE	0.73%	0.87%	0.88%	0.79%	0.82%	0.82%	0.70%	0.70%
median of RMSE ex expect.	1.14%	1.01%	1.39%	1.01%	1.04%	1.04%	1.00%	0.98%

TABLE A9. RMSE of in-sample forecasts of the models without observed expectations

Variable-horizon	AR (1)	VAR (1)	RE WE	SNRE WE	WNRE WE
$obs_{C}(t+1)$	0.59%	0.52%	0.66%	0.62%	0.61%
$obs_{G}(t+1)$	0.85%	0.76%	0.84%	0.80%	0.79%
$obs_{I}(t+1)$	2.93%	2.00%	2.87%	2.79%	2.80%
$obs_{P}(t+1)$	0.18%	0.16%	0.25%	0.19%	0.19%
$obs_{R}(t+1)$	0.13%	0.10%	0.13%	0.13%	0.13%
$obs_{STR}(t+1)$	8.61%	7.94%	8.64%	9.16%	8.62%
$obs_{taxL}(t+1)$	0.71%	0.63%	0.63%	0.63%	0.63%

$obs_{taxY}(t+1)$	0.25%	0.23%	0.24%	0.23%	0.23%
$obs_{tr}(t+1)$	2.27%	2.05%	2.24%	2.28%	2.27%
$obs_{WL}(t+1)$	0.82%	0.57%	0.86%	0.82%	0.81%
$obs_{Y}(t+1)$	0.54%	0.47%	0.69%	0.64%	0.63%
$obs_{C}(t+2)$	0.62%	0.59%	0.63%	0.61%	0.61%
$obs_{G}(t+2)$	0.87%	0.78%	0.82%	0.78%	0.79%
$obs_{I}(t+2)$	3.06%	2.70%	3.16%	3.14%	3.12%
$obs_{P}(t+2)$	0.19%	0.18%	0.26%	0.21%	0.20%
$obs_{R}(t+2)$	0.21%	0.16%	0.22%	0.21%	0.21%
$obs_{STR}(t+2)$	8.64%	8.28%	8.67%	8.64%	8.66%
$obs_{taxL}(t+2)$	0.83%	0.69%	0.72%	0.72%	0.72%
$obs_{taxY}(t+2)$	0.29%	0.27%	0.29%	0.28%	0.28%
$obs_{tr}(t+2)$	2.35%	2.30%	2.33%	2.34%	2.34%
$obs_{WL}(t+2)$	0.84%	0.74%	0.92%	0.86%	0.85%
$obs_{Y}(t+2)$	0.57%	0.55%	0.64%	0.63%	0.62%
$obs_{C}(t+3)$	0.63%	0.59%	0.69%	0.66%	0.66%
$obs_{G}(t+3)$	0.87%	0.78%	0.82%	0.78%	0.79%
$obs_{I}(t+3)$	3.13%	2.91%	3.21%	3.18%	3.17%
$obs_{P}(t+3)$	0.21%	0.19%	0.27%	0.23%	0.22%
$obs_{R}(t+3)$	0.28%	0.22%	0.31%	0.29%	0.29%
$obs_{STR}(t+3)$	8.67%	8.52%	8.69%	8.67%	8.67%
$obs_{taxL}(t+3)$	1.00%	0.82%	0.88%	0.89%	0.89%
$obs_{taxY}(t+3)$	0.35%	0.33%	0.35%	0.34%	0.34%
$obs_{tr}(t+3)$	2.38%	2.32%	2.32%	2.34%	2.34%
$obs_{WL}(t+3)$	0.86%	0.77%	0.91%	0.87%	0.87%
$obs_{Y}(t+3)$	0.60%	0.56%	0.64%	0.62%	0.61%
$obs_{C}(t+4)$	0.65%	0.61%	0.68%	0.65%	0.66%
$obs_{G}(t+4)$	0.88%	0.80%	0.82%	0.78%	0.79%
$obs_{I}(t+4)$	3.14%	2.98%	3.20%	3.16%	3.15%
$obs_{P}(t+4)$	0.22%	0.20%	0.29%	0.24%	0.24%
$obs_{R}(t+4)$	0.35%	0.27%	0.39%	0.36%	0.35%
$obs_{STR}(t+4)$	8.70%	8.57%	8.72%	8.69%	8.70%
$obs_{taxL}(t+4)$	1.17%	0.93%	1.05%	1.04%	1.04%
$obs_{taxY}(t+4)$	0.41%	0.38%	0.39%	0.38%	0.38%
$obs_{tr}(t+4)$	2.39%	2.35%	2.35%	2.36%	2.36%
$obs_{WL}(t+4)$	0.87%	0.79%	0.96%	0.90%	0.89%
$obs_{Y}(t+4)$	0.60%	0.58%	0.64%	0.62%	0.61%
mean of RMSE	1.70%	1.57%	1.71%	1.70%	1.68%
RMSE of RMSE	2.91%	2.77%	2.92%	2.94%	2.91%
median of RMSE	0.83%	0.66%	0.77%	0.75%	0.76%

TABLE A10. RMSE of out-of-sample forecasts of the models without observed expectations

Variable-horizon	AR (1)	VAR (1)	RE WE	SNRE WE	WNRE WE
$obs_{C}(t+1)$	0.97%	0.94%	1.07%	1.02%	1.03%
$obs_{G}(t+1)$	1.18%	1.20%	1.05%	0.95%	0.96%
$obs_{I}(t+1)$	4.40%	3.10%	4.36%	4.30%	4.33%
$obs_{P}(t+1)$	0.22%	0.24%	0.33%	0.23%	0.21%
$obs_{R}(t+1)$	0.09%	0.15%	0.14%	0.12%	0.12%
$obs_{STR}(t+1)$	12.64%	13.93%	12.14%	13.50%	12.14%
$obs_{taxL}(t+1)$	0.79%	0.84%	0.70%	0.75%	0.75%
$obs_{taxY}(t+1)$	0.47%	0.49%	0.42%	0.40%	0.42%
$obs_{tr}(t+1)$	2.82%	2.58%	2.65%	2.84%	2.88%
$obs_{WL}(t+1)$	1.44%	0.94%	1.28%	1.21%	1.16%
$obs_{Y}(t+1)$	0.75%	0.83%	1.10%	0.93%	0.94%
$obs_{C}(t+2)$	1.10%	1.15%	1.01%	0.99%	0.99%

$obs_G(t+2)$	1.32%	1.11%	1.01%	0.90%	0.94%
$obs_I(t+2)$	5.00%	4.61%	4.93%	4.86%	4.87%
$obs_P(t+2)$	0.25%	0.26%	0.36%	0.27%	0.25%
$obs_R(t+2)$	0.15%	0.26%	0.27%	0.20%	0.21%
$obs_{STR}(t+2)$	12.14%	14.56%	12.12%	12.05%	12.14%
$obs_{taxL}(t+2)$	1.21%	1.20%	0.91%	0.96%	0.95%
$obs_{taxY}(t+2)$	0.45%	0.54%	0.44%	0.43%	0.44%
$obs_{tr}(t+2)$	2.73%	2.81%	2.75%	2.83%	2.77%
$obs_{WL}(t+2)$	1.39%	1.40%	1.51%	1.38%	1.37%
$obs_Y(t+2)$	0.86%	0.95%	0.96%	0.89%	0.90%
$obs_C(t+3)$	0.71%	0.82%	0.69%	0.67%	0.68%
$obs_G(t+3)$	1.35%	1.05%	1.02%	0.91%	0.95%
$obs_I(t+3)$	4.72%	5.31%	4.66%	4.59%	4.60%
$obs_P(t+3)$	0.27%	0.28%	0.37%	0.31%	0.28%
$obs_R(t+3)$	0.21%	0.34%	0.40%	0.28%	0.29%
$obs_{STR}(t+3)$	8.83%	11.21%	8.72%	8.79%	8.96%
$obs_{taxL}(t+3)$	1.45%	1.51%	1.07%	1.13%	1.13%
$obs_{taxY}(t+3)$	0.48%	0.64%	0.49%	0.47%	0.48%
$obs_{tr}(t+3)$	2.37%	2.77%	2.13%	2.19%	2.17%
$obs_{WL}(t+3)$	1.44%	1.42%	1.44%	1.37%	1.39%
$obs_Y(t+3)$	0.63%	0.88%	0.69%	0.62%	0.63%
$obs_C(t+4)$	0.52%	0.62%	0.50%	0.51%	0.52%
$obs_G(t+4)$	1.34%	1.04%	1.01%	0.87%	0.91%
$obs_I(t+4)$	3.56%	4.56%	3.40%	3.31%	3.31%
$obs_P(t+4)$	0.28%	0.29%	0.38%	0.31%	0.30%
$obs_R(t+4)$	0.26%	0.44%	0.51%	0.35%	0.36%
$obs_{STR}(t+4)$	7.65%	9.73%	7.59%	7.67%	7.86%
$obs_{taxL}(t+4)$	1.63%	1.80%	1.22%	1.28%	1.29%
$obs_{taxY}(t+4)$	0.47%	0.69%	0.48%	0.46%	0.46%
$obs_{tr}(t+4)$	2.42%	2.64%	2.23%	2.30%	2.27%
$obs_{WL}(t+4)$	0.91%	0.96%	1.05%	0.95%	0.91%
$obs_Y(t+4)$	0.41%	0.74%	0.46%	0.42%	0.42%
mean of RMSE	2.14%	2.36%	2.09%	2.09%	2.07%
RMSE of RMSE	3.62%	4.16%	3.54%	3.64%	3.56%
median of RMSE	1.14%	1.00%	1.02%	0.94%	0.94%