A Online appendix (Not for publication)

A Technology choice

The following section provides some economic intuition for the reduced-form formulation of technology choice, which we borrow from Cochrane (1993), in our economy. Suppose that the central planner can choose to invest in a complete set of different technologies as in Jermann (2010). With a complete set we mean that there are as many independent technologies, indexed by $i = [1, \ldots, I]$, as there are states of nature denoted by $s = [1, \ldots, S]$. The productivity of a technology i is denoted by $\Theta_i(s)$ for state s. Without loss of generality, let also $\Theta_1(s)$ be the productivity next period for the exogenous benchmark technology which is log-normally distributed,

$$\log \Theta_1 = \mu + \epsilon, \tag{A1}$$

where $\epsilon \sim N(0, \sigma^2)$. Define

$$\vartheta_i(s) = \frac{\Theta_i(s)}{\Theta_1(s)}, \forall i = 1, ..., I,$$

where by definition $\vartheta_1(s) = 1$.

Each technology produces the same good and the production of a technology i is given by

$$Y_i(s) = K_i^{\alpha} \Theta_i(s)^{1-\alpha},$$

where K_i is the capital invested in technology i at the beginning of the current period. The central planner has a total of K capital to allocate over the set of technologies. Let w_i be the fraction invested in technology i, i.e.,

$$w_i = \frac{K_i}{K}.$$

Then, total production can be expressed as follows:

$$Y = K^{\alpha} \Theta_1^{1-\alpha} \sum_{i=1}^{I} w_i^{\alpha} \vartheta_i(s)^{1-\alpha}.$$

Let us now define

$$T(\mathbf{w}, s) = \sum_{i=1}^{I} w_i^{\alpha} \vartheta_i(s)^{1-\alpha} \qquad \text{and} \qquad \Omega(s) = \Theta_1(s) T(\mathbf{w}, s)^{1/1-\alpha}.$$

Then, aggregate output can be rewritten as

$$Y = K^{\alpha}\Omega^{1-\alpha},$$

where Ω becomes the endogenously chosen productivity or technology next period through the choice of the portfolio of technologies $\mathbf{w} = [w_1, \ldots, w_I]$. Since, the production technology market is complete, instead of choosing $\mathbf{w}$ the social planner can directly choose Ω (or T) in all future states given, of course, the joint productivity distribution of the technologies. Instead of specifying, however, the joint productivity distribution of the available technologies, we adopt the reduced-form assumption by which we can choose T given the constraint

$$\mathbb{E}\left[T^{\nu}\right] \leq 1, \tag{A2}$$

for some constant ν. This implies that the endogenously chosen productivity Ω can have any conditional distribution as long as (A2) holds. Since we log-linearize the economy, the endogenous productivity next period Ω can be expressed as

$$\log \Omega = \log X + \sigma_{\omega}\epsilon + \sigma_u u, \tag{A3}$$

where $u \sim N(0, 1)$ is an innovation to productivity orthogonal to ϵ. The central planner can therefore choose, σ_{ω}, σ_u and X according to a certain objective and subject to the constraint (A3). Choosing $\sigma_{\omega} = 1$, $\sigma_u = 0$ and $\log X = \mu$ ensures that $\Omega = \Theta$.

To understand the role of the parameter ν, we can derive the optimal choice for σ_{ω}, σ_u, and $\log X$ from maximizing average production next period, which is given by

$$\mathbb{E}\left[\Omega^{1-\alpha}\right] = X^{1-\alpha}\exp\left[\frac{1}{2}(1-\alpha)^2(\sigma^2\sigma_{\omega}^2 + \sigma_u^2)\right].$$

Then, we can investigate the cost to average production from deviating from such a choice. Note, first, that the productivity choice constraint (A2) implies that

$$X^{1-\alpha} \leq \exp\left\{(1-\alpha)\mu - \frac{1}{2}\nu(1-\alpha)^2\left[(\sigma_{\omega}-1)^2 + \sigma_u^2\right]\right\}.$$

Assuming, therefore, that the above constraint is binding at the optimum, we have that the average productivity next period is given by

$$\mathbb{E}\left[\Omega^{1-\alpha}\right] = \exp\left\{(1-\alpha)\mu + \frac{1}{2}(1-\alpha)^2\left[\sigma_{\omega}^2\sigma^2 - \nu(\sigma_{\omega}-1)^2\sigma^2 + (1-\nu)\sigma_u^2\right]\right\}.$$

Maximizing next period's average production would then mean that

$$\max_{\sigma_\omega, \sigma_u} \qquad \sigma_\omega^2 \sigma^2 - \nu(\sigma_\omega - 1)^2 \sigma^2 + (1-\nu)\sigma_u^2.$$

Given this maximization problem, if ν is less than one then letting σ_u and/or σ_ω tend to infinity is the optimal decision. For this reason, we restrict to cases where $\nu > 1$ in which case the optimal solution is $\sigma_u^* = 0$ and

$$\sigma_\omega^* = \frac{\nu}{\nu - 1},$$

that maximizes average production next period. If any other exposure $\sigma_\omega = \sigma_\omega^* - \Delta$ is chosen, then the cost to the average production is proportional to $(\nu - 1)\Delta^2$. Therefore, the larger the parameter ν is, the larger is the cost to average production from a deviation Δ from the growth optimal choice. When $\nu \to \infty$, then it becomes infinitely costly to deviate from the exogenous benchmark productivity and $\sigma_\omega^* \to 1$.

B Loglinearization

B.1 Equilibrium conditions

With a slight abuse of notation, all variables below are normalized by the time-trend, in the main text denoted as $\widetilde{X}$, for $X \in \{\Theta, K, \Omega, Y, C, I, U\}$, except γ_t and $M_{t,t+1}$. The equilibrium conditions for recursive preferences with technology choice, in addition to the and for a general law of motion for γ_t, are summarized as follows:

$$\log \Theta_{t+1} = \phi \log \Theta_t + \epsilon_{t+1}, \tag{B4}$$

$$1 = \mathbb{E}_t \left[\frac{\Omega_{t+1}^{(1-\alpha)\nu}}{\Theta_{t+1}^{(1-\alpha)\nu}} \right], \tag{B5}$$

$$M_{t,t+1} = \beta e^{-\mu/\psi} \left[\frac{C_{t+1}}{C_t} \right]^{-\frac{1}{\psi}} \left[\frac{U_{t+1}^{1-\gamma_t}}{\mathbb{E}_t \left(U_{t+1}^{1-\gamma_t} \right)} \right]^{\frac{\frac{1}{\psi} - \gamma_t}{1-\gamma_t}}, \tag{B6}$$

$$Y_t = K_t^\alpha \Omega_t^{1-\alpha}, \tag{B7}$$

$$Y_t = C_t + I_t, \tag{B8}$$

$$K_{t+1} = (1-\delta) e^{-\mu} K_t + \left[\frac{a_1}{1 - 1/\chi} \left(\frac{I_t}{K_t} \right)^{1-1/\chi} + a_2 \right] K_t e^{-\mu}, \tag{B9}$$

$$\left(\frac{I_t}{K_t}\right)^{1/\chi} = \mathbb{E}_t\left\{M_{t,t+1}\left[\alpha a_1\frac{Y_{t+1}}{K_{t+1}} + (1-\delta+a_2)\left(\frac{I_{t+1}}{K_{t+1}}\right)^{1/\chi} + \frac{a_1}{\chi-1}\frac{I_{t+1}}{K_{t+1}}\right]\right\}, \quad \text{(B10)}$$

$$\Omega_{t+1}^{(1-\alpha)\nu} = \frac{\left(M_{t,t+1}\Theta_{t+1}^{1-\alpha}\right)^{\frac{\nu}{\nu-1}}}{\mathbb{E}_t\left[\left(M_{t,t+1}\Theta_{t+1}^{1-\alpha}\right)^{\frac{\nu}{\nu-1}}\right]}\Theta_{t+1}^{(1-\alpha)\nu}, \quad \text{(B11)}$$

$$U_t = \left\{(1-\beta)\,C_t^{1-1/\psi} + \beta e^{\mu(1-\gamma_t)/\theta}\mathbb{E}_t\left[U_{t+1}^{1-\gamma_t}\right]^{\frac{1-1/\psi}{1-\gamma_t}}\right\}^{\frac{1}{1-1/\psi}}. \quad \text{(B12)}$$

Condition (B5) is redundant, since it is implied by condition (B11). Therefore, we have 8 first-order conditions that determine the dynamics of the 8 variables Θ, Ω, Y, C, I, K, U and M.

The key variables in the deterministic steady-state of the economy are described by

$$\begin{aligned}
\Theta &= \Omega = 1,\\
Y &= K^{\alpha},\\
K &= \left[\frac{e^{\mu/\psi} - \beta(1-\delta)}{\alpha\beta}\right]^{\frac{1}{\alpha-1}},\\
C &= Y - I,\\
I &= (e^{\mu} - 1 + \delta)K,\\
U &= C\left[\frac{1-\beta}{1-\beta e^{\mu(1-1/\psi)}}\right]^{\frac{1}{1-1/\psi}},\\
M &= \beta e^{-\mu/\psi}.
\end{aligned}$$

Therefore, the deterministic steady-state is independent of risk aversion parameter γ and the technology choice curvature ν.

B.2 Log-linearization: Recursive preferences with technology choice

By convention, the percentage deviation of variable X_t from its detrended steady-state value (X) is defined as $x_t = logX_t - logX$. For example, the exogenous technology shock process can be rewritten as $\theta_t = \phi\,\theta_{t-1} + \epsilon_t$ where $\epsilon \sim \mathbb{N}(0, \sigma^2)$. The log-linearization is derived assuming that risk aversion is (partially) independent of the rest of the state variables. Thus, the log-linearized model depends on θ_t, k_t, ω_t and γ_t.

The percentage deviations of output, consumption, investment, and utility can be summarized as follows

$$x_t = x_k k_t + x_\omega \omega_t + x_\theta \theta_t + x_\gamma(\gamma_t - \gamma) \quad \text{(B13)}$$

where $x \in \{y, c, i, u\}$ and γ is the steady-state value of the risk aversion parameter. The coefficients y_k, y_ω, y_θ, y_γ, c_k, c_ω, c_θ, c_γ, i_k, i_ω, i_θ, i_γ, u_k, u_ω, u_θ, and u_γ are coefficients to be determined.

We first show that x_γ is zero for all variables $x \in \{y, c, i, u\}$. Note that γ_t appears only in (B10), through (B6), and in (B12). We re-write (B12) as follows

$$U_t^{1-1/\psi} = (1-\beta)\, C_t^{1-1/\psi} + \beta e^{\mu(1-1/\psi)} R_{u,t}^{1-1/\psi} \tag{B14}$$

where

$$R_{u,t} = \mathbb{E}_t \left[U_{t+1}^{1-\gamma_t} \right]^{\frac{1}{1-\gamma_t}}. \tag{B15}$$

Log-linearizing (B14) and (B15) yields

$$u_t = (1 - \beta e^{\mu(1-1/\psi)}) c_t + \beta e^{\mu(1-1/\psi)} r_{u,t}, \tag{B16}$$

$$r_{u,t} = E_t(u_{t+1}). \tag{B17}$$

The above implies that c_γ and u_γ are zero. Using R_u to log-linearize (B6), we obtain

$$m_{t+1} = -\frac{1}{\psi}(c_{t+1} - c_t) + \left(\frac{1}{\psi} - \gamma_t\right) \left[u_{t+1} - \mathbb{E}_t(u_{t+1})\right], \tag{B18}$$

which implies that the first conditional moment of m_{t+1} is independent of γ_t. Finally, log-linearizing (B10), in which only the conditional expectation of m_{t+1} appears, implies that i_γ, κ_γ, and y_γ are zero. The exogenous productivity is by assumption independent of γ_t and the only variable that depends on risk aversion is the endogenous productivity ω_t.

Log-linearizing condition (B5) implies that the conditional expectation of ω_{t+1} is the same as that of θ_{t+1}. Thus, from (B4) we obtain that

$$\omega_{t+1} = \phi \theta_t + \sigma_\omega(\gamma_t) \epsilon_{t+1}. \tag{B19}$$

Matching the coefficients of ϵ_{t+1} in (B11), for which we use (B4) and (B6), and solving for $\sigma_\omega(\gamma_t)$ we obtain the optimal technology choice,

$$\sigma_\omega(\gamma_t) \;=\; \frac{(1-\alpha)\nu - \frac{1}{\psi} c_\theta + (\frac{1}{\psi} - \gamma_t) u_\theta}{(1-\alpha)(\nu - 1) + \frac{1}{\psi} c_\omega + (\gamma_t - \frac{1}{\psi}) u_\omega}. \tag{B20}$$

Log-linearizing the equilibrium conditions yields the remaining coefficients. For example, c_k

is the positive root from the following quadratic equation

$$0 = B\Big[\frac{\alpha(C+I)k_2}{I} + k_1\Big] - \frac{\alpha(C+I) - I}{\chi I} - \Big(\frac{Bk_2C}{I} - \frac{1}{\psi} - \frac{C}{\chi I}\Big)c_k, \tag{B21}$$

where

$$B = \frac{\alpha K^{\alpha-1}(\alpha-1)}{\alpha K^{\alpha-1}+1-\delta} - \frac{c_k}{\psi} + \frac{1}{\chi(\alpha K^{\alpha-1}+1-\delta)}\left[\frac{\alpha(C+I)}{I} - \frac{C}{I}c_k - 1\right], \tag{B22}$$

$$k_1 = \frac{1-\delta}{e^{\mu}}, \tag{B23}$$

$$k_2 = \frac{e^{\mu}-1+\delta}{e^{\mu}}. \tag{B24}$$

The other coefficients are given by:

$$c_\omega = \frac{\frac{(\alpha-1)(C+I)}{\chi I} + B\frac{k_2}{I}(1-\alpha)(C+I)}{Bk_2\frac{C}{I} - \frac{1}{\psi} - \frac{C}{\chi I}}, \tag{B25}$$

$$c_\theta = \frac{\phi\left\{\frac{\alpha K^{\alpha-1}(1-\alpha)}{\alpha K^{\alpha-1}+1-\delta} - \frac{c_\omega}{\psi} + \frac{1}{\chi(\alpha K^{\alpha-1}+1-\delta)}\left[\frac{(1-\alpha)(C+I)}{I} - \frac{C}{I}c_\omega\right]\right\}}{\phi\left(\frac{1}{\psi} + \frac{C}{(\alpha K^{\alpha-1}+1-\delta)\chi I}\right) + \frac{Bk_2C}{I} - \frac{1}{\psi} - \frac{C}{\chi I}}, \tag{B26}$$

$$i_k = \frac{\alpha(C+I)}{I} - \frac{C}{I}c_k, \tag{B27}$$

$$i_\omega = \frac{(1-\alpha)(C+I)}{I} - \frac{C}{I}c_\omega, \tag{B28}$$

$$i_\theta = -\frac{C}{I}c_\theta, \tag{B29}$$

$$u_k = \frac{u_1c_k}{1-u_2k_1-u_2k_2i_k}, \tag{B30}$$

$$u_\omega = u_1c_\omega + u_2k_2u_ki_\omega, \tag{B31}$$

$$u_\theta = \frac{u_1c_\theta + u_2k_2u_ki_\theta + \phi u_2u_\omega}{1-\phi u_2}, \tag{B32}$$

where

$$u_1 = 1-\beta e^{\mu(1-\frac{1}{\psi})}, \tag{B33}$$

$$u_2 = \beta e^{\mu(1-\frac{1}{\psi})}. \tag{B34}$$

As for output, the coefficients are given by $y_\kappa = \alpha$, $y_\omega = (1-\alpha)$, and $y_\theta = 0$.

From the above equations, we see that coefficients u_k, u_ω, u_θ, c_k, c_ω, c_θ, i_k, i_ω, i_θ are dependent on EIS (ψ) but independent of the risk aversion (γ_t) and technology choice curvature (ν). Moreover, from equation (B20), $\sigma_\omega(\gamma_t)$ depends on risk aversion and technology choice curvature (ν). Thus, in a standard RBC economy without technology choice, macroeconomic quantities are not risk aversion sensitive. Introducing technology choice makes macroeconomic quantities sensitive to the risk aversion. Proposition 1 concludes the above subsection.

C Stock prices and the risk-free rate

The stochastic discount factor, M, which is given in (B6), is log-normally distributed. As shown in Proposition 3 it can be expressed in the following form:

$$\log M_{t,t+1} = \log \hat{\beta}(\gamma_t) - \frac{1}{\psi}\mu_t - \sigma_m(\gamma_t)\,\epsilon_{t+1}.$$

The risk-free rate is determined via

$$r_{f,t} = -\log \mathbb{E}_t(M_{t,t+1}), \tag{C35}$$

which yields the expression provided in Proposition 4.

The Euler equation of the stock is given as follows

$$e^{p_t - d_t} = \mathbb{E}_t\left[J_{t,t+1}\left(e^{p_{t+1}-d_{t+1}} + 1\right)\right], \tag{C36}$$

where $J_{t,t+1} = M_{t,t+1}D_{t+1}/D_t$ and, thus,

$$\ln J_{t,t+1} = \ln \hat{\beta}(\gamma_t) - \frac{1}{\psi}\mu_t + \sigma_m(\gamma_t)\epsilon_{t+1} + \mu + d_1(\theta_t - c_t) + d_2\epsilon_{t+1} + d_3\epsilon^d_{t+1}. \tag{C37}$$

The log of the price-dividend ratio is approximated to be linear in the (demeaned) state vector z_t, which includes deviations of risk aversion γ_t from its steady state. Therefore,

$$p_t - d_t \approx \overline{p-d} + b\,z_t, \tag{C38}$$

where $\overline{p-d}$ is the average log price-dividend ratio. To derive approximate dynamics we assume that risk aversion follows an AR(1) process around a steady state γ, driven by ϵ_{t+1} and/or an idiosyncratic shock ϵ^{γ}_{t+1}. Consequently,

$$z_{t+1} = Z\,z_t + \Sigma_z(\gamma_t)\,\epsilon_{t+1} + \Sigma_\gamma\,\epsilon^{\gamma}_{t+1}. \tag{C39}$$

When $z_t = 0$, then $p_{t+1} - d_{t+1} = \overline{p-d} + b\Sigma_z(\gamma)\epsilon_{t+1} + b\Sigma_\gamma\epsilon^{\gamma}_{t+1}$. Solving the Euler equation when the state is $z_t = 0$, we obtain the following:

$$e^{\overline{p-d}} = \hat{J}e^{\overline{p-d}} + J, \tag{C40}$$

where

$$\log\ J = \log \hat{\beta}(\gamma) + \left(1 - \frac{1}{\psi}\right)\mu + \frac{1}{2}\left\{d_3^2 + \sigma^2\left[d_2 - \sigma_m(\gamma)\right]^2\right\}, \tag{C41}$$

$$\log\ \hat{J} = \log\ J + \left[d_2 - \sigma_m(\gamma)\right]\ b\Sigma_z(\gamma) + \frac{1}{2}(b\Sigma_\gamma)^2 + \frac{1}{2}\left[b\Sigma_z(\gamma)\right]^2, \tag{C42}$$

and, therefore, $\overline{p-d} = \log\left(J/(1-\hat{J})\right)$. Solving the Euler equation for a general state and applying a first-order approximation, we obtain the following:

$$(p_t - d_t) - \overline{p-d} \approx \hat{J}\,\mathbb{E}_t\left[(p_{t+1} - d_{t+1}) - \overline{p-d}\right] + \xi_t, \tag{C43}$$

where

$$\xi_t = d_1(\theta_t - c_t) - \frac{1}{\psi}(\mu_t - \mu) + \left[\xi_1(\gamma)(\gamma_t - \gamma) + \frac{1}{2}\xi_2(\gamma)(\gamma_t - \gamma)^2\right]\sigma^2, \tag{C44}$$

$$\xi_1(\gamma) = \left(1 - \frac{1}{\psi}\right)\left[\frac{1}{2}\sigma_u^2 + \sigma_u'\sigma_u\left(\gamma - \frac{1}{\psi}\right)\right] - d_2\sigma_m' + \frac{1}{\psi}\left[\sigma_c'\sigma_m + \sigma_c\sigma_m'\right] \tag{C45}$$

$$+\ \hat{J}\left[\frac{\partial(b\Sigma_z)}{\partial\gamma}(d_2 - \sigma_m + b\Sigma_z) - b\Sigma_z\sigma_m'\right], \tag{C46}$$

$$\xi_2(\gamma) = \left[\sigma_m' + \frac{\partial(b\Sigma_z)}{\partial\gamma}\right]^2. \tag{C47}$$

In the above expressions, σ_x refers to $\sigma_x(\gamma)$ and σ_x' refers to the first derivative of $\sigma_x(\gamma)$ with respect to γ, for some variable x. Solving forward the above equation, we obtain the following expression:

$$p_t - d_t \approx \overline{p-d} + \sum_{\tau=0}^{\infty}\hat{J}^\tau\mathbb{E}_t\xi_{t+\tau}. \tag{C48}$$

We can provide similar expressions for the consumption claim.

D Data

We collect macroeconomic variables from the NIPA tables over the period 1929 to 2017. Output series are taken to be the total output reported, the consumption series is the consumption of non-durables and services, and the investment series is the non-residential fixed investments. All macroeconomic variables are deflated by realized average inflation computed from the CPI index of the Bureau of Labor Statistics and normalized by the population size reported in the NIPA Table 2.1.

For the calibration we use the annual data. For predictive regression based on macroeconomic variables, we use quarterly data starting in 1947.

We use quarterly CRSP value-weighted returns as the market return and the Fama 3-month T-bill rate as the risk-free rate from WRDS from 1927 to 2017. Real returns equal nominal returns deflated by realized average inflation. The price-dividend ratio is inferred from the CRSP value-weighted returns with and without dividends.

E Additional tables

Table 7: Calibrated model parameters - low EIS

TCV is the model with technology choice and time-varying risk aversion, NTCV is the model without technology choice but with time-varying risk aversion, TCC is an economy with technology choice and constant risk aversion, and NTCC is the no technology choice and constant risk aversion benchmark. For all economies with low EIS, we set the time discount factor to just below 1 and use the EIS to match the mean of the risk-free rate.

Description	Parameter	Values			
		TCV	NTCV	TCC	NTCC
Subjective discount factor	β	0.9999	0.9999	0.9999	0.9999
(Mean) coefficient of relative risk aversion	γ	50	50	50	40
Elasticity of intertemporal substitution	ψ	0.60	0.60	0.53	0.48
Capital adjustment cost parameter	χ	6.4	6.9	6.9	7.0
Technology choice parameter	ν	11.1	∞	12.7	∞
Volatility of exogenous productivity shocks	σ	4.87%	4.73%	4.95%	4.73%
CRRA function λ linear coefficient	η_1	120	120	-	-
CRRA function λ quadratic coefficient	η_2	70.0	70.1	-	-
		Averages across simulations			
Mean CRRA		52.8	52.7		
Standard deviation of CRRA		21.3	20.7		
Minimum CRRA		12.1	12.9		
Maximum CRRA		114.7	112.8		

Table 8: Calibrated models: Low EIS

Δx denotes the first-difference of the natural logarithm of a variable X. y denotes (the natural logarithm of) total output; c denotes total consumption; i denotes total investment. For a variable x, $\sigma(x)$ denotes its volatility; $ac_1(x)$ is its first-order autocorrelation and $\rho(x,z)$ is its correlation with variable z. The data are described in Online appendix D. The parentheses next to the data estimates show the standard errors ($s.e.$), which are Newey and West (1987) corrected with 24 lags. TCV is the model with technology choice and time-varying risk aversion, NTCV is the model without technology choice but with time-varying risk aversion, TCC is an economy with technology choice and constant risk aversion, and NTCC is the no technology choice and constant risk aversion benchmark. The model statistics are averages of 1000 simulated paths of 300 quarters with a burn-in of 100 quarters. The parentheses next to the model statistics show the t-statistics ($t-st$) of the hypotheses that the data estimates are generated from model averages. Macroeconomic data are annual: $1929-2017$. The corresponding data from the models are time-aggregated. Price data are quarterly: $1927-2017$.

	Data		TCV		NTCV		TCC		NTCC	
	est.	*s.e.*	*avg.*	$t-st$	*avg.*	$t-st$	*avg.*	$t-st$	*avg.*	$t-st$
$\mu(\Delta c)$	1.74	(0.38)	1.60	(0.36)	1.60	(0.36)	1.60	(0.36)	1.60	(0.36)
$\sigma(\Delta c)$	2.70	(0.54)	2.70	(0.00)	2.70	(0.01)	2.70	(0.00)	2.70	(0.00)
$ac_1(\Delta c)$	0.48	(0.07)	0.29	(2.62)	0.27	(2.91)	0.30	(2.59)	0.27	(3.00)
$\sigma(\Delta c)/\sigma(\Delta y)$	0.55	(0.06)	0.55	(0.09)	0.55	(0.00)	0.55	(0.00)	0.55	(0.01)
$\sigma(\Delta i)/\sigma(\Delta y)$	2.71	(0.14)	1.97	(5.34)	1.97	(5.30)	2.03	(4.92)	2.06	(4.70)
$ac_1(\Delta y)$	0.53	(0.09)	0.22	(3.58)	0.19	(3.83)	0.23	(3.46)	0.20	(3.81)
$ac_1(\Delta i)$	0.41	(0.15)	0.17	(1.61)	0.16	(1.68)	0.19	(1.53)	0.17	(1.66)
$\mu(R_f)$	0.14	(0.15)	0.35	(1.34)	0.16	(0.14)	0.27	(0.82)	0.16	(0.10)
$\sigma(R_f)$	0.84	(0.10)	0.86	(0.18)	0.27	(5.57)	0.83	(0.04)	0.21	(6.19)
$\mu(R_i-R_f)$			0.12		0.25		0.45		0.65	
$\sigma(R_i)$			1.31		1.28		1.95		2.67	
SR_i			0.12		0.20		0.26		0.24	
$\sigma(\Delta d)$	11.10	(2.12)	11.47	(0.18)	11.34	(0.12)	11.54	(0.21)	11.35	(0.12)
$ac_1(\Delta d)$	0.18	(0.14)	0.27	(0.63)	0.27	(0.61)	0.27	(0.65)	0.27	(0.62)
$\rho(\Delta c, \Delta d)$	0.52	(0.15)	0.55	(0.20)	0.53	(0.11)	0.56	(0.25)	0.53	(0.11)
$\mu(p-d)$	4.79	(0.10)	4.41	(3.61)	4.49	(2.89)	4.67	(1.16)	4.75	(0.38)
$\sigma(p-d)$	0.44	(0.05)	0.20	(4.52)	0.18	(4.80)	0.08	(6.66)	0.08	(6.63)
$\rho(p-d, r_f)$	0.03	(0.17)	0.32	(1.69)	0.86	(4.90)	0.32	(1.71)	0.45	(2.45)
$\mu(R_m-R_f)$	2.04	(0.39)	1.85	(0.48)	1.95	(0.23)	1.39	(1.64)	1.46	(1.48)
$\sigma(R_m)$	11.16	(2.21)	10.65	(0.23)	10.73	(0.19)	8.01	(1.43)	8.34	(1.28)
SR_m	0.18	(0.05)	0.17	(0.18)	0.18	(0.03)	0.18	(0.15)	0.18	(0.16)

Table 9: Excess return predictability by $p - d$: Low EIS

The table shows the standardized regression coefficient on the log price-dividend ratio from a standard predictive regression using the stock market excess return for horizons from one quarter to 28 quarters. The data are described in Online appendix D. The t-statistics ($t - st$) for the data are for the null hypothesis that the regression coefficients are zero. Standard errors are Newey and West (1987) corrected with 24 lags. TCV is the model with technology choice and time-varying risk aversion, NTCV is the model without technology choice but with time-varying risk aversion, TCC is an economy with technology choice and constant risk aversion, and NTCC is the no technology choice and constant risk aversion benchmark. The model statistics are averages of 1000 simulated paths of 300 quarters with a burn-in of 100 quarters. The parentheses below the regression coefficients for the models show the t-statistics ($t - st$) of the hypotheses that the data estimates are generated from model averages. The data are quarterly: $1947 - 2017$.

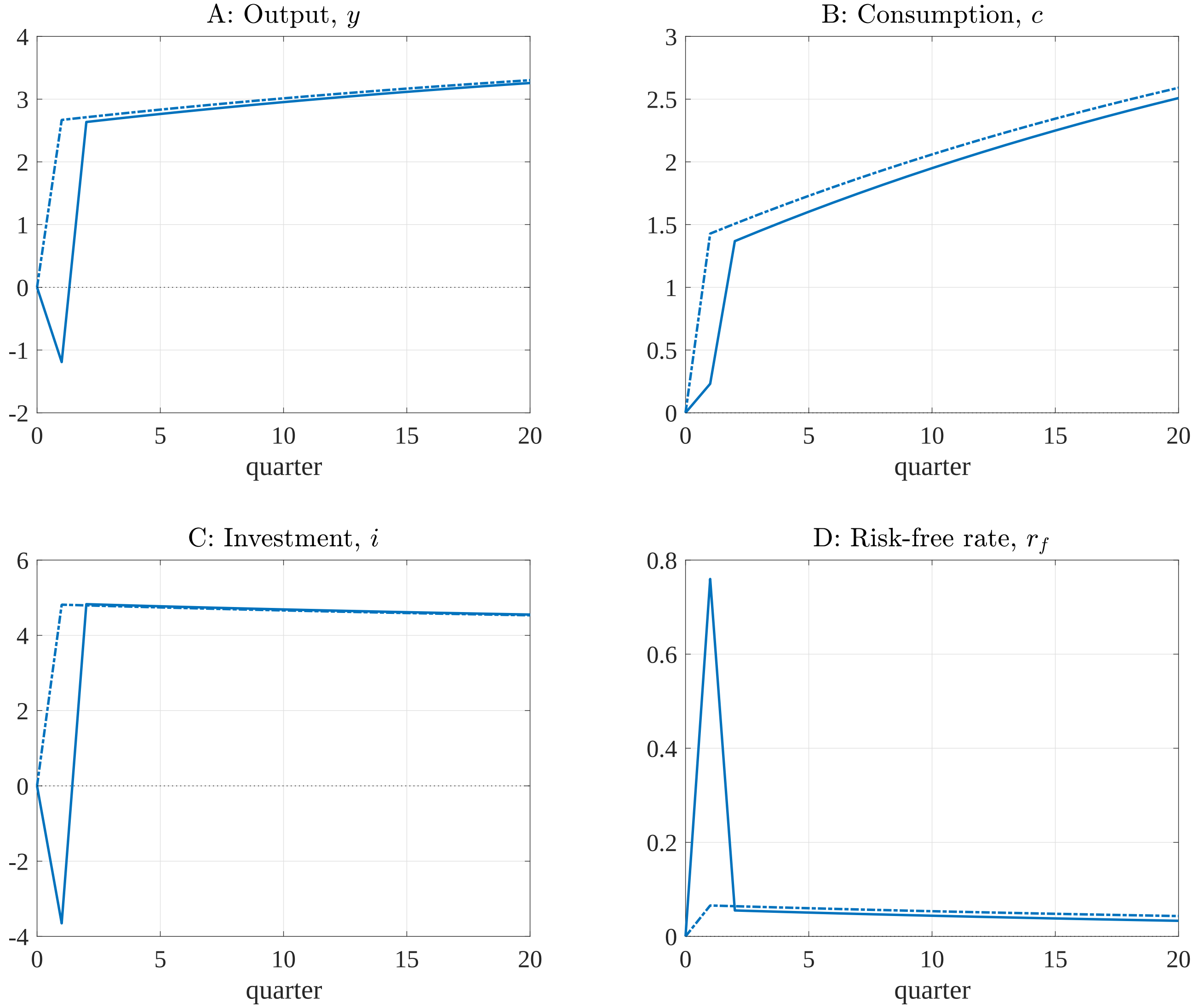
	$\rho(p - d_t, \sum_{s=1}^{\tau}[R_{m,t+s} - R_{f,t+s-1}])$								
	$\tau = 1$	$\tau = 2$	$\tau = 4$	$\tau = 8$	$\tau = 12$	$\tau = 16$	$\tau = 20$	$\tau = 24$	$\tau = 28$
Data	-0.13	-0.19	-0.26	-0.35	-0.39	-0.42	-0.47	-0.50	-0.53
$t - st$	(3.03)	(3.33)	(3.34)	(3.23)	(2.97)	(2.81)	(3.20)	(3.52)	(3.75)
TCV	-0.08	-0.11	-0.15	-0.21	-0.24	-0.27	-0.29	-0.31	-0.32
$t - st$	(1.20)	(1.37)	(1.36)	(1.28)	(1.13)	(1.01)	(1.21)	(1.37)	(1.49)
NTCV	-0.09	-0.12	-0.17	-0.23	-0.26	-0.29	-0.31	-0.33	-0.34
$t - st$	(1.04)	(1.20)	(1.19)	(1.11)	(0.97)	(0.86)	(1.05)	(1.20)	(1.31)
TCC	-0.01	-0.02	-0.02	-0.03	-0.04	-0.04	-0.05	-0.05	-0.05
$t - st$	(2.74)	(3.02)	(3.04)	(2.93)	(2.68)	(2.53)	(2.88)	(3.17)	(3.37)
NTCC	-0.01	-0.02	-0.03	-0.04	-0.05	-0.05	-0.06	-0.06	-0.06
$t - st$	(2.67)	(2.95)	(2.97)	(2.86)	(2.62)	(2.46)	(2.81)	(3.08)	(3.28)

Table 10: Excess return predictability by σ_i - High EIS

The table shows the standardized regression coefficient on the conditional volatility of investment from a standard predictive regression using the stock market excess return for horizons from one quarter to 28 quarters. The data are described in Online appendix D. The t-statistics ($t-st$) for the data are for the null hypothesis that the regression coefficients are zero. Standard errors are Newey and West (1987) corrected with 24 lags. The conditional volatility series of investment both in the data and for the models are obtained by fitting an ARMA(1,1)-EGARCH(1,1) in Panel A and ARMA(2,2)-EGARCH(1,1) in Panel B, to each growth rate series. We constrain the estimation for the process for volatility (EGARCH) by setting the AR(1) coefficient equal to 0.9999 to mimic the persistence of the exogenous shocks in the model economies. The model statistics are averages of 1000 simulated paths of 300 quarters with a burn-in of 100 quarters. The parentheses below the regression coefficients for the models show the t-statistics ($t-st$) of the hypotheses that the data estimates are generated from model averages. The data are quarterly: $1947-2017$.

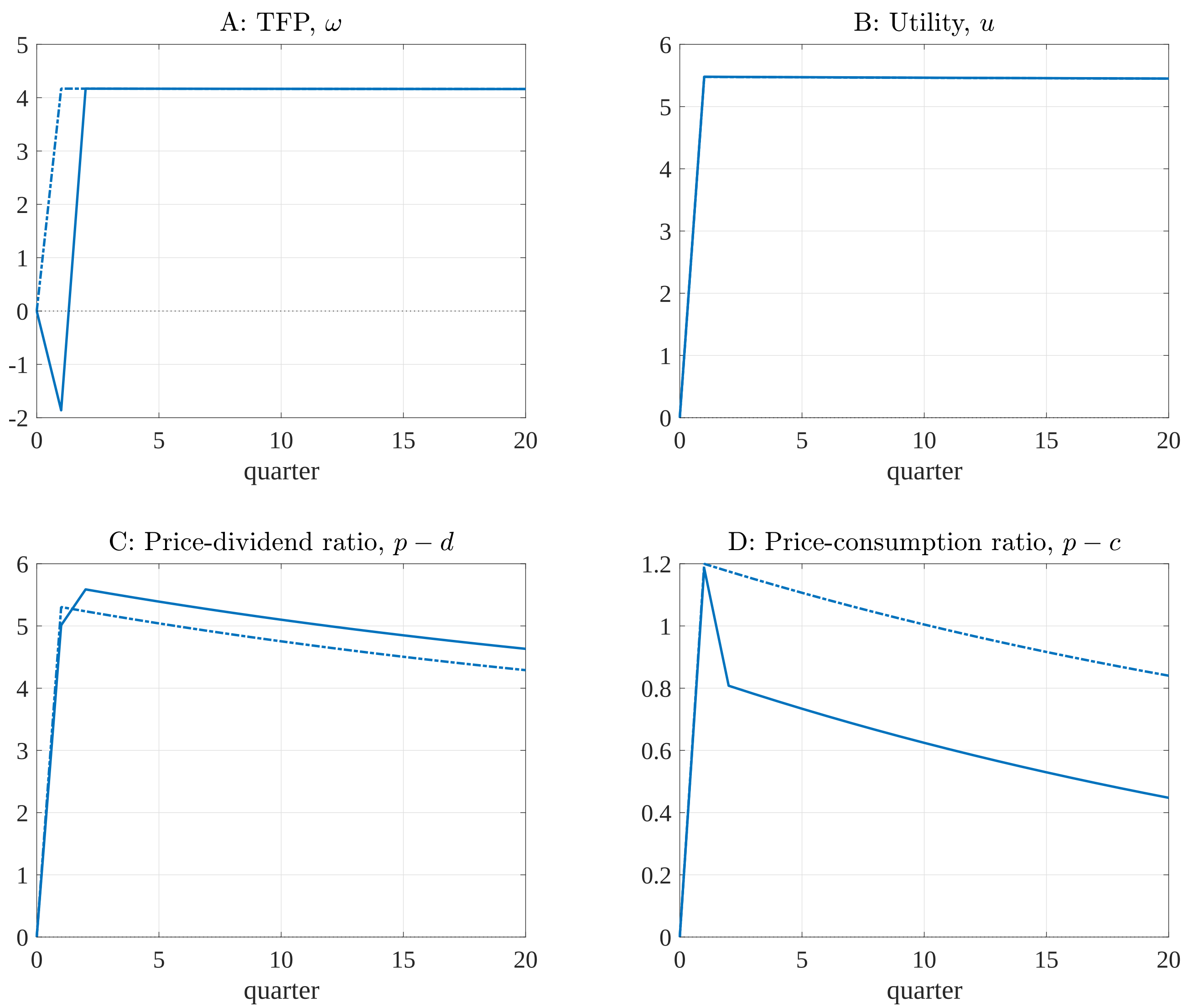
	$\rho(\sigma_{i,t}, \sum_{s=1}^{\tau}[R_{m,t+s} - R_{f,t+s-1}])$								
	A. ARMA(1,1) - EGARCH(1,1)								
	$\tau=1$	$\tau=2$	$\tau=4$	$\tau=8$	$\tau=12$	$\tau=16$	$\tau=20$	$\tau=24$	$\tau=28$
Data	0.11	0.15	0.21	0.31	0.39	0.43	0.45	0.49	0.48
$t-st$	(2.53)	(2.47)	(2.53)	(2.71)	(2.94)	(3.01)	(3.30)	(3.57)	(3.71)
TCV	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.14	0.16
$t-st$	(1.99)	(1.88)	(1.92)	(2.07)	(2.23)	(2.22)	(2.35)	(2.52)	(2.48)
NTCV	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03
$t-st$	(2.32)	(2.25)	(2.31)	(2.49)	(2.72)	(2.78)	(3.06)	(3.32)	(3.44)
TCC	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$t-st$	(2.44)	(2.37)	(2.44)	(2.61)	(2.84)	(2.91)	(3.20)	(3.47)	(3.59)
NTCC	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$t-st$	(2.45)	(2.38)	(2.44)	(2.62)	(2.84)	(2.91)	(3.19)	(3.46)	(3.60)
	B. ARMA(2,2) - EGARCH(1,1)								
Data	0.12	0.16	0.23	0.32	0.41	0.45	0.46	0.48	0.46
$t-st$	(2.66)	(2.69)	(2.70)	(2.79)	(3.08)	(3.04)	(3.20)	(3.27)	(3.30)
TCV	0.03	0.05	0.07	0.10	0.12	0.14	0.16	0.18	0.20
$t-st$	(1.92)	(1.90)	(1.88)	(1.95)	(2.17)	(2.07)	(2.07)	(2.04)	(1.88)
NTCV	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.04	0.04
$t-st$	(2.44)	(2.46)	(2.46)	(2.55)	(2.83)	(2.79)	(2.94)	(3.00)	(3.02)
TCC	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00
$t-st$	(2.61)	(2.62)	(2.63)	(2.74)	(3.03)	(3.01)	(3.17)	(3.25)	(3.29)
NTCC	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
$t-st$	(2.55)	(2.57)	(2.57)	(2.67)	(2.94)	(2.90)	(3.06)	(3.13)	(3.15)

F Additional figures



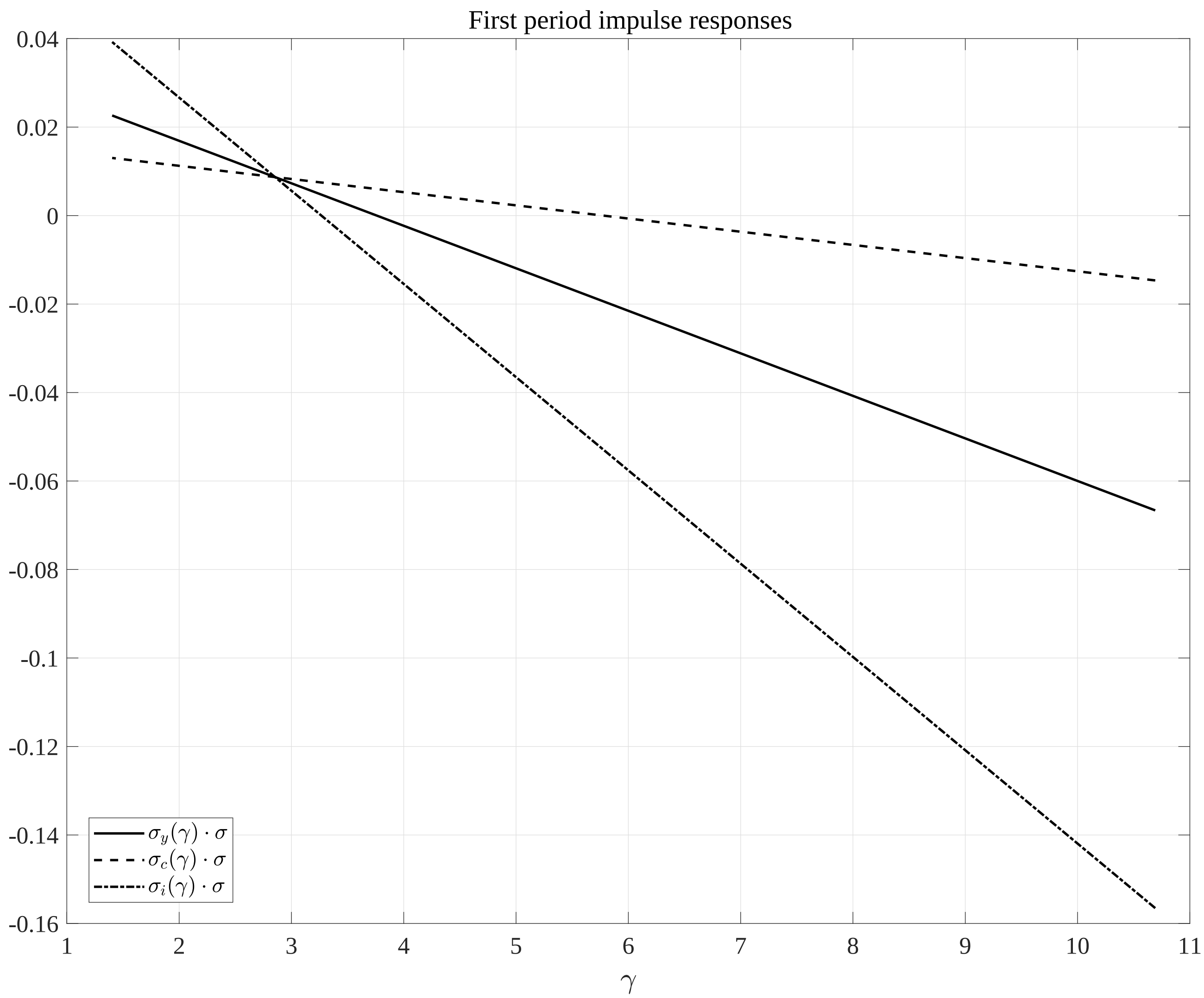
The plots show the impulse responses of output (A), consumption (B), investment (C), and the risk-free rate (D) for model TCV with high EIS, shown with continuous lines, against those of a standard RBC model with the same parameters, shown with dashed lines. The impulse responses are shown for the steady state where $\gamma = 5$, they are with respect to log deviations from the steady states and are plotted in percentages.

Figure 3: Impulse responses for TCV vs standard RBC model (high EIS)



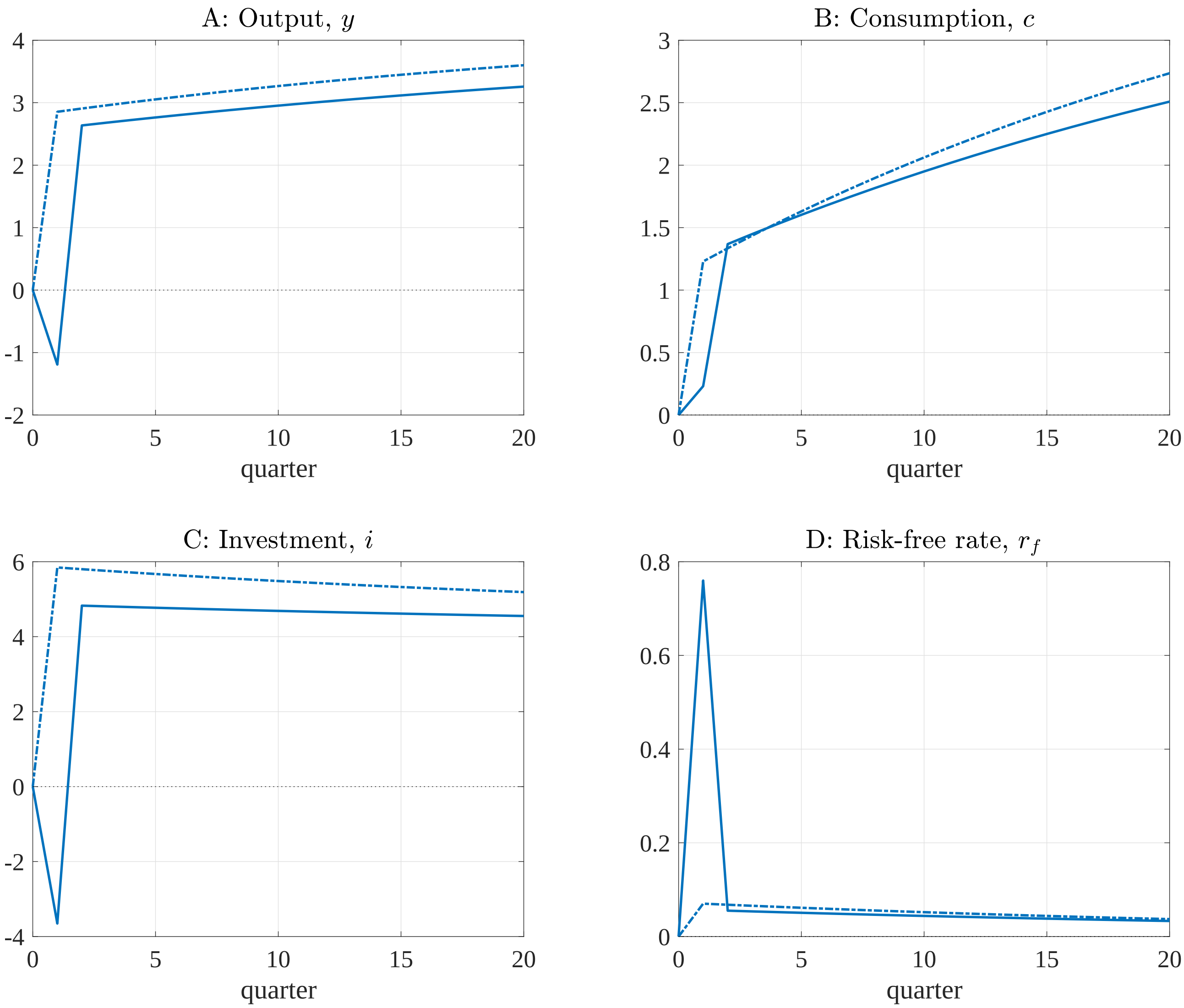
The plots show the impulse responses of endogenous productivity (A), representative agent utility (B), price-dividend ratio of the dividend claim (C), and the price-consumption ratio of the consumption claim (D) for model TCV with high EIS, shown with continuous lines, against those of a standard RBC model with the same parameters, shown with dashed lines. The impulse responses are shown for the steady state where $\gamma = 5$, they are with respect to log deviations from the steady states and are plotted in percentages.

Figure 4: Impulse responses for TCV vs standard RBC model (high EIS)



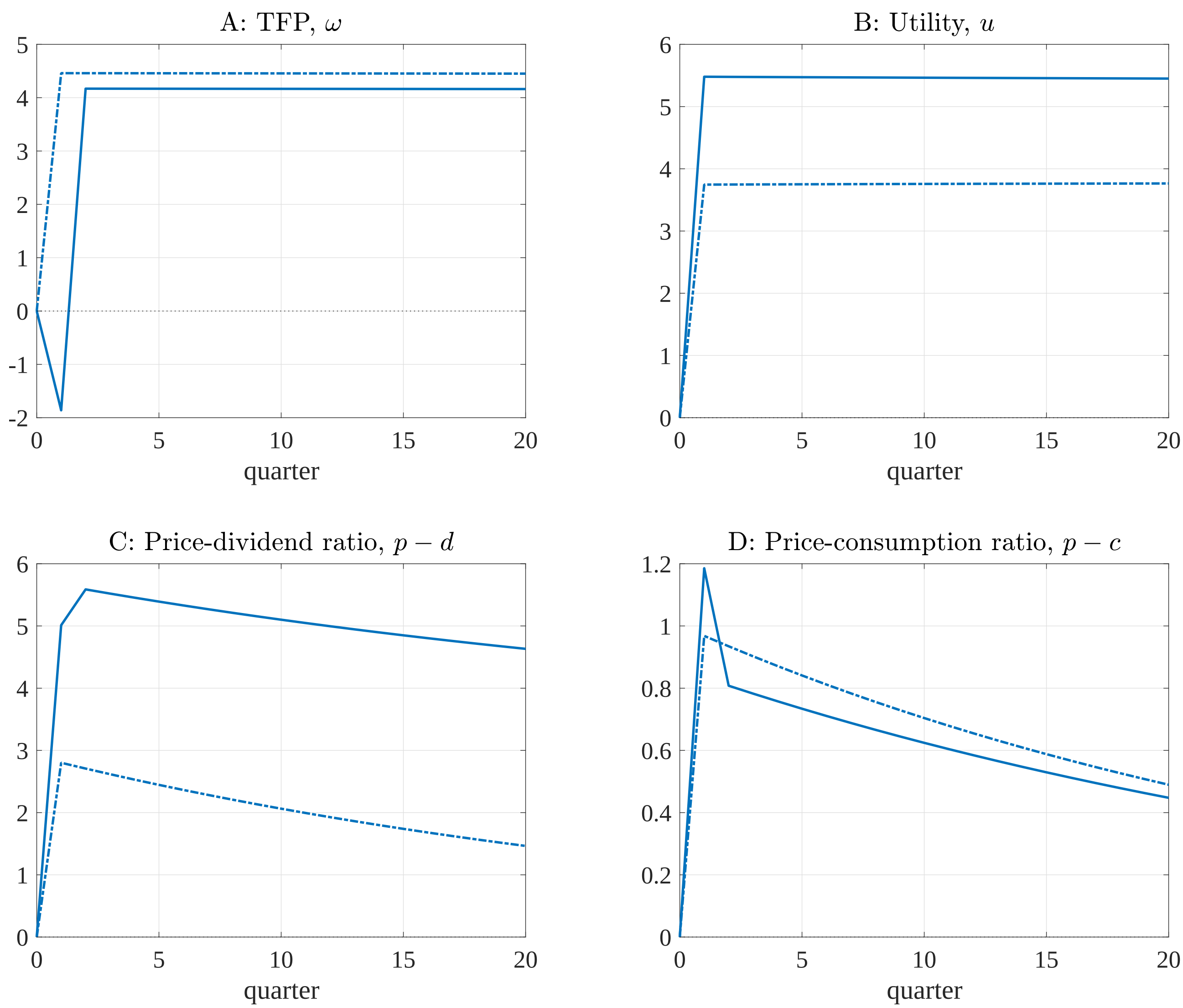
The plot shows the first period impulse responses for output, consumption, and investment as functions of the risk-aversion parameter.

Figure 5: Response functions of output, consumption and investment for TCV (high EIS)



The plots show the impulse responses of output (A), consumption (B), investment (C), and the risk-free rate (D) for model TCV with high EIS, shown with continuous lines, against those of the standard RBC model NTCC, shown with dashed lines. The impulse responses are shown for the steady state where $\gamma = 5$, they are with respect to log deviations from the steady states and are plotted in percentages.

Figure 6: Impulse responses for TCV vs NTCC (high EIS)



The plots show the impulse responses of endogenous productivity (A), representative agent utility (B), price-dividend ratio of the dividend claim (C), and the price-consumption ratio of the consumption claim (D) for model TCV with high EIS, shown with continuous lines, against those of the standard RBC model NTCC, shown with dashed lines. The impulse responses are shown for the steady state where $\gamma = 5$, they are with respect to log deviations from the steady states and are plotted in percentages.

Figure 7: Impulse responses for TCV vs NTCC (high EIS)