1 Numerical solution: main text

	Description	Value	Notes
ψ	IES	0.75	
σ	trade elasticity	1.5	?
ς	home bias	0.4	?
ν	Frisch elasticity	0.75	?
α	1 - labor share	0.33	
δ	depreciation rate	0.025	
ϵ	elast. of subs. across workers	20	
χ^W	Rotemberg wage adj. costs	400	$\approx \mathbb{P}(\text{adjust}) = 5$ qtrs
ϕ^π	Taylor coeff. on inflation	1.5	?
$\underline{\varphi}$	disaster shock	-0.10	?
p	disaster risk	0.4%	$E[p] = 0.5\%$ (?)
ρ^p	dis. risk persistence	0.75	$\rho(p) = 0.7$
σ^p	dis. risk std. dev.	0.55	$\sigma(p)/E[p] = 1$
ω^d	safety skewness	0.002	$skew(\omega) = 6.1$
ρ^ω	safety persistence	0.4	$\rho(\omega) = 0.3$
$\rho^{p\omega}$	corr. safety, disaster	0.5	$\rho(p, \omega) = 0.4$

Table 1: externally set parameters

	Description	Value	Moment	Target	Model
ζ^*	rel. pop.	1.6	$y^*/(sy)$	1.6	1.6
σ^z	std. dev. prod.	0.002	$\sigma(\Delta \log c)$	0.5%	0.5%
σ^F	std. dev. rel. prod.	0.005	$\sigma(\Delta \log y^*)$	0.8%	0.8%
ρ^F	persist. rel. prod.	0.9	$\rho(y^*/y, y^*_{-4}/y_{-4})$	0.6	0.5
χ^x	capital adj cost	3	$\sigma(\Delta \log x)$	1.6%	1.6%
β^*	disc. fac. Foreign	0.9892	$4\mathbb{E}r$	2.0%	2.0%
β	disc. fac. Home	0.9887	$nfa/(4y)$	-23%	-23%
σ^ω	std. dev. safety	0.91	$\rho_{-1}\left(r^e, r^* + \Delta \log q - r\right)$	0.5	0.5
γ^*	RRA Foreign	24	$4\mathbb{E}\left[r^e - r\right]$	5.1%	5.2%
γ	RRA Home	21	$\beta((\Delta nfa)/y, r^e - r)$	0.5	0.6
$\bar{b}^g$	safe debt/agg. cons.	0.127	$b^*_{H,s}/(4y)$	3.8%	3.8%
$\bar{\nu}$	ℓ disutility	0.73	ℓ	1	1.0
$\bar{\nu}^*$	ℓ^* disutility	0.71	ℓ^*	1	1.0
$\bar{i}$	Taylor intercept Home	0.49%	$\log P/P_{-1}$	0.0%	0.0%
$\bar{i}^*$	Taylor intercept Foreign	0.47%	$\log P^*/P^*_{-1}$	0.0%	0.0%

Table 2: targeted moments and calibrated parameters

Notes: second moments are reported over quarterly frequency. Data moments are estimated over Q1 1995 – Q4 2019. Model moments are computed by (i) simulating model for 20,000 quarters and discarding first 10,000 quarters; (ii) drawing 100 starting points from remaining 10,000 quarters; (iii) simulating 100 samples beginning from these starting points, with no disaster realizations in sample; (iv) computing moments for each sample and averaging across samples.

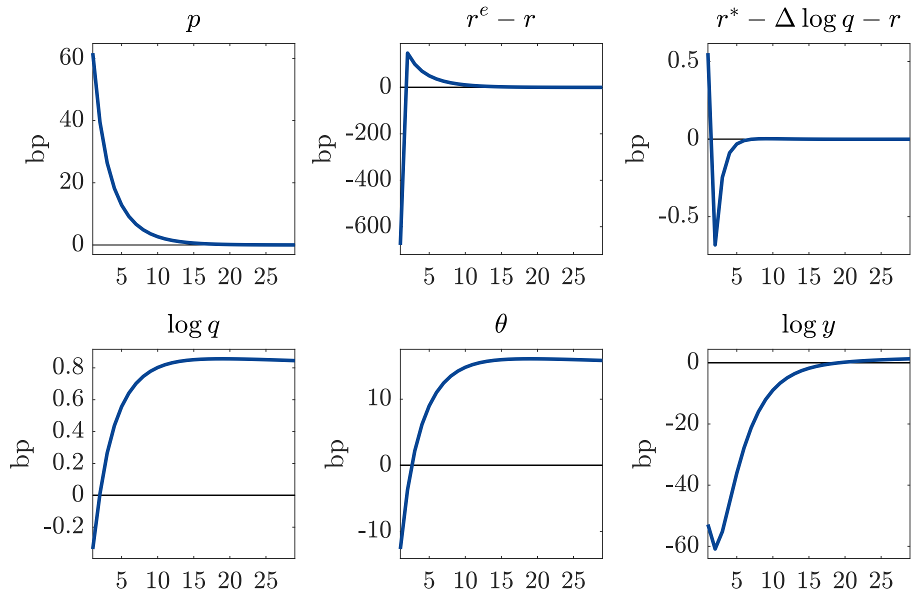

Figure 2: effects of increase in disaster probability

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

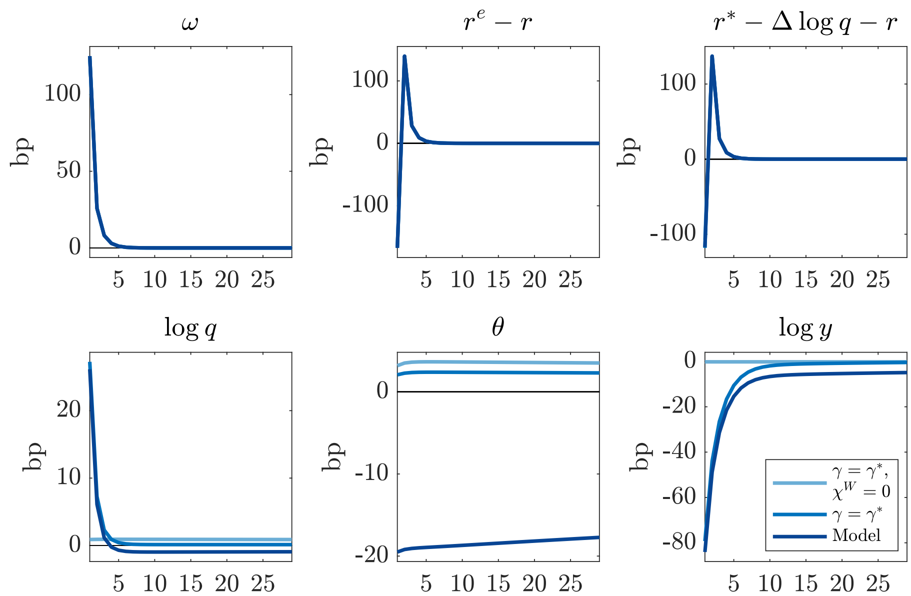

Figure 3: effects of increase in safety

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table ??.

	Data	Model	No ω	$\gamma = \gamma^*$
$\beta(r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1}, \log y_t - \log y_{t-4})$	-0.17	-0.11	0.00	-0.11
	(0.11)			
$\beta(r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1}, r^e_{t+1})$	0.23	0.06	-0.00	0.06
	(0.04)			
$\beta((\Delta nfa_{t+1})/y_t, r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1})$	1.38	1.45	-3.39	0.25
	(0.30)			
Memo: $(k - \kappa)/(4y)$		59.8%	50.2%	0.1%
$b_H/(4y)$		-102.5%	151.3%	14.3%
$b_F/(4y)$		19.8%	-224.6%	-15.9%

Table 3: comovements in the international monetary system

Notes: data moments estimated over 1995 - 2019. Standard errors are given in parenthesis. First two rows use monthly data and thus **?** standard errors with 4 lags to correct for overlapping observations. Model moments are computed as described in note to Table **??**.

Moment	Data	Model	No ω	$\gamma = \gamma^*$
$\sigma(4r_t)$	2.9%	4.1%	2.1%	4.1%
$\sigma(4[r^e_t - r_t])$	33.6%	17.2%	11.2%	17.5%
$\sigma(4[r^*_t - \Delta \log q_t - r_t])$	15.5%	1.9%	0.3%	1.9%
$\sigma(\Delta \log q_t)$	3.8%	0.3%	0.2%	0.3%
$\sigma(\Delta \log E_t)$	3.8%	0.4%	0.2%	0.4%
$\sigma(\Delta \log q_t, \Delta \log c^*_t - \Delta \log c_t)$	0.10	0.91	0.92	0.97

Table 4: additional second moments

Notes: data moments are estimated over Q1 1995 – Q4 2019. Standard errors are given in parenthesis. Model moments are computed as described in note to Table **??**.

Moment	Data	Model	No ω	$\gamma = \gamma^*$
$\sigma(\Delta \log y_t)$	0.59%	0.61%	0.44%	0.60%
$\sigma(\Delta \log y_t^*)$	0.81%	0.81%	0.75%	0.81%

Table 5: output volatility

Notes: data moments estimated over Q1 1995 - Q4 2019. Model moments are computed as described in note to Table **??**.

Moment	Data	Model	No ω	$\gamma = \gamma^*$
$\sigma((\Delta nfa_t)/y_t)$	11.0%	3.3%	1.6%	0.8%
$\sigma(nx_t/y_t)$	1.0%	1.0%	0.8%	0.8%
$\sigma((\Delta nfa_t - nx_t)/y_t)$	10.9%	3.1%	1.8%	0.2%
$\Delta nfa/y$	-2.8%	0.2%	0.1%	0.0%
nx/y	-3.2%	-0.6%	-0.2%	0.1%
$(\Delta nfa - nx)/y$	0.4%	0.7%	0.3%	-0.1%

Table 6: U.S. net foreign asset volatility

Notes: volatilities in data estimated over Q1 2006 - Q4 2019 since BEA IIP data is available quarterly only after that date; means are estimated using annual data over Q1 1995 - Q4 2019. Model moments are computed as described in note to Table **??**.

	Model	No ω	$\gamma = \gamma^*$
As share of $Var\left((\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$:			
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r_{t+i}^k}\right)nx_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	32.3%	76.2%	99.1%
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r_{t+i}^k}\right)val_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	67.6%	23.8%	0.9%
$Cov\left((\mathbb{E}_t - \mathbb{E}_{t-1})\left(\prod_{i=1}^{500}\frac{1}{1+r_{t+i}^k}\right)nfa_{t+500}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	0.1%	0.1%	−0.0%

Table 7: understanding U.S. external adjustment

Notes: moments are computed as described in note to Table **??**, but including disaster realizations.

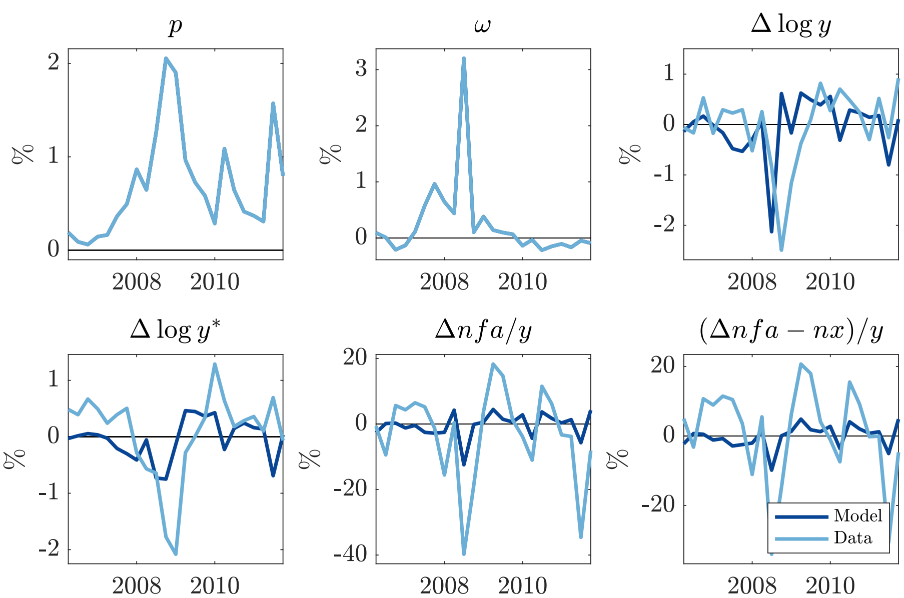

Figure 4: simulation using observed p and ω series

Notes: p is from **?** and ω is from **?** (demeaned). Both are scaled to match volatilities of p and ω in model. Given these shocks, figure depicts average paths starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

	Data	Model Constant i	Active Taylor
Impact effects			
$\log E_t$	$-72bp$	$-100bp$	$-18bp$
$\log P_t r^e_t$	$+151bp$	$+135bp$	$+29bp$
$\Delta nfa_t/y_t$		$+436bp$	$+67bp$
$\Delta(nfa_t - nx_t)/y_t$		$+351bp$	$+63bp$
Peak effects			
$\log y_t$		$+79bp$	$+11bp$
$\log y^*_t$		$+21bp$	$+4bp$

Table 8: effects of dollar swap lines

Notes: data column are cumulative estimates from **?** for March 19-20, 2020 announcements (Table 1 in that paper). Model columns simulate a decrease in ω_t of $14bp$ starting from the average of the model's ergodic distribution.

2 Numerical solution: appendix

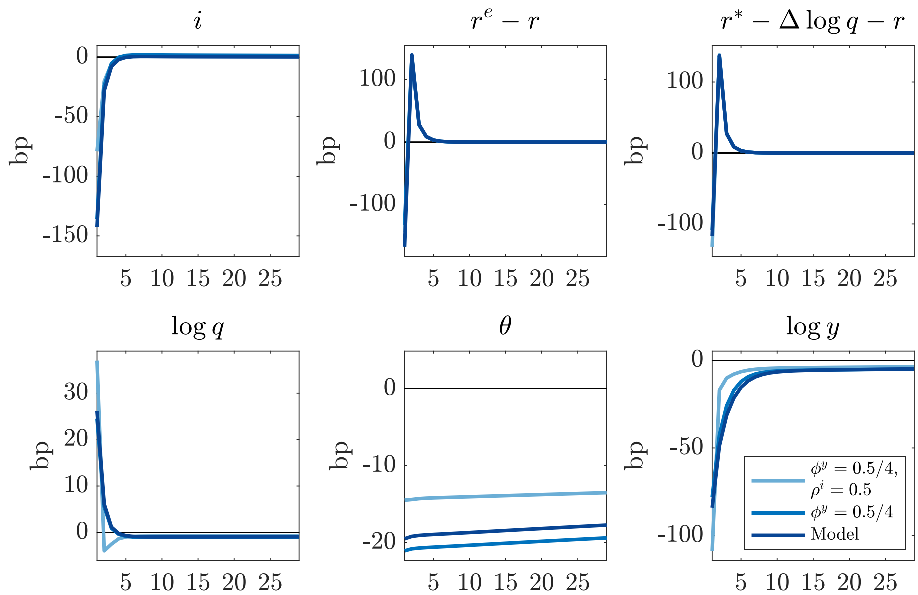

Figure 5: effects of increase in safety under alternative monetary policy rules

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

	Model	$\phi^y = 0.5/4$	$\phi^y = 0.5/4$, $\rho^i = 0.5$
$\beta(r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1}, \log y_t - \log y_{t-4})$	-0.11	-0.10	-0.13
$\beta(r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1}, r^e_{t+1})$	0.06	0.06	0.08
$\beta((\Delta nfa_{t+1})/y_t, r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1})$	1.45	1.30	0.86
Memo: $(k - \kappa)/(4y)$	59.8%	51.9%	37.7%
$b_H/(4y)$	-102.5%	-127.0%	-72.5%
$b_F/(4y)$	19.8%	52.1%	12.9%

Table 9: comovements under alternative monetary policy rules

Notes: moments are computed as described in note to Table **??**.

γ	$=\gamma^*$	Model	Model	Model	Model
σ^ω	0	0	Model	Model	Model
$b^g_{H,s}$	n/a	n/a	0	Model	Model
$\rho^{p,\omega}$	n/a	n/a	0	0	Model
k/a	100.00%	137.09%	137.70%	137.74%	142.41%
b_H/a	105.94%	73.34%	4.69%	1.82%	-51.94%
b_F/a	-105.94%	-110.43%	-42.39%	-39.56%	9.53%
$\rho_t(r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1}, \log m_{t,t+1})$	0.06	0.09	0.02	0.02	-0.53
$\rho_t(r^*_{t+1} - \Delta \log q_{t+1} - r_{t+1}, \log m^*_{t,t+1} + \Delta \log q_{t+1})$	0.07	0.08	0.02	0.02	-0.49

Table 10: portfolios and risk premium

Notes: model moments are computed as described in note to Table 2.

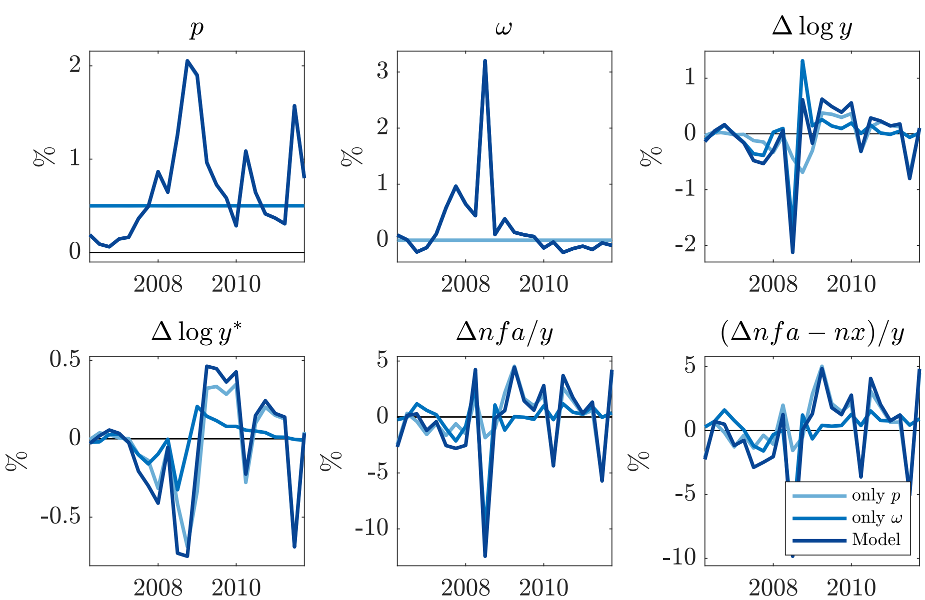

Figure 6: simulation using observed p and ω series

Notes: see notes to Figure ??.

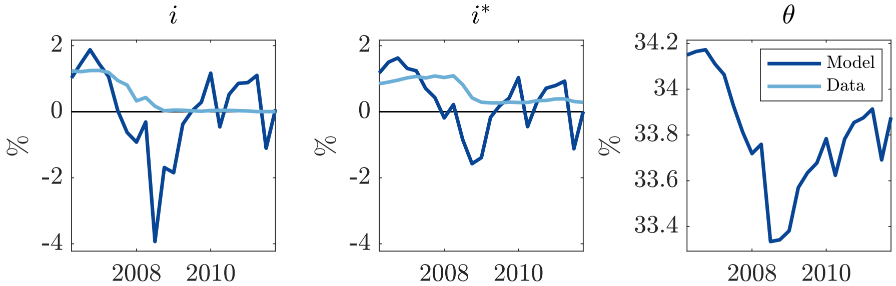

Figure 7: simulation using observed p and ω series

Notes: see notes to Figure ??.

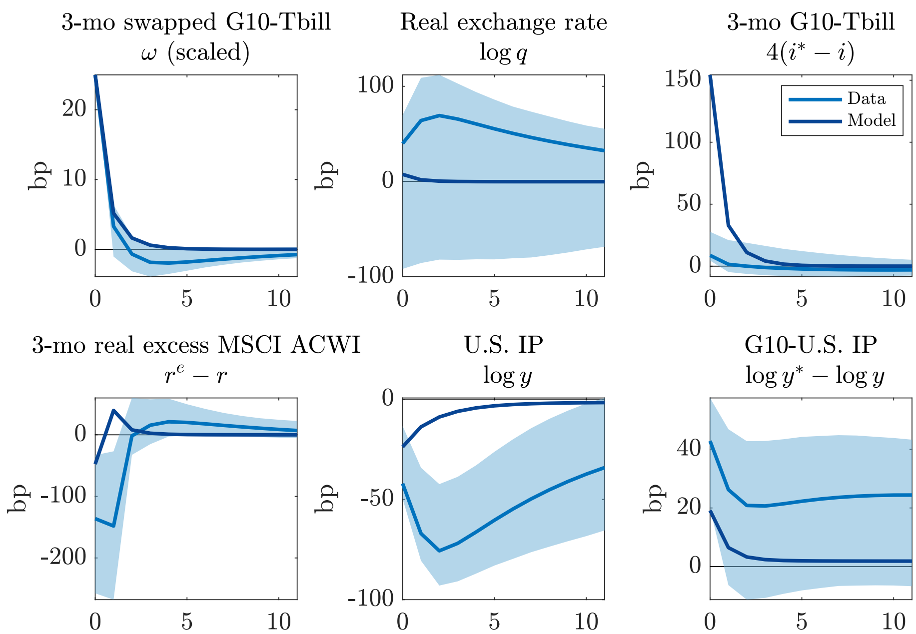

Figure 9: effects of safety shock in model and data

Notes: in data, impulse responses estimated as in Figure ?? except using quarterly data over Q1 1995 – Q4 2019. In model, innovation to ω_t equals estimated innovation in swapped G10/Tbill spread, multiplied by ratio of unconditional volatilities of ω_t in model to swapped G10/Tbill spread in data.

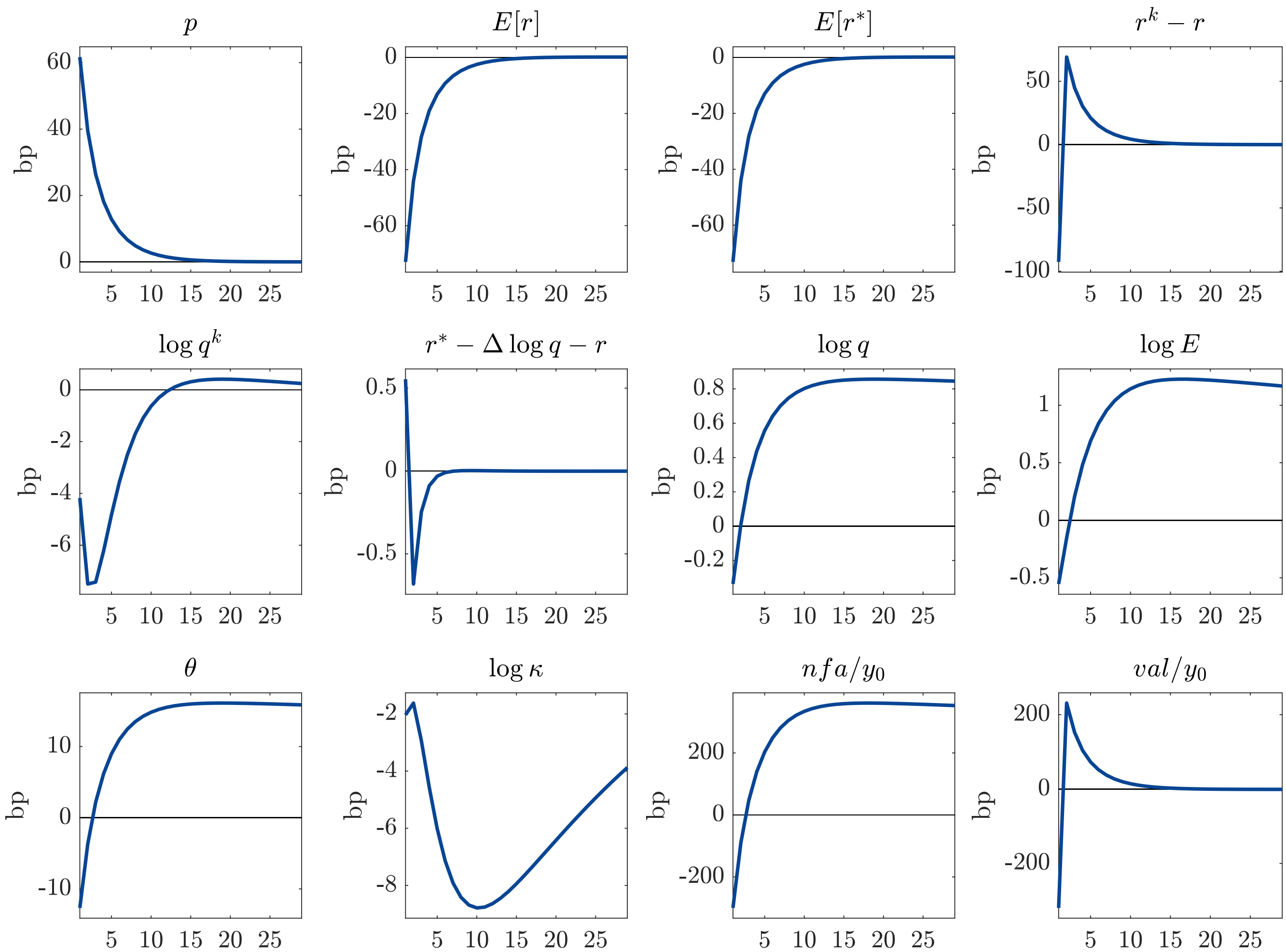

Figure 10: effects of increase in disaster probability - 1/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

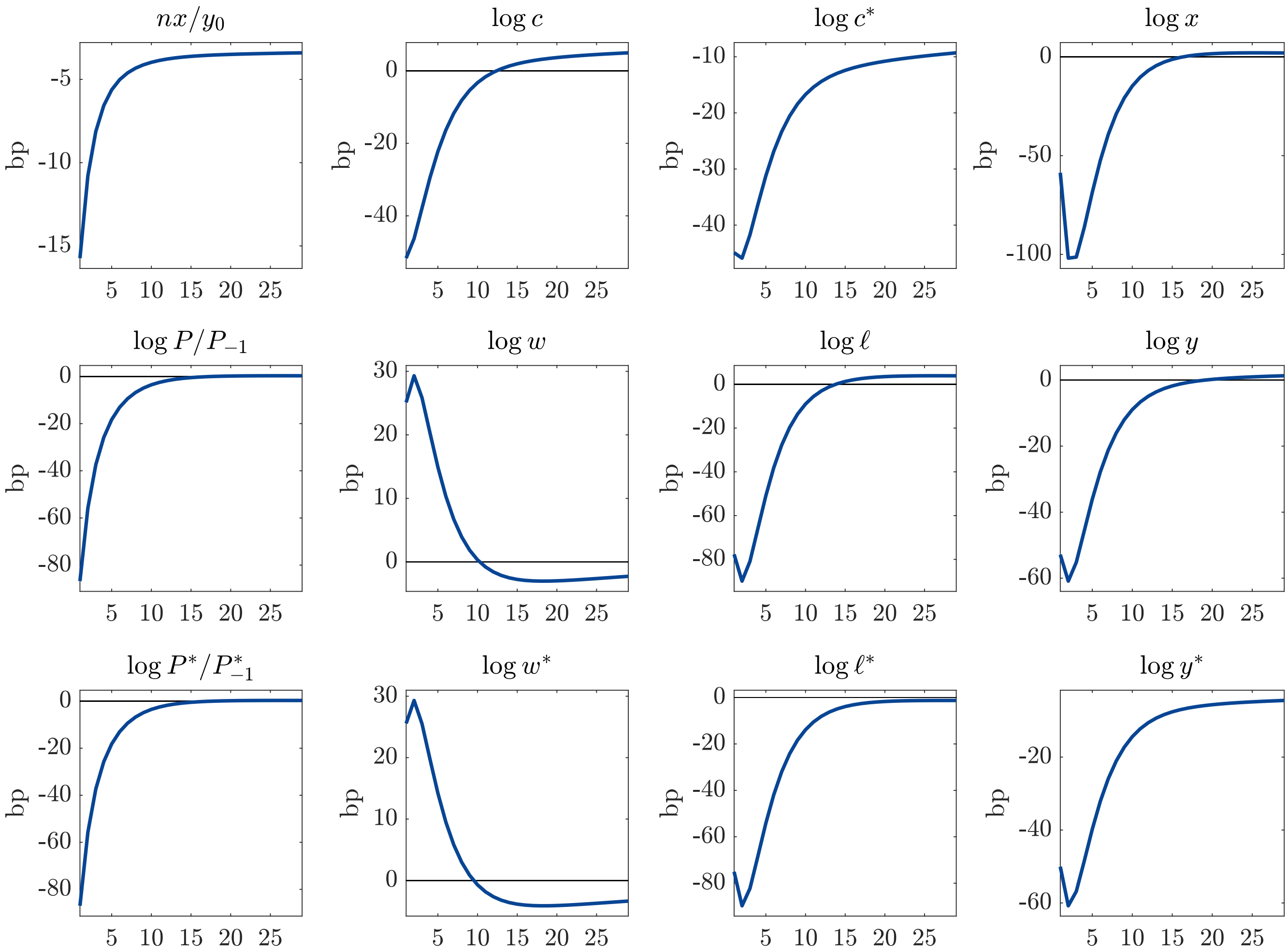

Figure 11: effects of increase in disaster probability - 2/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

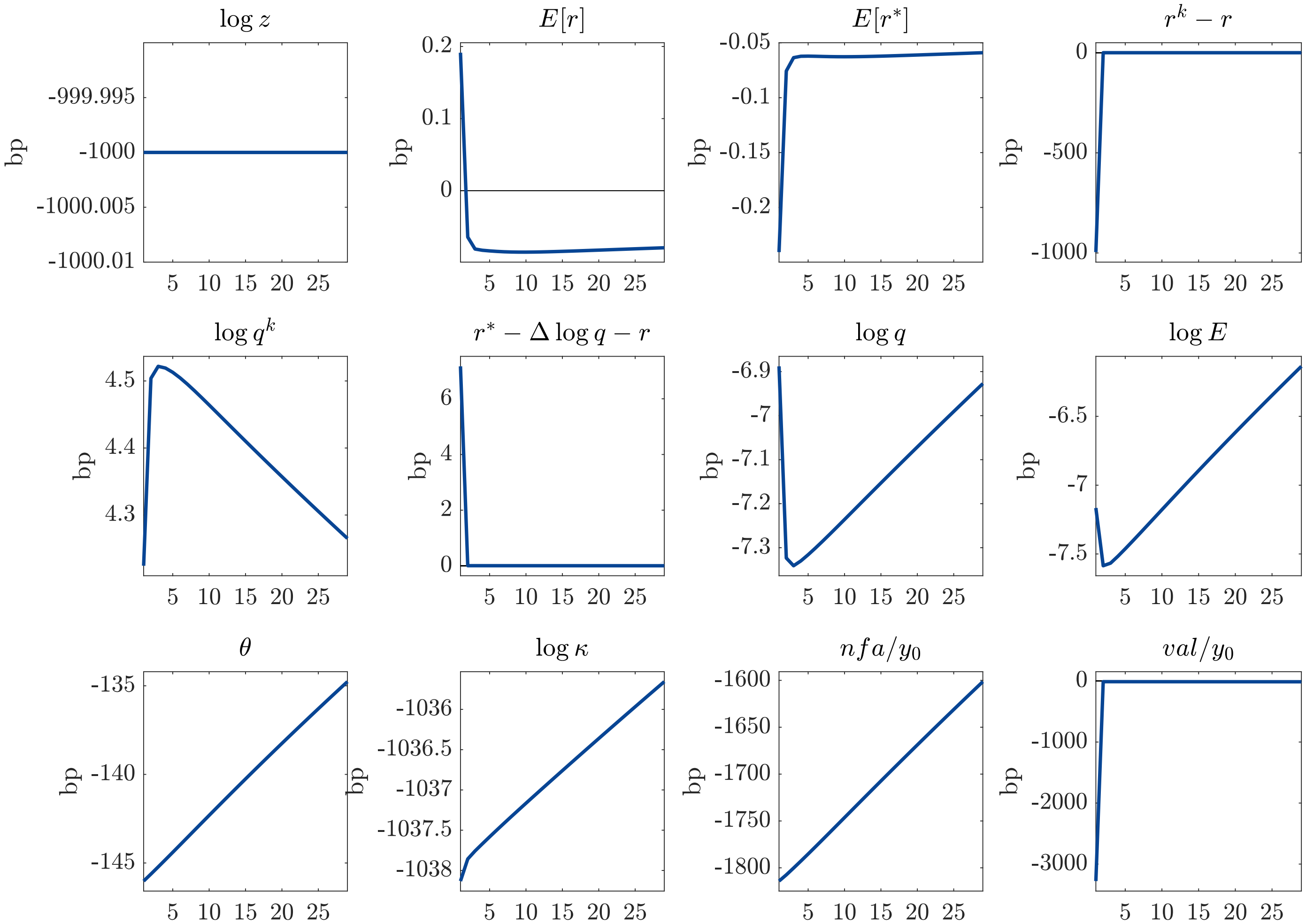

Figure 12: effects of disaster realization - 1/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

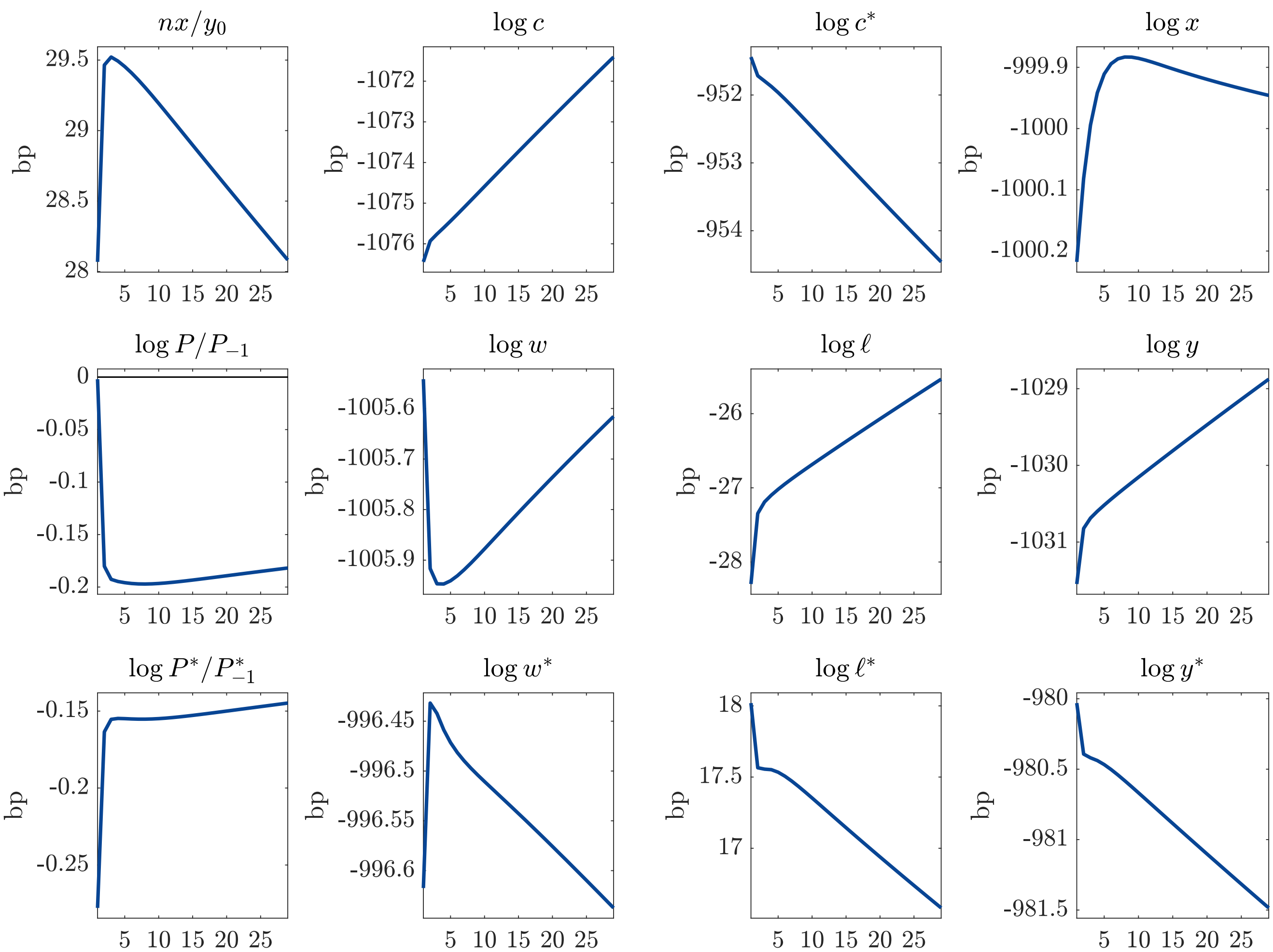

Figure 13: effects of disaster realization - 2/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

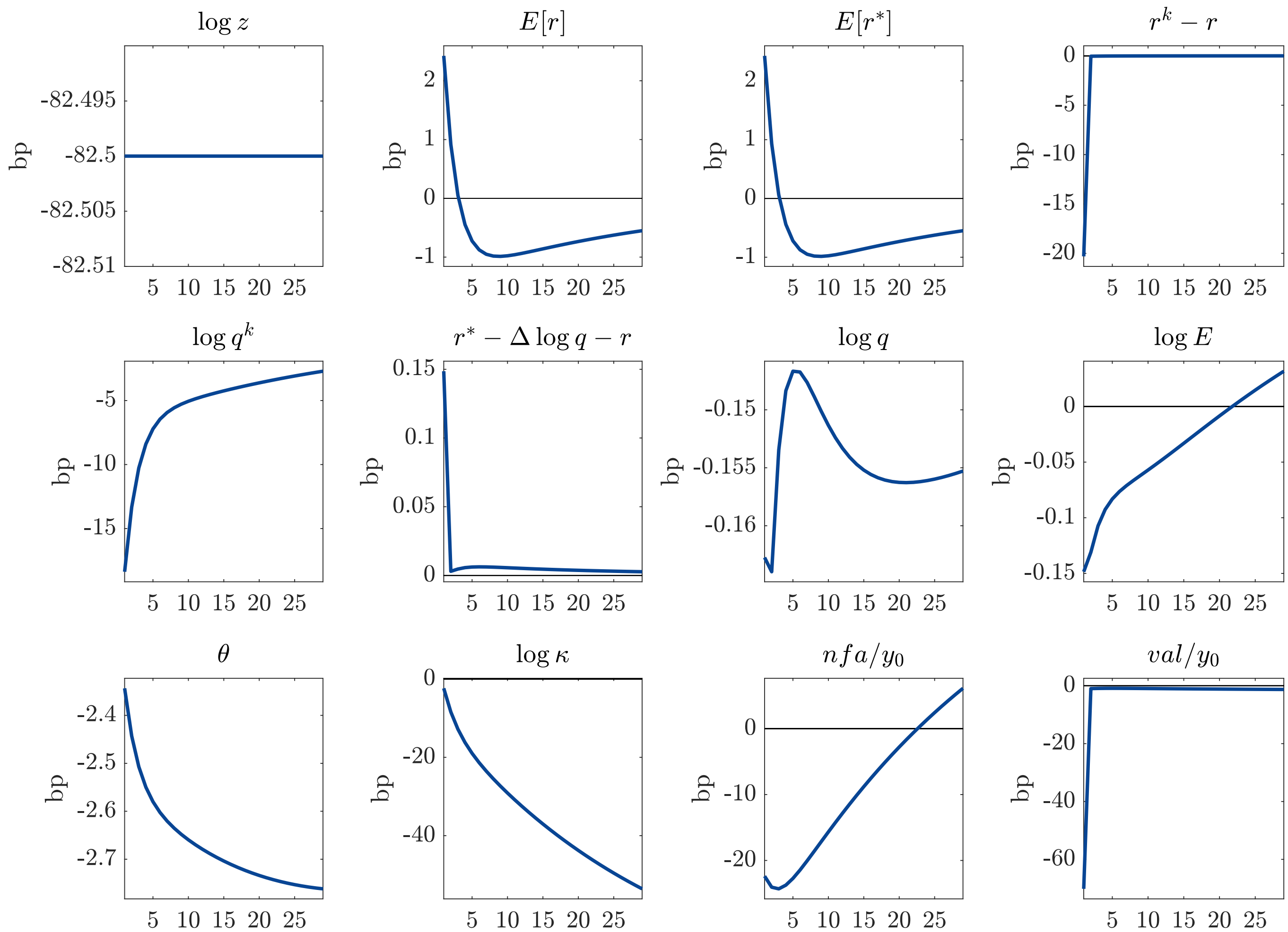

Figure 14: effects of global productivity shock - 1/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table ??.

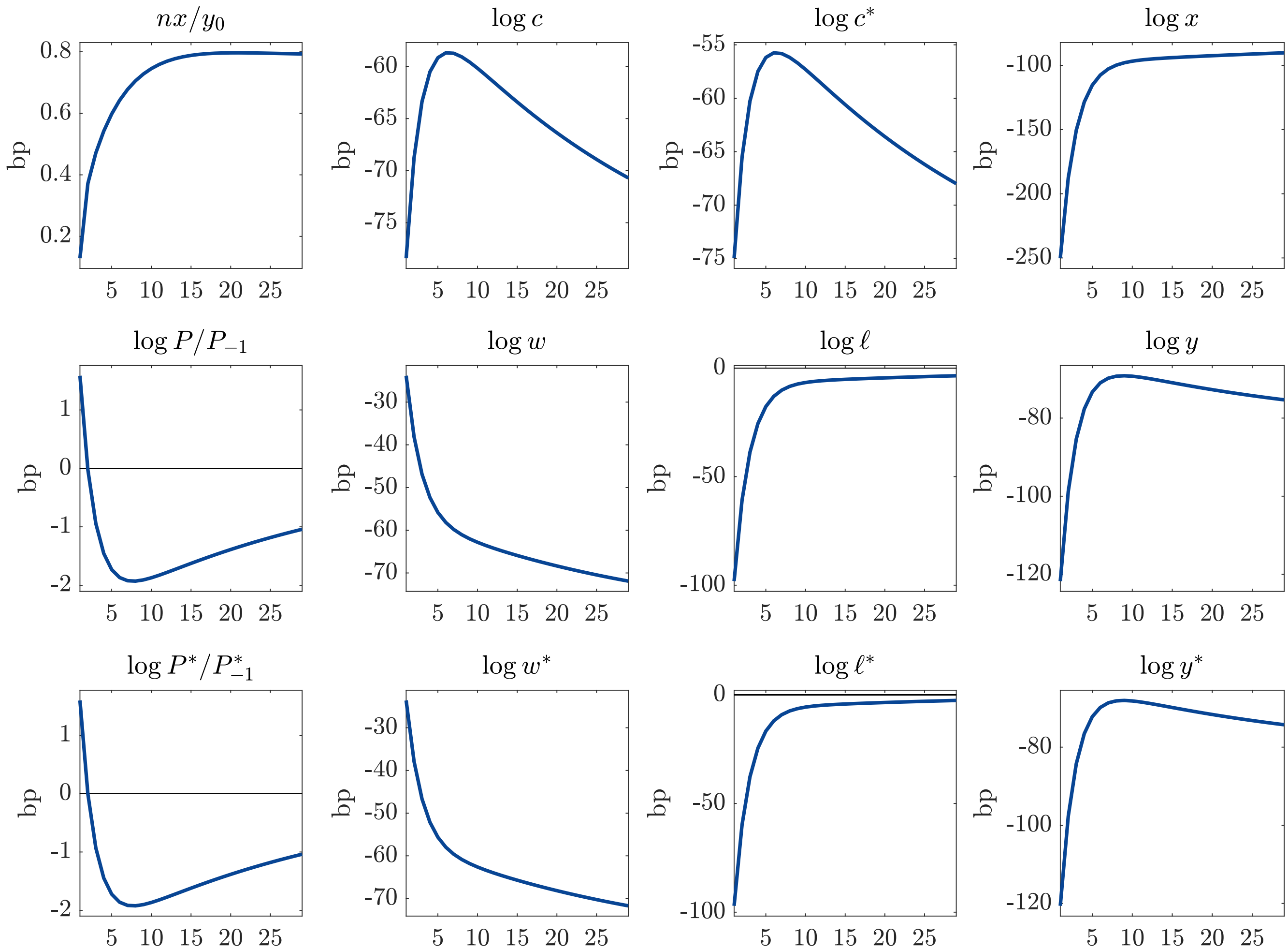

Figure 15: effects of global productivity shock - 2/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

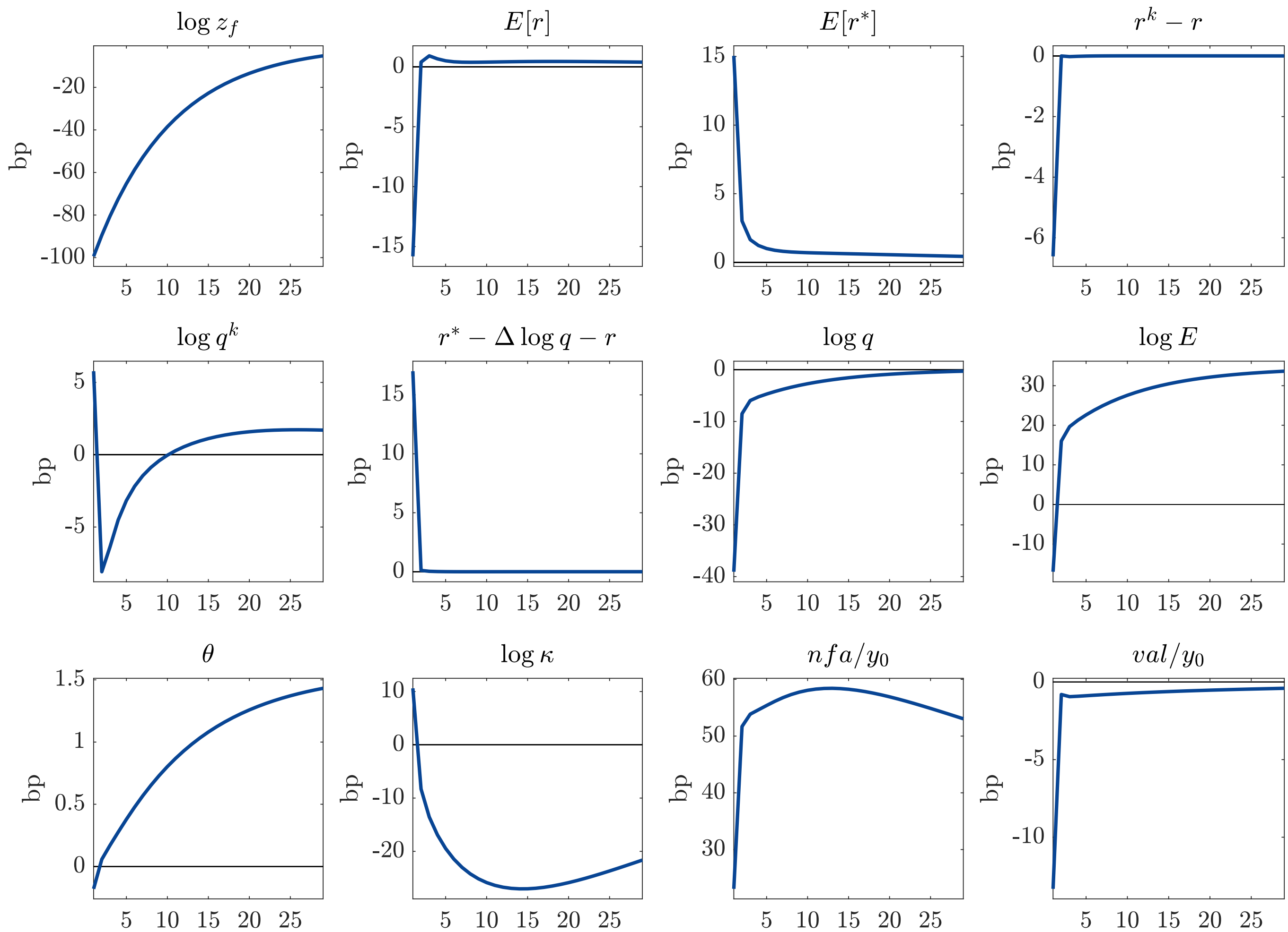

Figure 16: effects of relative productivity shock - 1/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table ??.

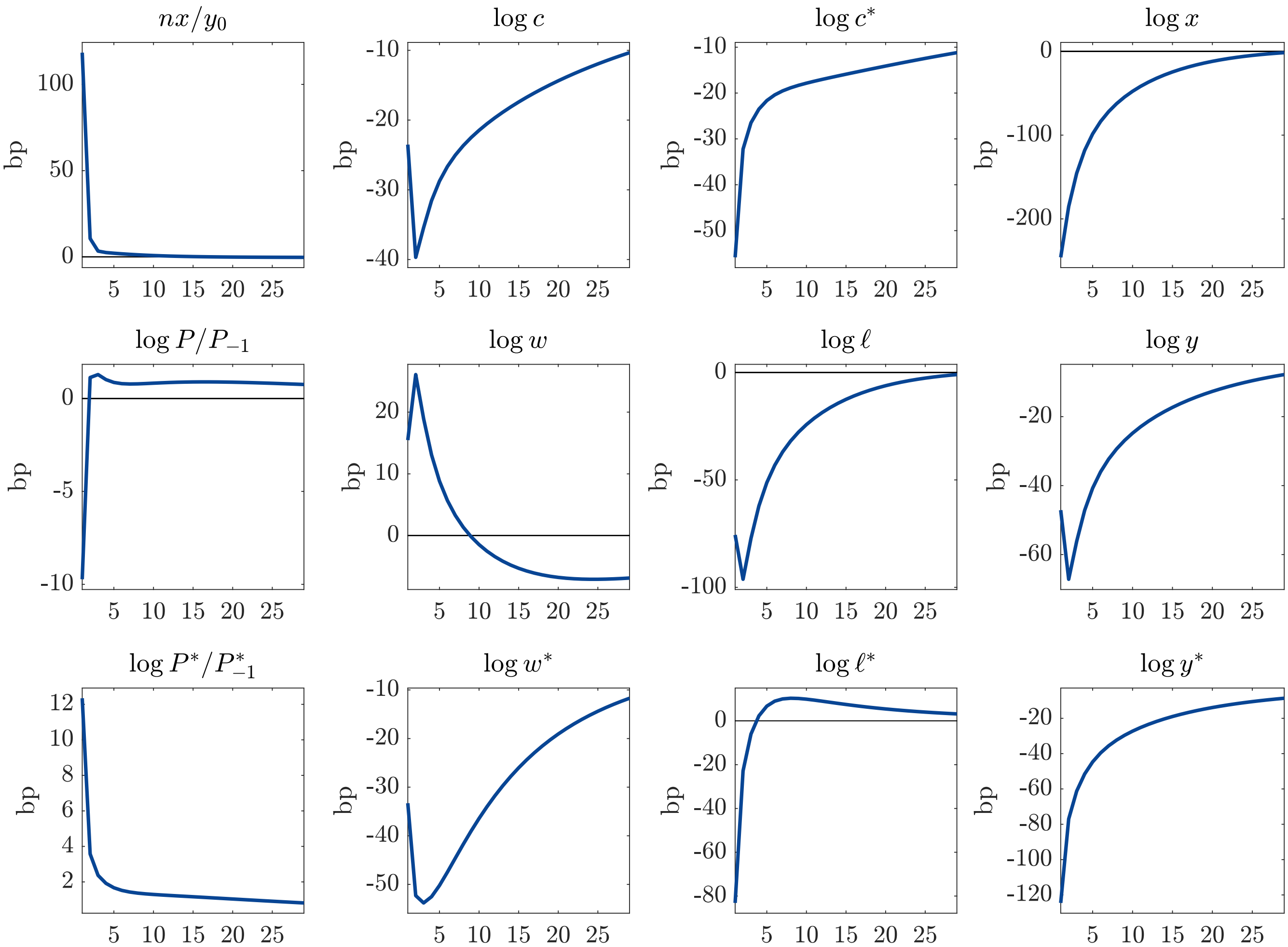

Figure 17: effects of relative productivity shock - 2/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

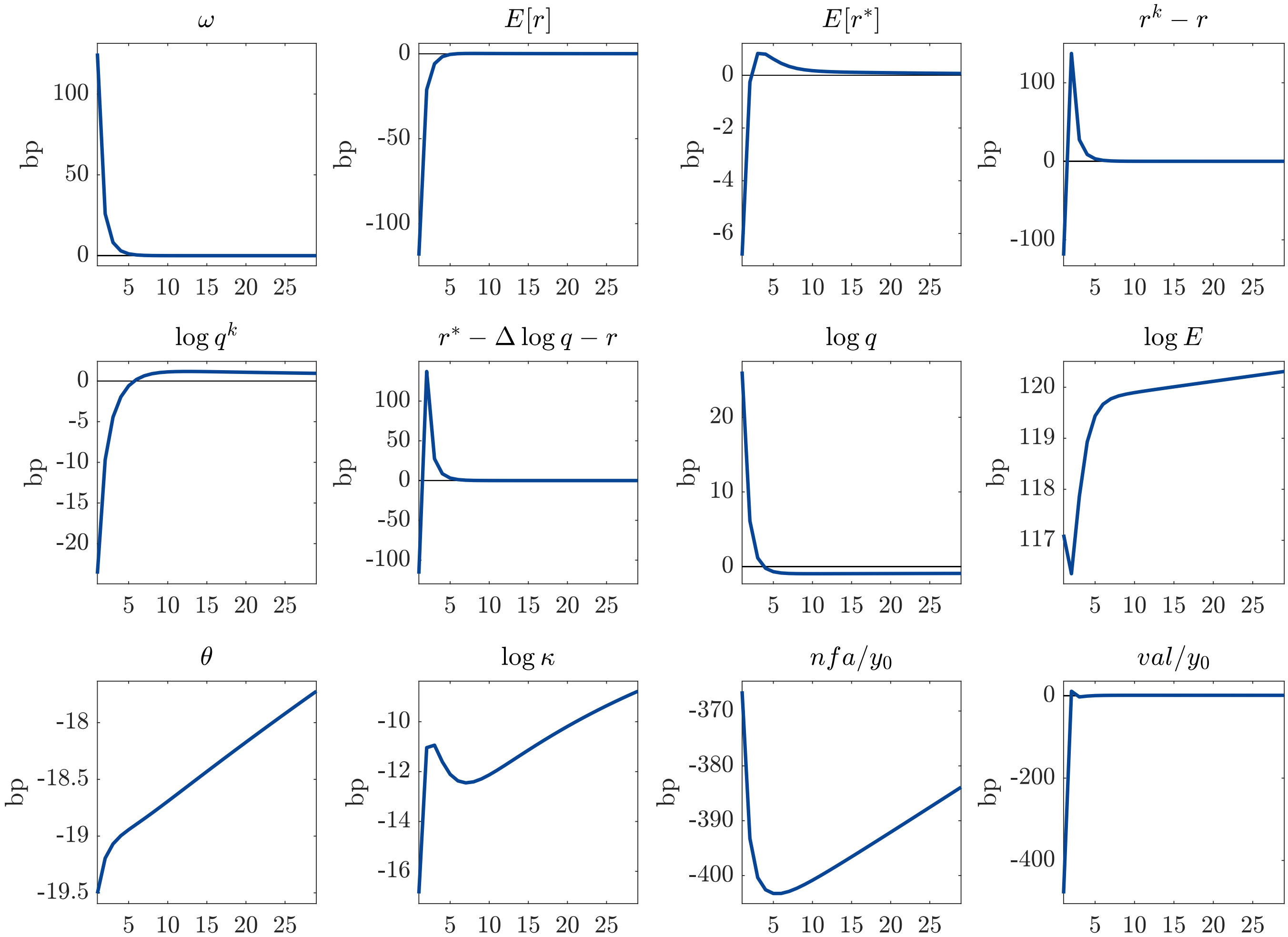

Figure 18: effects of safety shock - 1/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

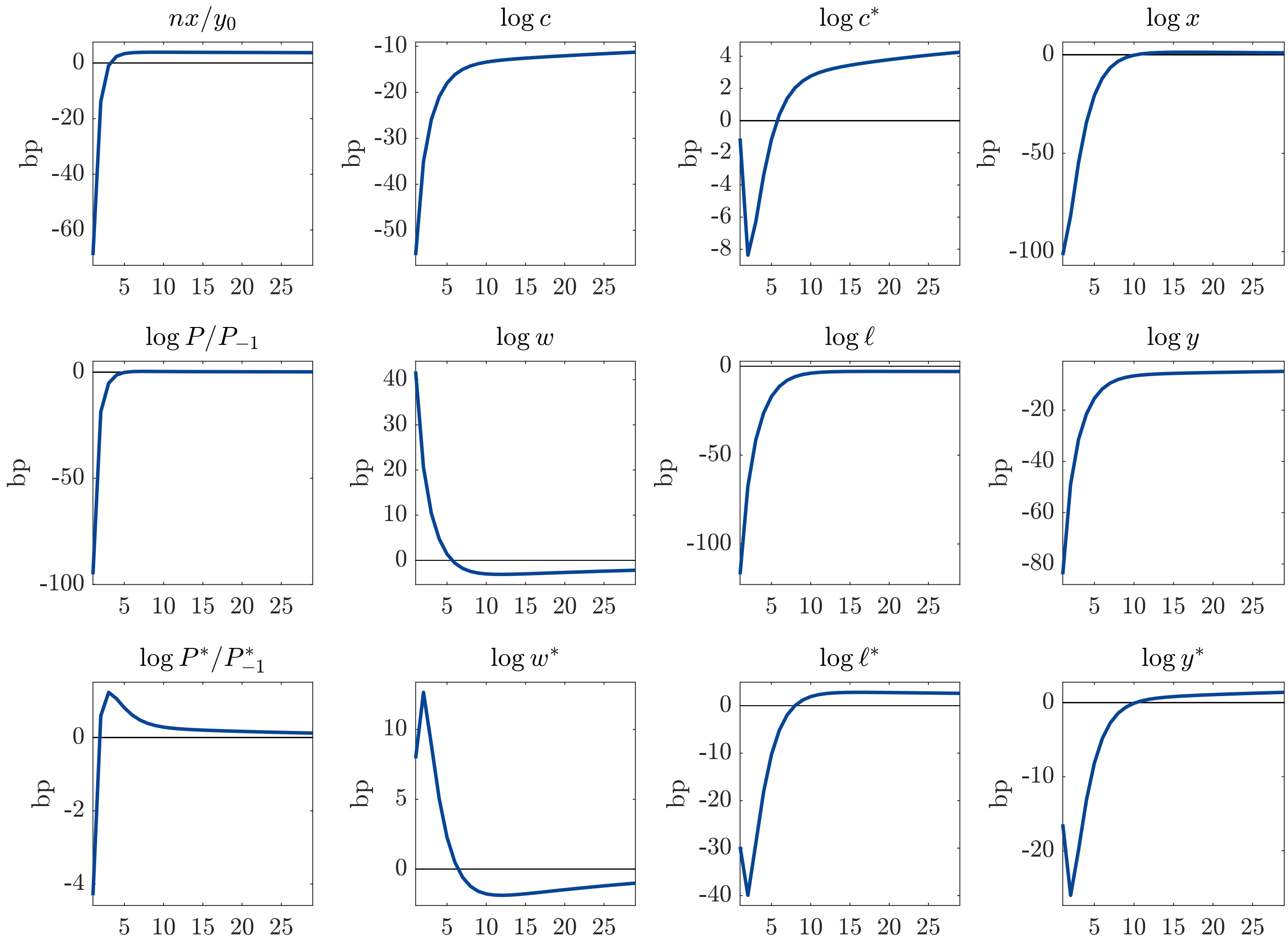

Figure 19: effects of safety shock - 2/2

Notes: impulse responses are average responses starting from 100 points drawn from ergodic distribution as described in note to Table **??**.

3 Additional results

Q3 07 - Q3 09	Data	Model
$\Delta \log y$	-4.7536%	-1.3304%
$\Delta \log y^*$	-5.1183%	-1.4699%
$\Delta nfa/y$	-10.0397%	-8.6086%

Table A1: Output decline

	Model	No ω	$\gamma = \gamma^*$
As share of $Var\left((\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$:			
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r^k_{t+i}}\right)nx_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	32.3%	76.2%	99.1%
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r^k_{t+i}}\right)val_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	67.6%	23.8%	0.9%
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r^k_{t+i}}\right)val^r_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	67.0%	23.4%	-0.1%
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r^k_{t+i}}\right)val^{r^*}_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	0.3%	0.4%	0.1%
$Cov\left(-(\mathbb{E}_t - \mathbb{E}_{t-1})\sum_{h=1}^{500}\left(\prod_{i=1}^{h}\frac{1}{1+r^k_{t+i}}\right)val^s_{t+h}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	0.4%	0.0%	0.8%
$Cov\left((\mathbb{E}_t - \mathbb{E}_{t-1})\left(\prod_{i=1500200}\frac{1}{1+r^k_{t+i}}\right)nfa_{t+500}, (\mathbb{E}_t - \mathbb{E}_{t-1})nfa_t\right)$	0.1%	0.1%	-0.0%

Table 7: understanding U.S. external adjustment

Notes: moments are computed as described in note to Table **??**, but including disaster realizations.