Online Appendix of "The Importance of Being Special: Repo Markets During the Crisis" *

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Table 1 **Statistics on repo transactions for repo maturity -** This table reports the average and the standard deviation of the daily distribution of the special repo transactions for repo maturity. The statistics are reported for the full sample and for three distinct sub-periods. First period from 1 October 2009 to 7 August 2011. Second period: from 8 August 2011 to 21 December 2011. Third period: from 22 December 2011 to 12 July 2012.

	Spot next		Tomorrow next		Over night	
	Mean	St.dev	Mean	St.dev	Mean	St.dev
Full Sample	86.315	3.154	12.047	2.908	1.638	0.820
1st period	86.431	3.238	11.868	2.978	1.699	0.844
2nd period	84.869	2.425	13.620	2.285	1.509	0.622
3rd period	86.962	3.020	11.519	2.694	1.517	0.838

Table 2 **Statistics of GC and Special repo rates -** This table reports the average, the standard deviation, the 5th and 95th percentile of the daily distribution of the GC and special repo rates. Special and GC repo rates are based on spot next (SN), tomorrow next (TN) and overnight (ON) transactions.The statistics are reported for the full sample and for three distinct sub-periods. First period from 1 October 2009 to 7 August 2011. Second period: from 8 August 2011 to 21 December 2011. Third period: from 22 December 2011 to 12 July 2012 (see Section 3 for details about the variables).

	GC repo rates				Special repo rates			
	Mean	St.dev	5 Perc.	95 Perc.	Mean	St.dev	5 Perc.	95 Perc.
Full Sample	0.618	0.377	0.246	1.590	0.491	0.390	-0.326	1.409
1st period	0.593	0.347	0.254	1.622	0.496	0.382	-0.231	1.462
2nd period	1.141	0.197	0.765	1.602	0.873	0.331	-0.372	1.310
3rd period	0.333	0.096	0.229	0.733	0.212	0.150	-0.396	0.397

2. Model

2.1. Population measures

To solve the system, we reduce it to a simpler one in six unknowns. Adding

$$\text{Sellers} \qquad \nu_i \mu_{\underline{bo}} \mu_{\bar{l}i} = \overline{\kappa} \mu_{\underline{s}i} + \underline{\kappa} \mu_{\underline{s}i} + \lambda \mu_{bi} \mu_{\underline{s}i} \tag{1}$$

$$\text{Non-searchers} \qquad \lambda \mu_{bi} \mu_{\underline{s}i} = \overline{\kappa} \mu_{\underline{n}i} + \underline{\kappa} \mu_{\underline{n}i} \tag{2}$$

we find

$$\nu_i \mu_{\underline{bo}} \mu_{\bar{l}i} + \bar{\kappa} \left(-\mu_{\underline{n}i} - \mu_{\underline{s}i} \right) + \underline{\kappa} \left(-\mu_{\underline{n}i} - \mu_{\underline{s}i} \right) = 0. \tag{3}$$

Using $\mu_{\underline{sn}i} = \mu_{\underline{s}i} + \mu_{\underline{n}i}$ we find

$$\mu_{\underline{sn}i} = \frac{\nu_i \mu_{\underline{bo}} \mu_{\bar{l}i}}{\bar{\kappa} + \underline{\kappa}}. \tag{4}$$

Then, equation

$$\mu_{\bar{l}i} + \mu_{\bar{h}i}^{cb} + \mu_{si} = S \tag{5}$$

implies

$$\mu_{\bar{l}i} = -\mu_{\bar{h}i}^{cb} + S - \mu_{si}. \tag{6}$$

Plugging equation (6) into

$$\text{Borrowers} \qquad \underline{F} + \sum_{i=1}^{2} \overline{\kappa} (\mu_{\underline{s}i} + \mu_{\underline{n}i}) = \underline{\kappa} \mu_{\underline{bo}} + \sum_{i=1}^{2} \nu_i \mu_{\underline{bo}} \mu_{\bar{l}i} \tag{7}$$

we find

$$\underline{F} = \frac{\underline{\kappa} \mu_{\underline{bo}} \left(-\nu_1 \mu_{\bar{h}1}^{cb} - \nu_2 \mu_{\bar{h}2}^{cb} + \bar{\kappa} + \underline{\kappa} + \nu_2 S - \nu_2 \mu_{s2} + \nu_1 S - \nu_1 \mu_{s1} \right)}{\bar{\kappa} + \underline{\kappa}}. \tag{8}$$

Equation

$$\text{Sellers} \qquad \nu_i \mu_{\underline{bo}} \mu_{\bar{l}i} = \overline{\kappa} \mu_{\underline{s}i} + \underline{\kappa} \mu_{\underline{s}i} + \lambda \mu_{bi} \mu_{\underline{s}i} \tag{9}$$

implies

$$\mu_{\underline{s}i} = \frac{\nu_i \mu_{\underline{bo}} \left(-\mu_{\bar{h}i}^{cb} + S - \mu_{si} \right)}{\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi}}. \tag{10}$$

Equation

$$\text{Non-searchers} \qquad \lambda \mu_{bi} \mu_{\underline{s}i} = \overline{\kappa} \mu_{\underline{n}i} + \underline{\kappa} \mu_{\underline{n}i} \tag{11}$$

implies

$$\mu_{\underline{n}i} = \frac{\lambda \nu_i \mu_{bi} \mu_{\underline{bo}} \left(-\mu_{\bar{h}1}^{cb} + S - \mu_{si} \right)}{\left(\bar{\kappa} + \underline{\kappa} \right) \left(\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi} \right)}. \tag{12}$$

Equation

$$\text{Buyers} \qquad \underline{\kappa} \mu_{\underline{n}i} = \overline{\kappa} \mu_{\underline{b}i} + \lambda \mu_{\underline{b}i} \mu_{si} \tag{13}$$

implies

$$\mu_{\underline{b}i} = \frac{\lambda \nu_i \underline{\kappa} \mu_{bi} \mu_{\underline{b}o} \left(-\mu^{cb}_{\overline{h}i} + S - \mu_{si}\right)}{\left(\bar{\kappa} + \underline{\kappa}\right)\left(\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi}\right)\left(\bar{\kappa} + \lambda \mu_{si}\right)}. \tag{14}$$

Combining these equations to compute $\mu_{\overline{s}i}$ we find

$$\mu_{\overline{s}i} = -\frac{\nu_i \mu_{\underline{b}o} \left(-\mu^{cb}_{\overline{h}i} + S - \mu_{si}\right)}{\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi}} - \mu^{cb}_{\overline{s}i} + \mu_{si}. \tag{15}$$

Using equation

$$\text{Sellers} \qquad \overline{\kappa} \mu_{\overline{l}i} + \overline{\kappa} \mu_{\underline{s}i} = \lambda \mu_{bi} \mu_{\overline{s}i} \tag{16}$$

we find

$$\begin{aligned} &\bar{\kappa}\left(-\mu^{cb}_{\overline{h}i} + S - \mu_{si}\right) + \frac{\nu_i \bar{\kappa} \mu_{\underline{b}o} \left(-\mu^{cb}_{\overline{h}i} + S - \mu_{si}\right)}{\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi}} \\ &- \lambda \mu_{bi} \left(-\frac{\nu_i \mu_{\underline{b}o} \left(-\mu^{cb}_{\overline{h}1} + S - \mu_{s1}\right)}{\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi}} - \mu^{cb}_{\overline{s}i} + \mu_{si}\right) = 0 \end{aligned}$$

and we solve for $\mu_{\underline{b}o}$

$$\mu_{\underline{b}o} = -\frac{\left(\bar{\kappa} + \underline{\kappa} + \lambda \mu_{bi}\right)\left(\lambda \mu_{bi} \mu^{cb}_{\overline{s}i} - \bar{\kappa} \mu_{\overline{h}i} + S\bar{\kappa} - \bar{\kappa} \mu_{si} - \lambda \mu_{bi} \mu_{si}\right)}{\nu_i \left(\bar{\kappa} + \lambda \mu_{bi}\right)\left(-\mu^{cb}_{\overline{h}i} + S - \mu_{si}\right)}. \tag{17}$$

Simplifying equation (15) we find

$$\mu_{\overline{s}i} = \frac{\bar{\kappa}\left(-\mu^{cb}_{\overline{h}i} - \mu^{cb}_{\overline{s}i} + S\right)}{\bar{\kappa} + \lambda \mu_{bi}}. \tag{18}$$

Equation

$$\text{Central bank seller} \qquad \overline{\kappa}^{cb} \mu_{\overline{h}i} = \lambda \mu_{bi} \mu^{cb}_{\overline{s}i} \tag{19}$$

implies

$$\mu^{cb}_{\overline{s}i} = \frac{\overline{\kappa}^{cb} \mu_{\overline{h}i}}{\lambda \mu_{bi}}. \tag{20}$$

Using equation (9) to compute $\mu_{\underline{b}o}$ we find

$$\mu_{\underline{b}o} = \frac{\underline{F}\left(\bar{\kappa} + \underline{\kappa}\right)}{\underline{\kappa}\left(-\nu_i \mu_{\overline{h}i} - \nu_2 \mu_{\overline{h}2} + \bar{\kappa} + \underline{\kappa} + \nu_2 S - \nu_2 \mu_{s2} + \nu_1 S - \nu_1 \mu_{s1}\right)}. \tag{21}$$

We use

$$\text{Buyers} \qquad \overline{F} = \overline{\kappa} \mu_{\overline{b}} + \sum_{i=1}^{2} \lambda \mu_{si} \mu_{\overline{b}} \tag{22}$$

to compute $\mu_{\overline{b}}$ using $\mu_{si} = \mu_{\overline{s}i} + \mu^{cb}_{\overline{s}i} + \mu_{\underline{s}i}$ and equations (18), (20) and (10).

We use

$$\text{Central bank buyer} \qquad \overline{F}^{cb} = \overline{\kappa}^{cb}\mu_{\overline{b}}^{cb} + \sum_{i=1}^{2} \lambda \mu_{si}\mu_{\overline{b}}^{cb} \tag{23}$$

to compute $\mu_{\overline{b}}^{cb}$ using $\mu_{si} = \mu_{\overline{s}i} + \mu_{\overline{s}i}^{cb} + \mu_{\underline{s}i}$ and equations (18), (20) and (10).

The reduced system consists of

$$\begin{aligned}
\mu_{si} &= \mu_{\overline{s}i} + \mu_{\overline{s}i}^{cb} + \mu_{\underline{s}i} \\
\mu_{bi} &= \mu_{\overline{b}i} + \mu_{\overline{b}i}^{cb} + \mu_{\underline{b}i} \\
\lambda \mu_{si}\mu_{\overline{b}}^{cb} &= \overline{\kappa}^{cb}\mu_{\overline{h}i}^{cb},
\end{aligned}$$

where the latter equation corresponds to the central bank holder transition equation. These are six equations (because one is for each asset), and the six unknowns are $\left\{\mu_{si}, \mu_{bi}, \mu_{\overline{h}i}^{cb}\right\}_{i\in\{1,2\}}$. The system is numerically solved using Mathematica.

3. Panel regressions

Table 3 **Panel Stationary Test -** This table reports the results of the Fisher stationary test whose null hypothesis is that all the panels contain a unit root for the SMP purchase, repo imbalance, specialness, cash imbalance, bid-ask spread, available for lending variables and CDS bond (log) over the sample 8 August 2011 - 21 December 2011.

	SMP purchase		Repo imbalance		Specialness	
	Statistic	P-value	Statistic	P-value	Statistic	P-value
Inverse chi-squared	393.26	0.00	305.43	0.00	187.92	0.00
Inverse normal	-15.36	0.00	-13.01	0.00	-8.30	0.00
Inverse logit t	-19.43	0.00	-15.02	0.00	-8.74	0.00
Modified inv. chi-squared	29.74	0.00	21.86	0.00	11.30	0.00
	Cash imbalance		Bid-ask spread		Lending	
	Statistic	P-value	Statistic	P-value	Statistic	P-value
Inverse chi-squared	70.26	0.00	300.23	0.00	305.89	0.00
Inverse normal	-4.42	0.00	-13.07	0.00	-12.77	0.00
Inverse logit t	-4.83	0.00	-15.07	0.00	-15.05	0.00
Modified inv. chi-squared	6.67	0.00	21.93	0.00	21.90	0.00
	CDS bond (log)					
	Statistic	P-value				
Inverse chi-squared	136.140	0.00				
Inverse normal	-6.23	0.00				
Inverse logit t	-6.15	0.00				
Modified inv. chi-squared	6.65	0.00				

Table 4 **Correlation matrix -** This table reports the correlation matrix of all the variables used in the analysis. The statistics are reported for the full sample and the second period. Specialness and repo imbalance are based on spot next (SN) and tomorrow next (TN) transactions.The second period: from 8 August 2011 to 21 December 2011.

	Special.	Repo imbalance	Imbalance cash	Bid-ask spread	Lend.	SMP purchase	Fail-to-deliver	CDS bond (Log)
Full sample								
Specialness	1.000							
Repo imb.	0.091	1.000						
Cash imb.	-0.022	-0.011	1.000					
Bid-ask	-0.012	-0.008	0.027	1.000				
Lending	-0.138	0.044	0.013	-0.040	1.000			
SMP purch.	0.069	0.004	0.014	-0.006	-0.030	1.000		
Fail-to-deliver	0.434	0.122	-0.034	-0.017	-0.073	0.005	1.000	
CDS bond (log)	0.198	-0.068	0.008	-0.017	-0.127	0.108	0.049	1.000
2nd period								
Specialness	1.000							
Repo imb.	0.155	1.000						
Cash imb.	-0.015	-0.054	1.000					
Bid-ask	-0.023	-0.006	0.010	1.000				
Lending	-0.181	-0.007	0.024	-0.033	1.000			
SMP purch.	0.050	0.048	0.040	-0.023	-0.032	1.000		
Fail-to-deliver	0.346	0.169	-0.061	-0.010	-0.051	0.016	1.000	
CDS bond (log)	0.220	-0.074	0.002	0.005	-0.184	-0.013	0.006	1.000

Table 5 **Specialness and SMP purchases with CCP margin instead of CDS bond** - The table shows the results of OLS (Columns $(1)-(2)$) and quantile (Columns $(3)-(4)$) panel regressions with bond fixed effects. Specialness is expressed in basis points and is based on spot next (SN) and tomorrow next (TN) transactions. The repo imbalance is based on spot next (SN) and tomorrow next (TN) transactions. The repo imbalance, cash imbalance, available for lending and SMP purchase variables are rescaled by the nominal outstanding amount of the bond, expressed in percentage terms and are lagged by one day (see Section 3.1 for details). Bond time-to-maturity denotes the time-to-maturity of a specific security. Bid-ask spread denotes the bid-ask spread based on BGN Bloomberg prices at or before 5pm. D. Auction is a dummy variable to control for the date of a primary issuance of the security. CCP margins variable is bond-specific and lagged by one day. In Column (2) the observations on the $10-$ year on-the-run bonds are excluded from the sample. Standard errors are in parenthesis and are clustered by bond identifier (Columns $(1)-(2)$)). The results are reported for the sub-period 8 August 2011 - 21 December 2011. Stars denote statistical significance at 10% $(*)$, 5% $(**)$ and 1% $(***)$.

	(1) OLS	(2) OLS	(3) Q-70	(4) Q-90
Specialness (lag)	0.802***	0.800***		
	(0.090)	(0.099)		
Repo imbalance	1.133**	0.569	0.954***	4.007***
	(0.525)	(0.347)	(0.257)	(0.688)
Cash imbalance	-1.986***	-1.336***	-2.671***	-5.034*
	(0.738)	(0.472)	(1.004)	(2.685)
Avail. lending	-0.466**	-0.477**	-1.790***	-3.088***
	(0.202)	(0.207)	(0.185)	(0.495)
Bond time-to-mat.	-0.082	-0.077	-0.351***	0.068
	(0.065)	(0.067)	(0.092)	(0.246)
D. Auction	-8.785***	-7.815***	-8.536	-18.271
	(2.677)	(2.865)	(6.724)	(17.986)
Bid-ask spread	-0.005	-0.009	-0.017	-0.136
	(0.024)	(0.023)	(0.107)	(0.286)
CCP margin	45.536**	43.956**	203.309***	173.414***
	(18.173)	(18.953)	(17.850)	(47.743)
SMP purchase	4.614***	5.169***	5.060***	15.610***
	(0.803)	(1.576)	(1.428)	(3.819)
Constant	5.890**	5.869**	29.795***	58.995***
	(2.645)	(2.807)	(1.091)	(2.918)
R^2	0.745	0.739		
Num. Obs.	4830	4742	4830	4830

4. Panel VAR

4.1. Alternative ordering: SMP purchase ordered last

Panel A - CDS bond

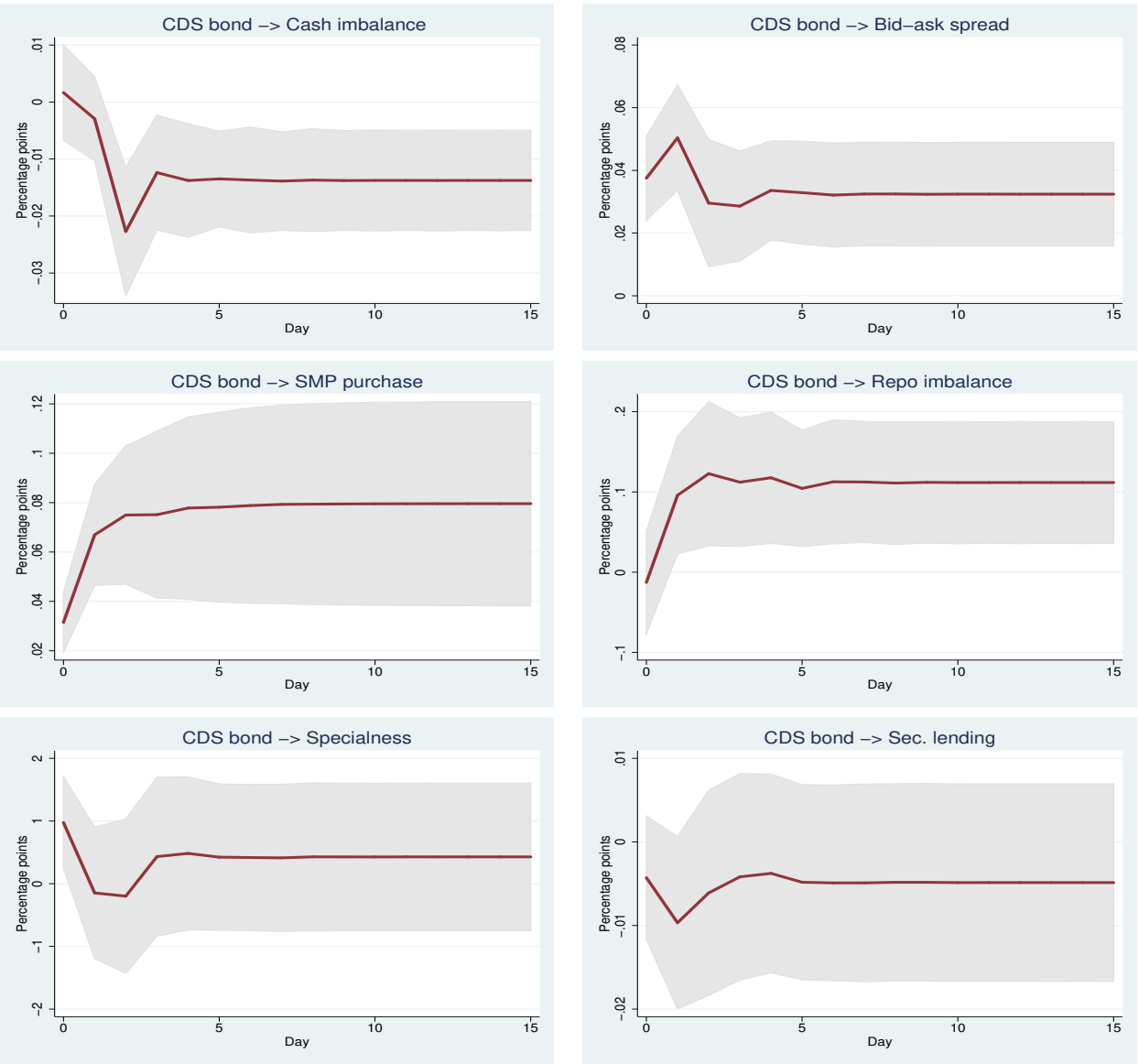

Fig. 1. **Panel VAR Cumulative IRFs - CDS bond** The figure plots the cumulative impulse response functions to a CDS bond shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel B - Cash imbalance

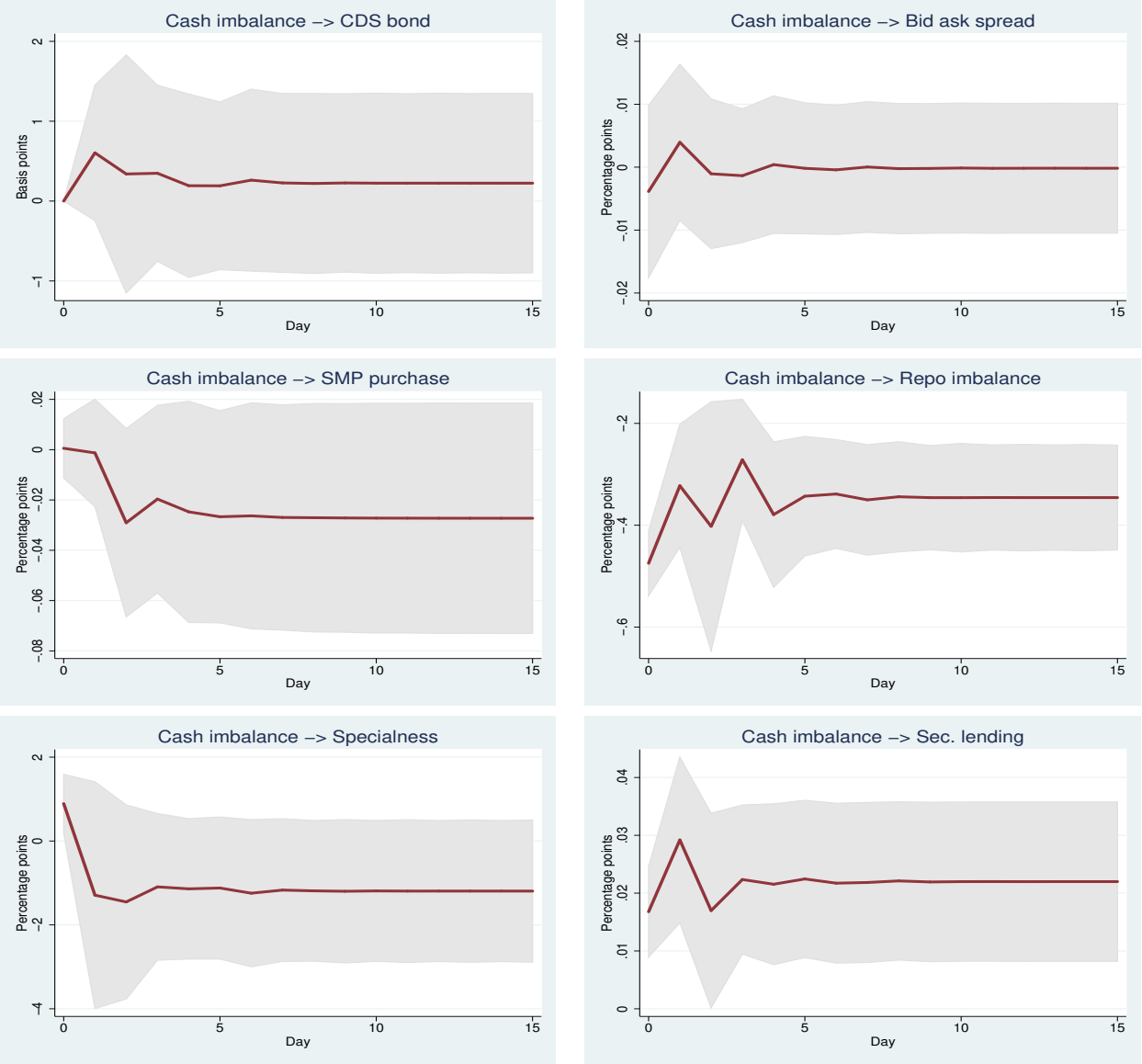

Fig. 2. **Panel VAR Cumulative IRFs - Cash imbalance** The figure plots the cumulative impulse response functions to a cash imbalance shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel C - Bid-ask spread

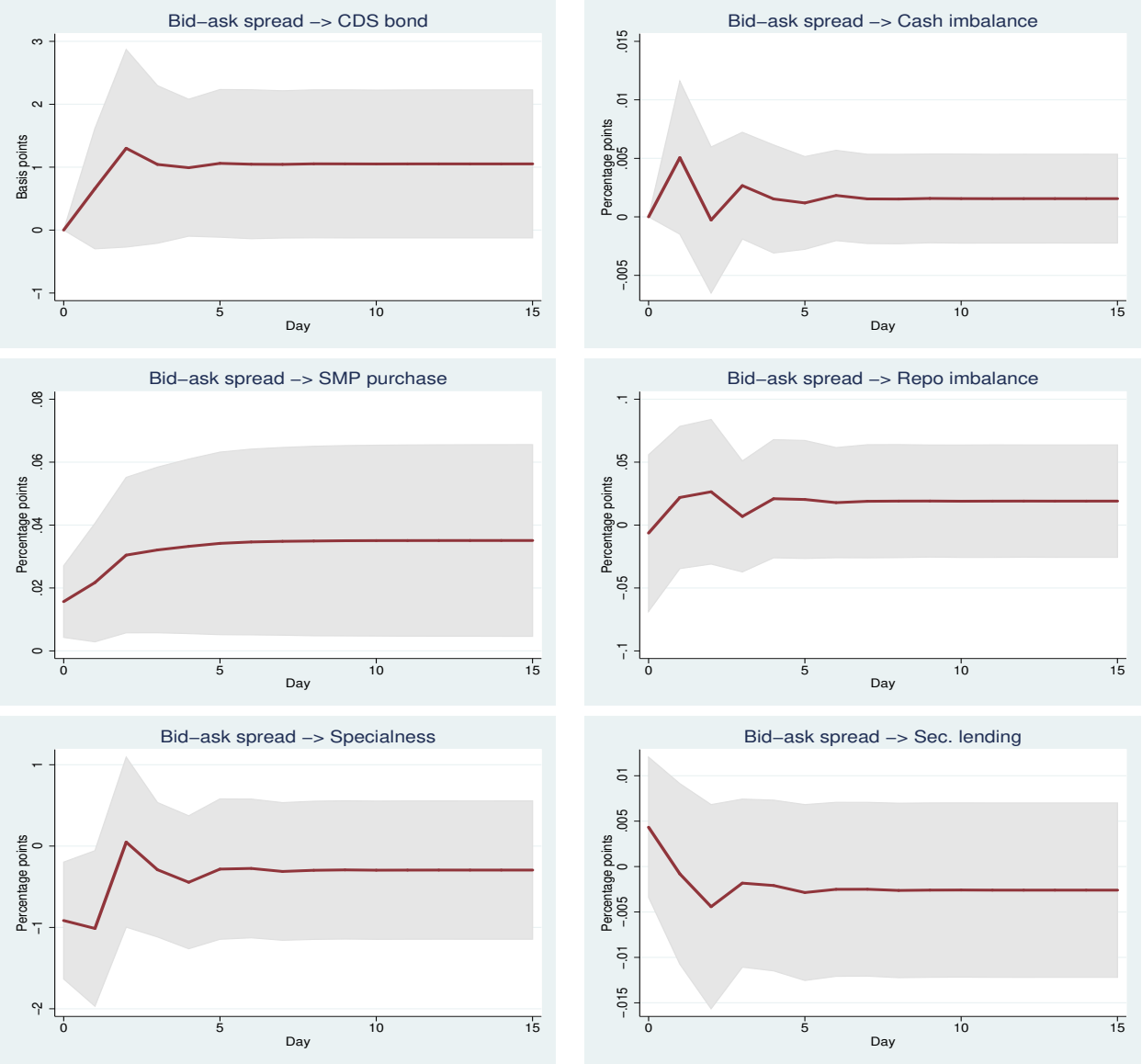

Fig. 3. **Panel VAR Cumulative IRFs - Bid-ask spread** The figure plots the cumulative impulse response functions to a bid-ask spread shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel D - SMP purchase

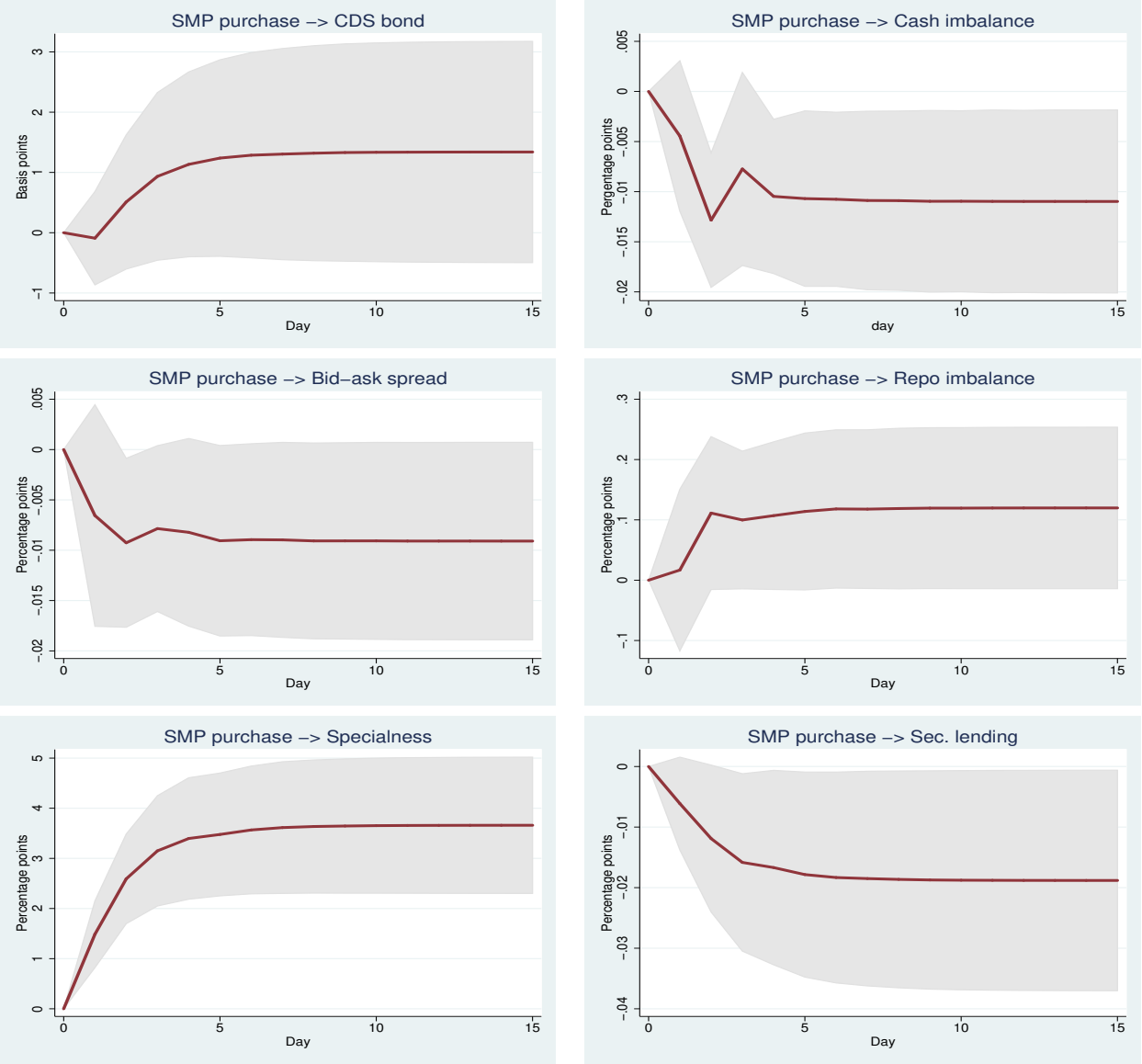

Fig. 4. **Panel VAR Cumulative IRFs - SMP purchase** The figure plots the cumulative impulse response functions to a SMP purchase shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel E - Repo imbalance

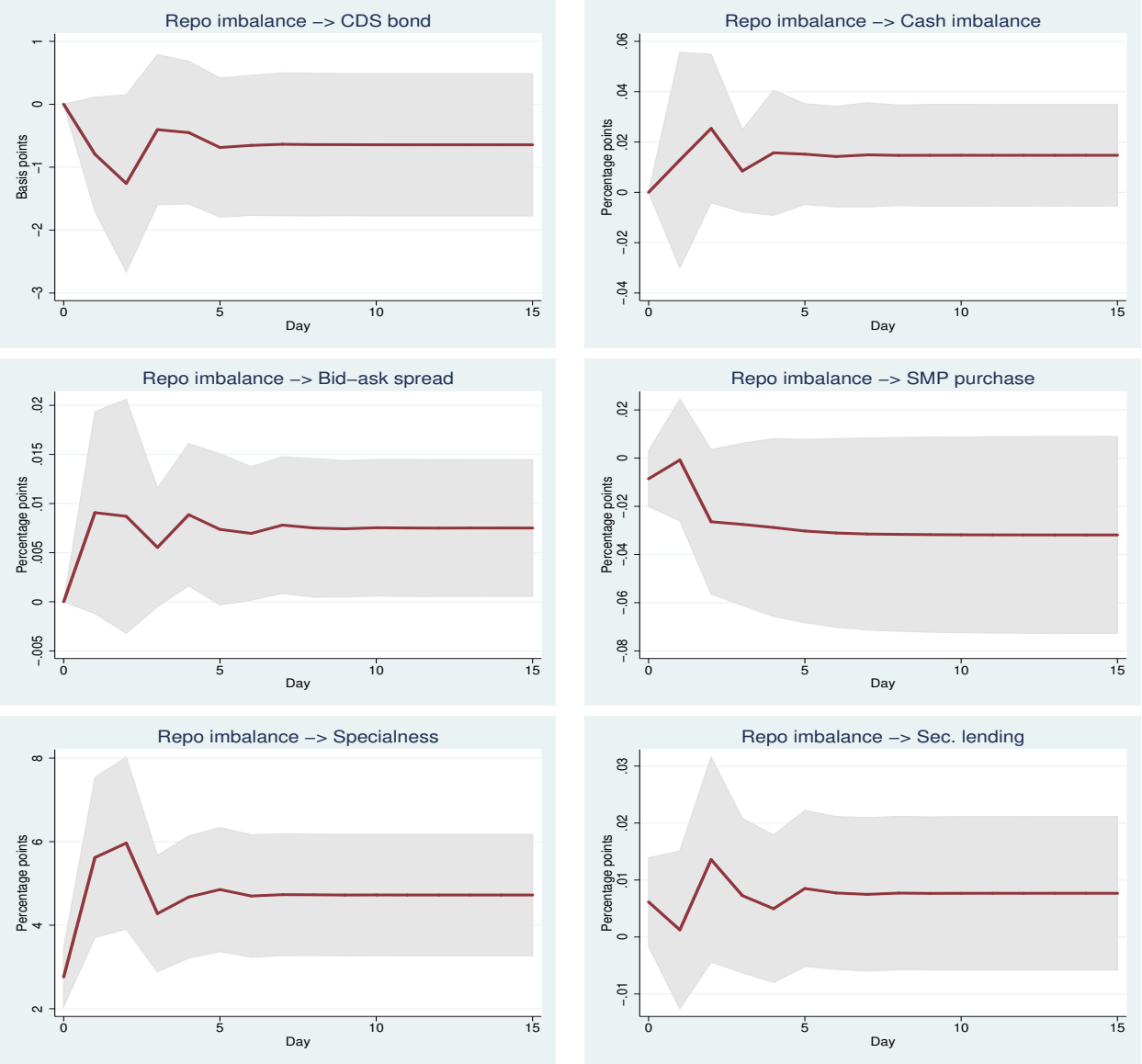

Fig. 5. **Panel VAR Cumulative IRFs - Repo imbalance** The figure plots the cumulative impulse response functions to a repo imbalance shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel F - Specialness

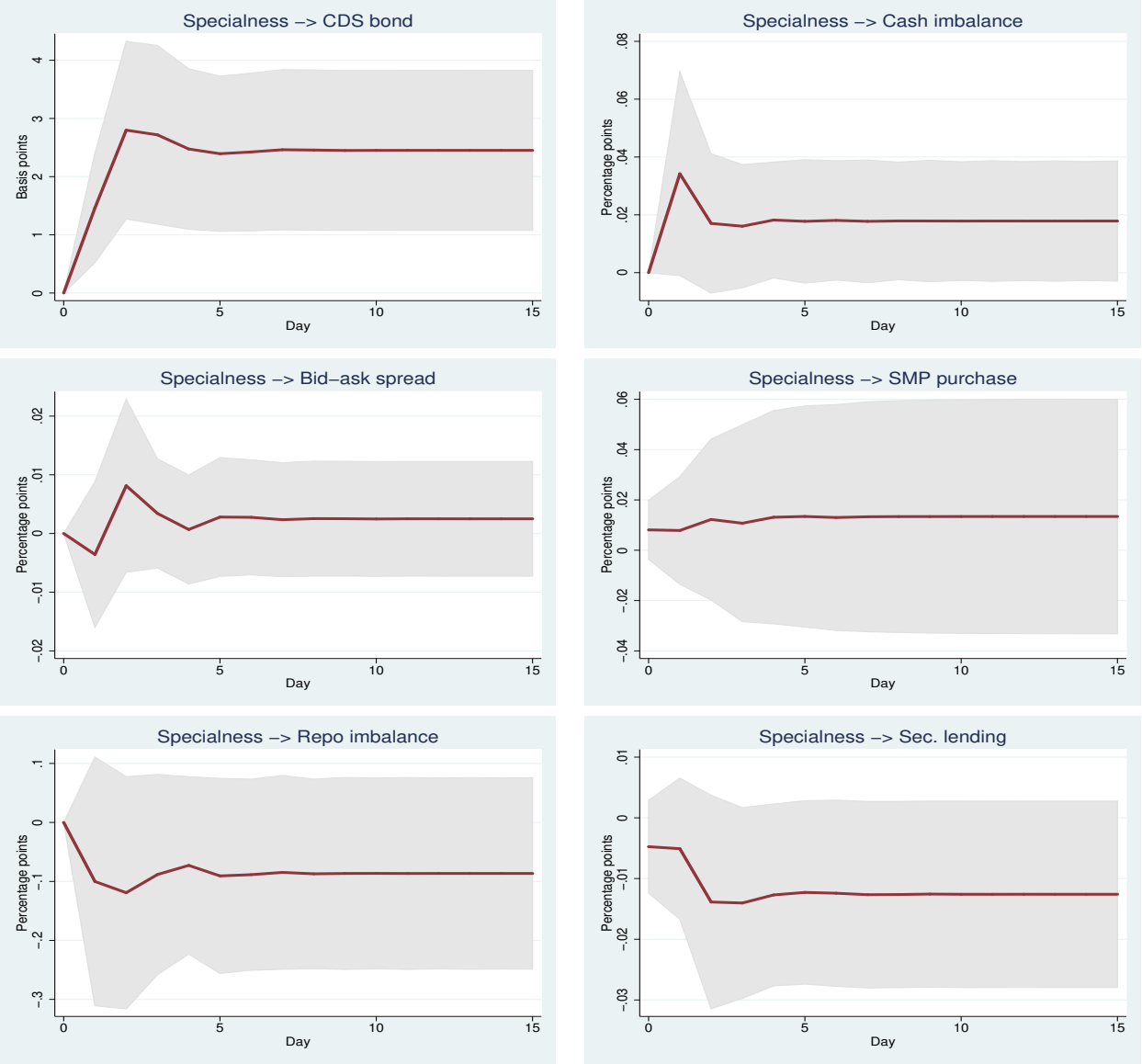

Fig. 6. **Panel VAR Cumulative IRFs - Specialness** The figure plots the cumulative impulse response functions to a specialness shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel G - Available lending

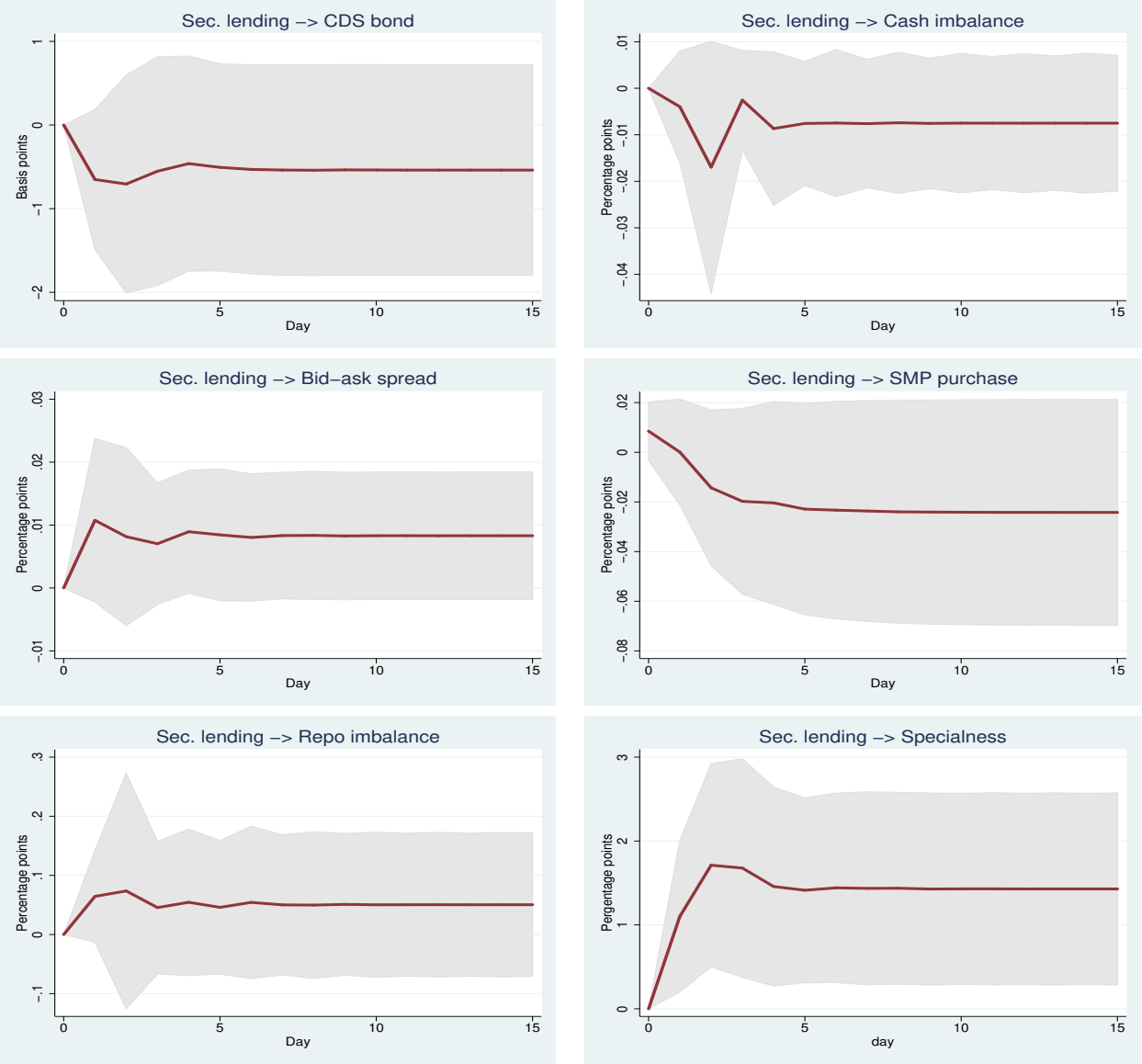

Fig. 7. **Panel VAR Cumulative IRFs - Available lending** The figure plots the cumulative impulse response functions to a available for lending shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

4.2. Without 10-year on-the-run bonds

Panel A - CDS bond

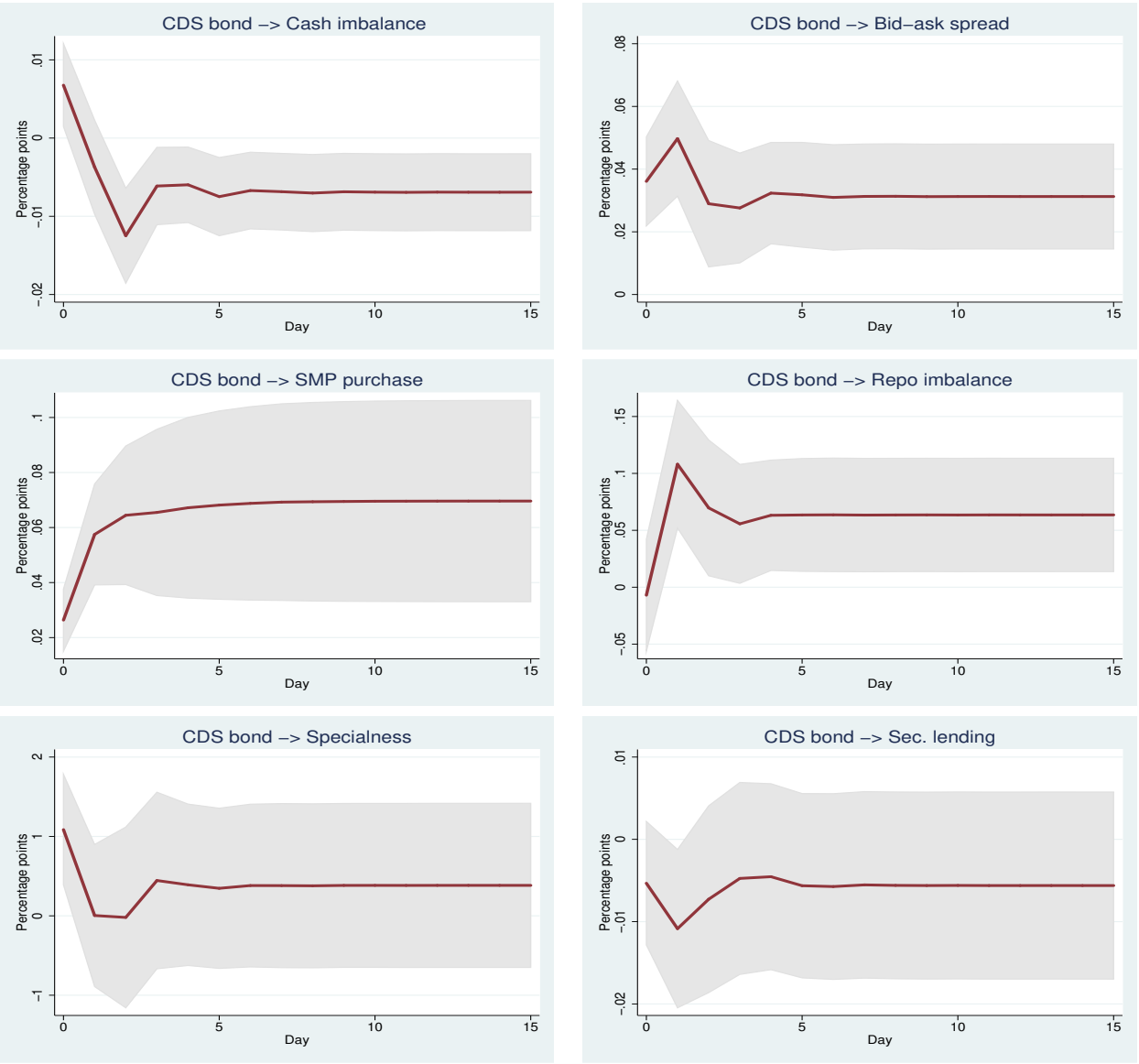

Fig. 8. **Panel VAR Cumulative IRFs - CDS bond** The figure plots the cumulative impulse response functions to a CDS bond shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel B - Cash imbalance

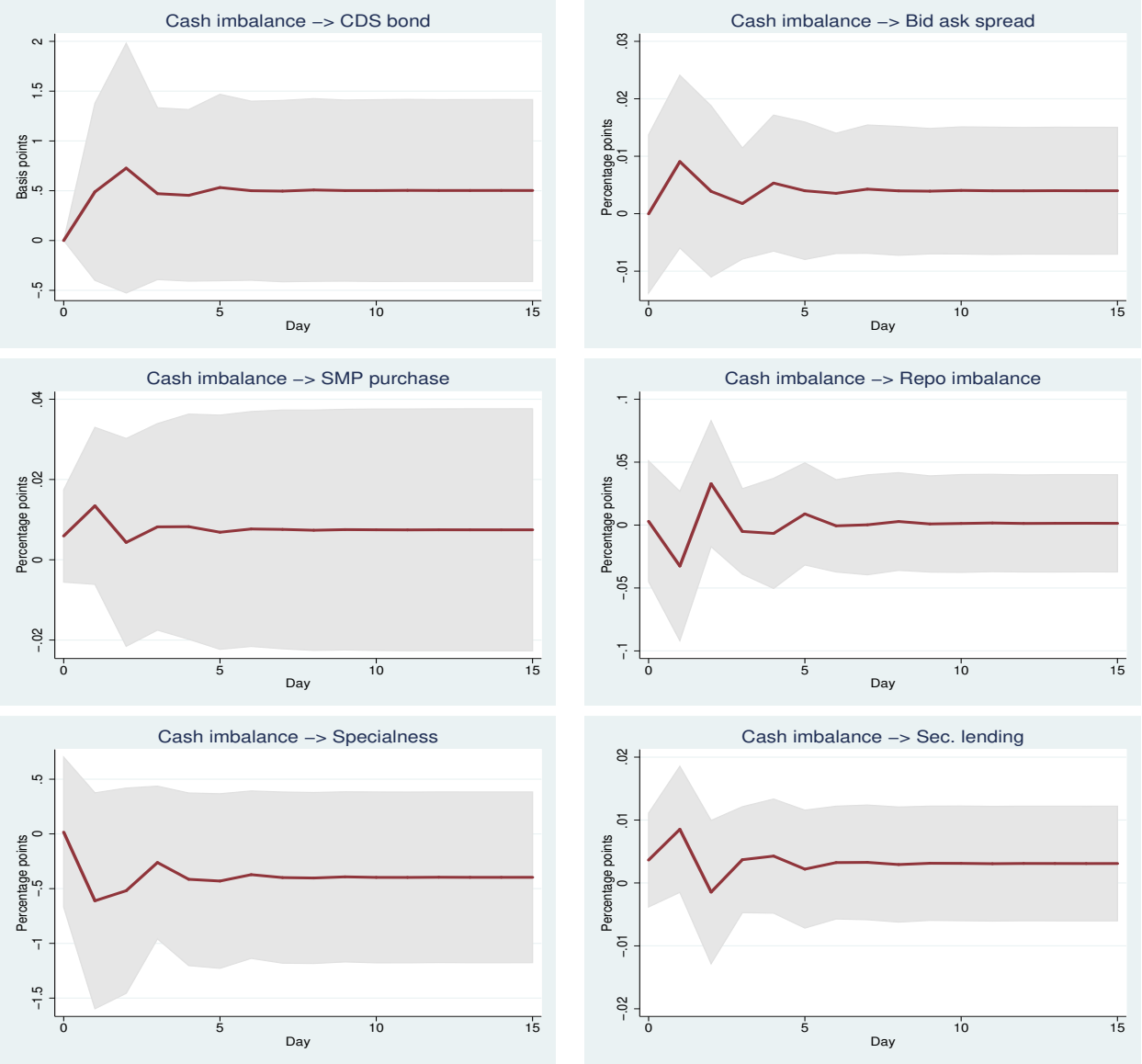

Fig. 9. **Panel VAR Cumulative IRFs - Cash imbalance** The figure plots the cumulative impulse response functions to a cash imbalance shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel C - Bid-ask spread

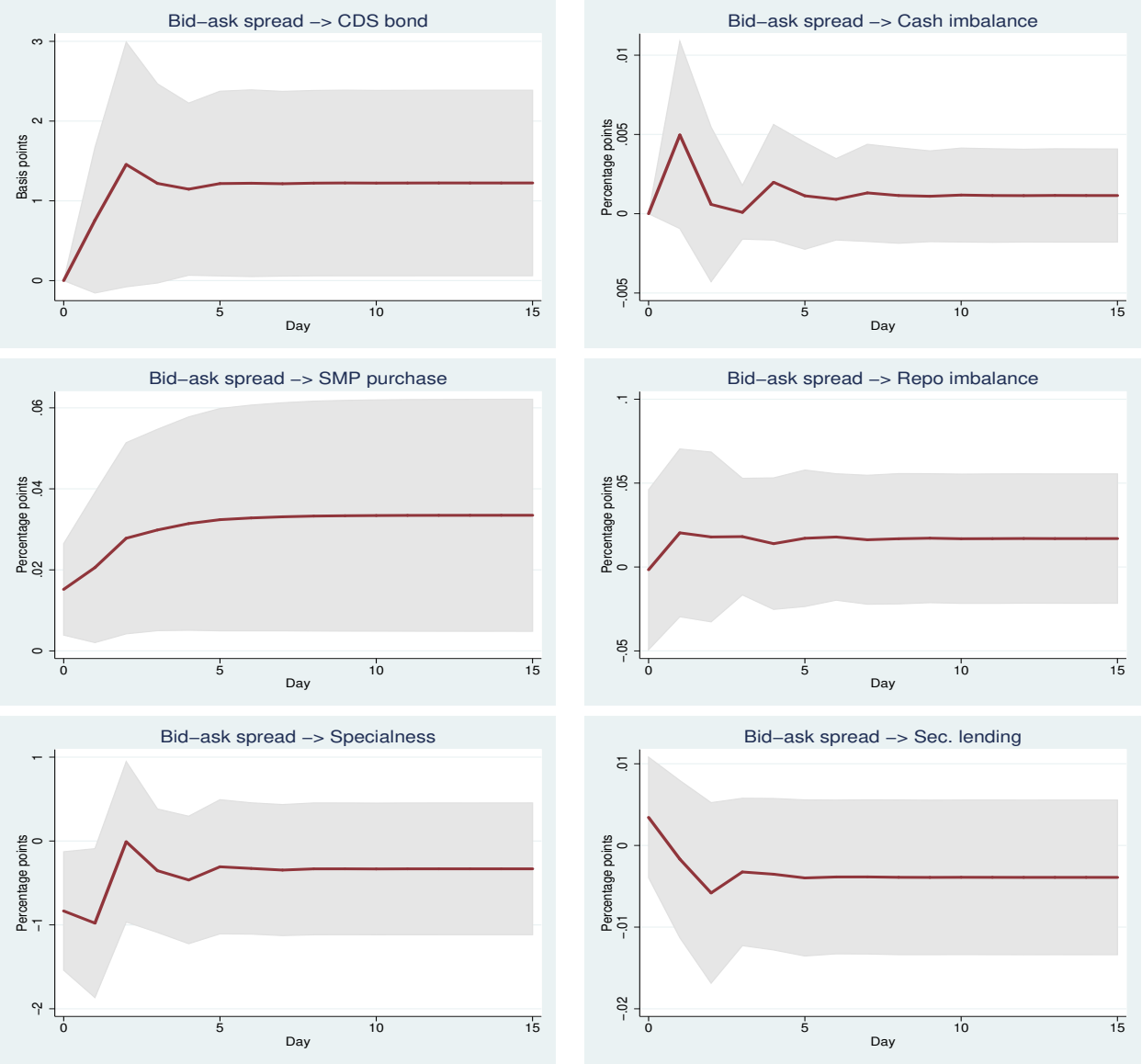

Fig. 10. **Panel VAR Cumulative IRFs - Bid-ask spread** The figure plots the cumulative impulse response functions to a bid-ask spread shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel D - SMP purchase

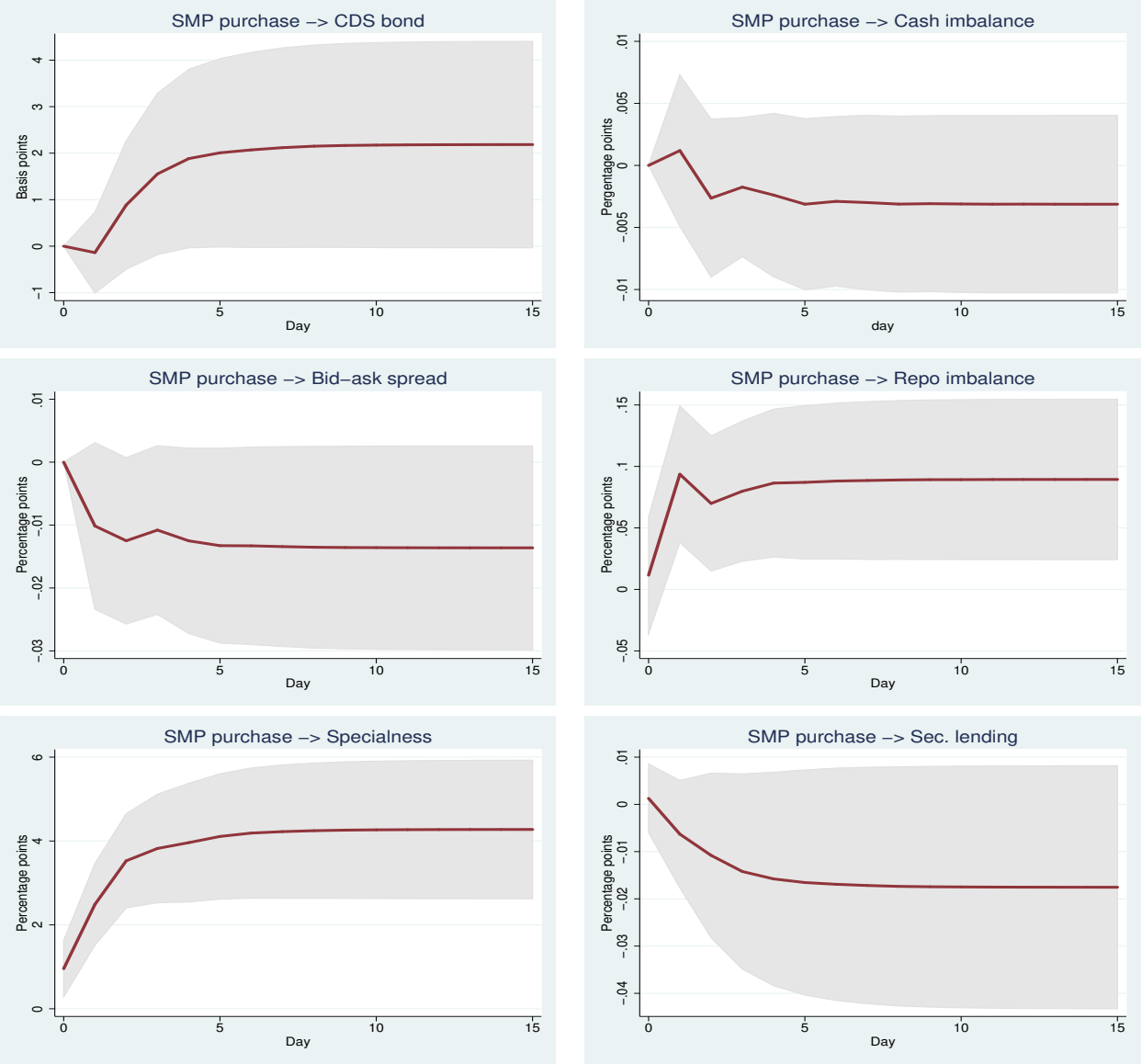

Fig. 11. **Panel VAR Cumulative IRFs - SMP purchase** The figure plots the cumulative impulse response functions to a SMP purchase shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel E - Repo imbalance

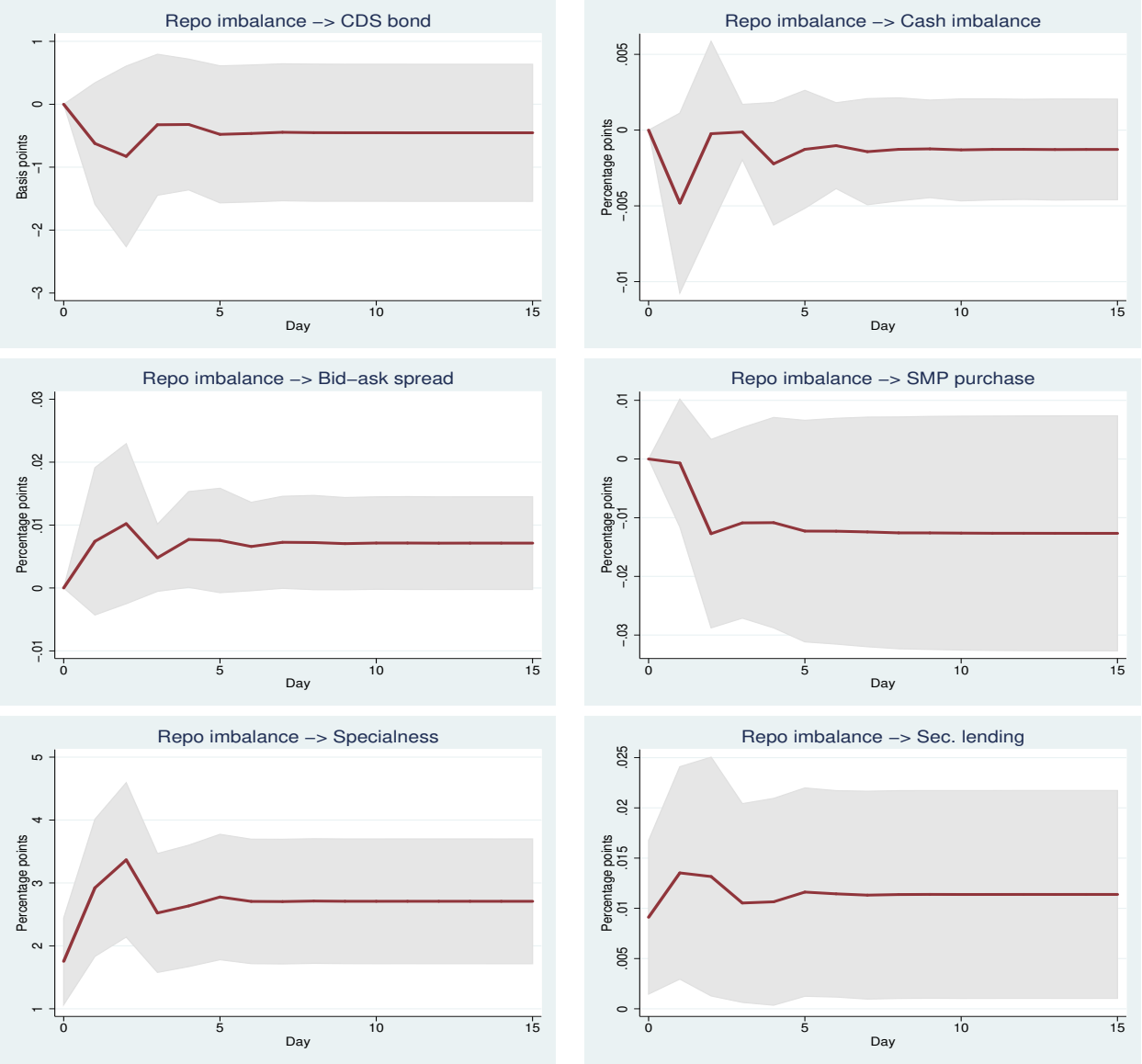

Fig. 12. **Panel VAR Cumulative IRFs - Repo imbalance** The figure plots the cumulative impulse response functions to a repo imbalance shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel F - Specialness

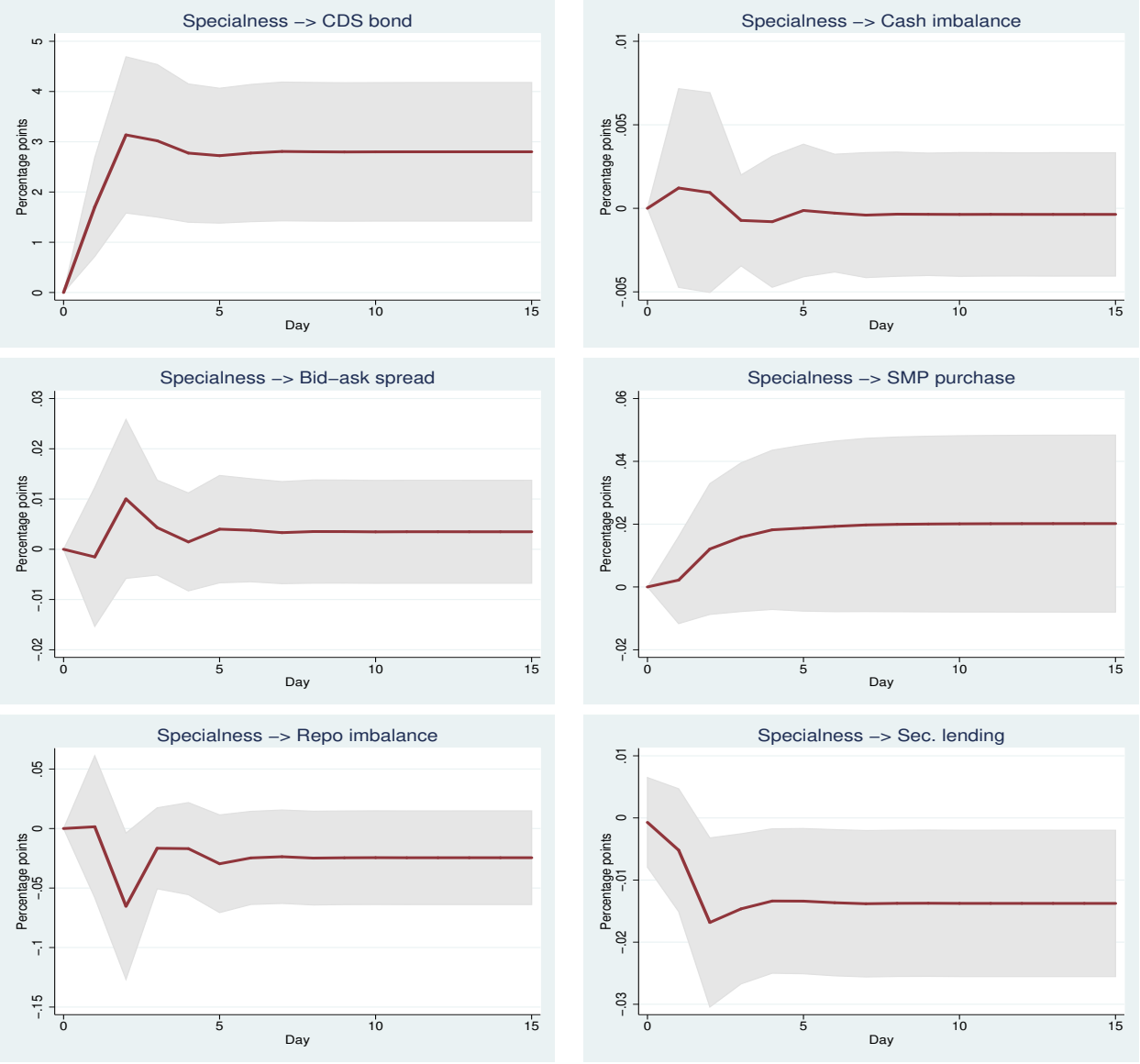

Fig. 13. **Panel VAR Cumulative IRFs - Specialness** The figure plots the cumulative impulse response functions to a specialness shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel G - Available lending

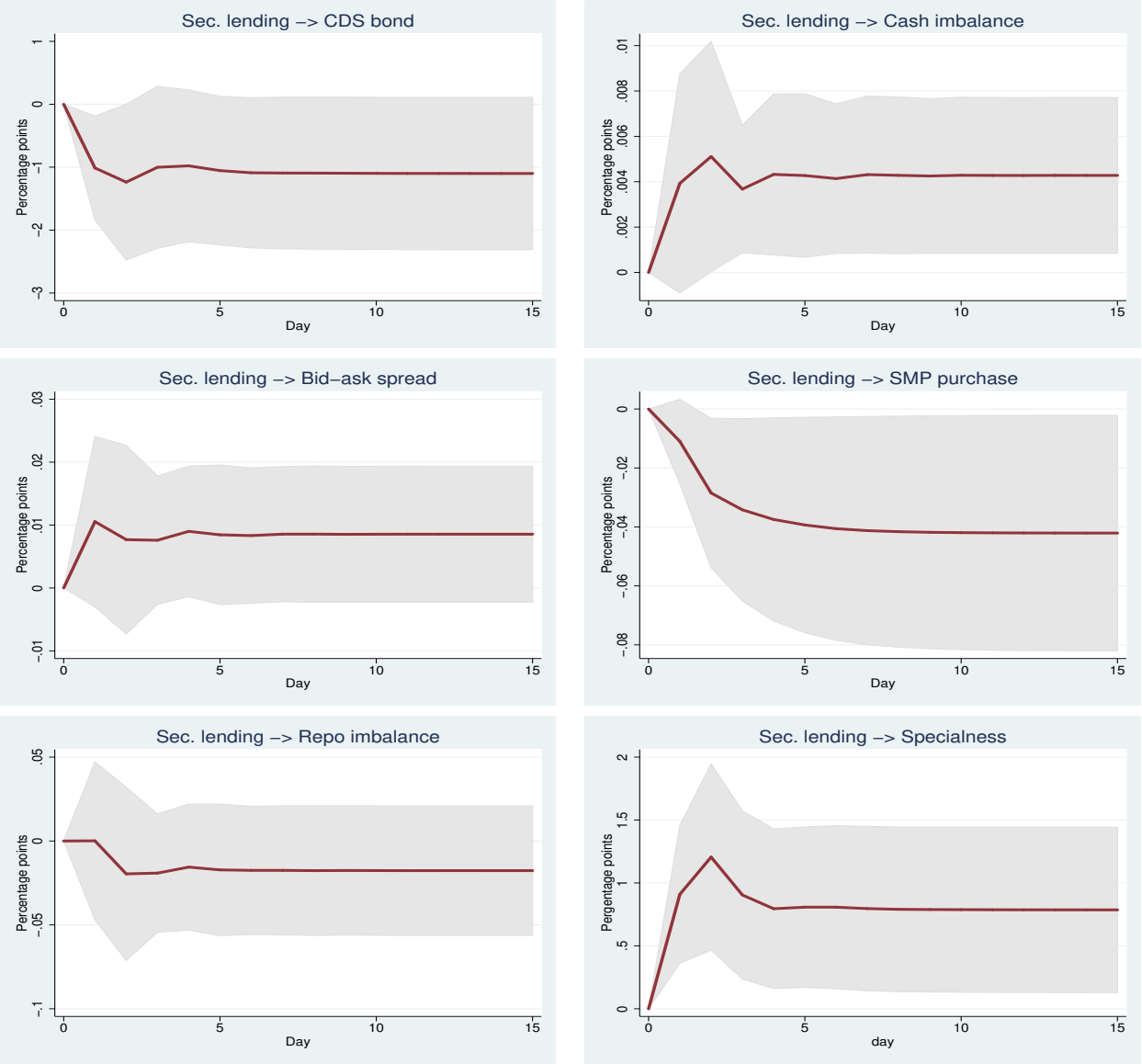

Fig. 14. **Panel VAR Cumulative IRFs - Available lending** The figure plots the cumulative impulse response functions to a available for lending shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CDS bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

4.3. CCP margin (instead of CDS bond)

Panel A - CCP margin

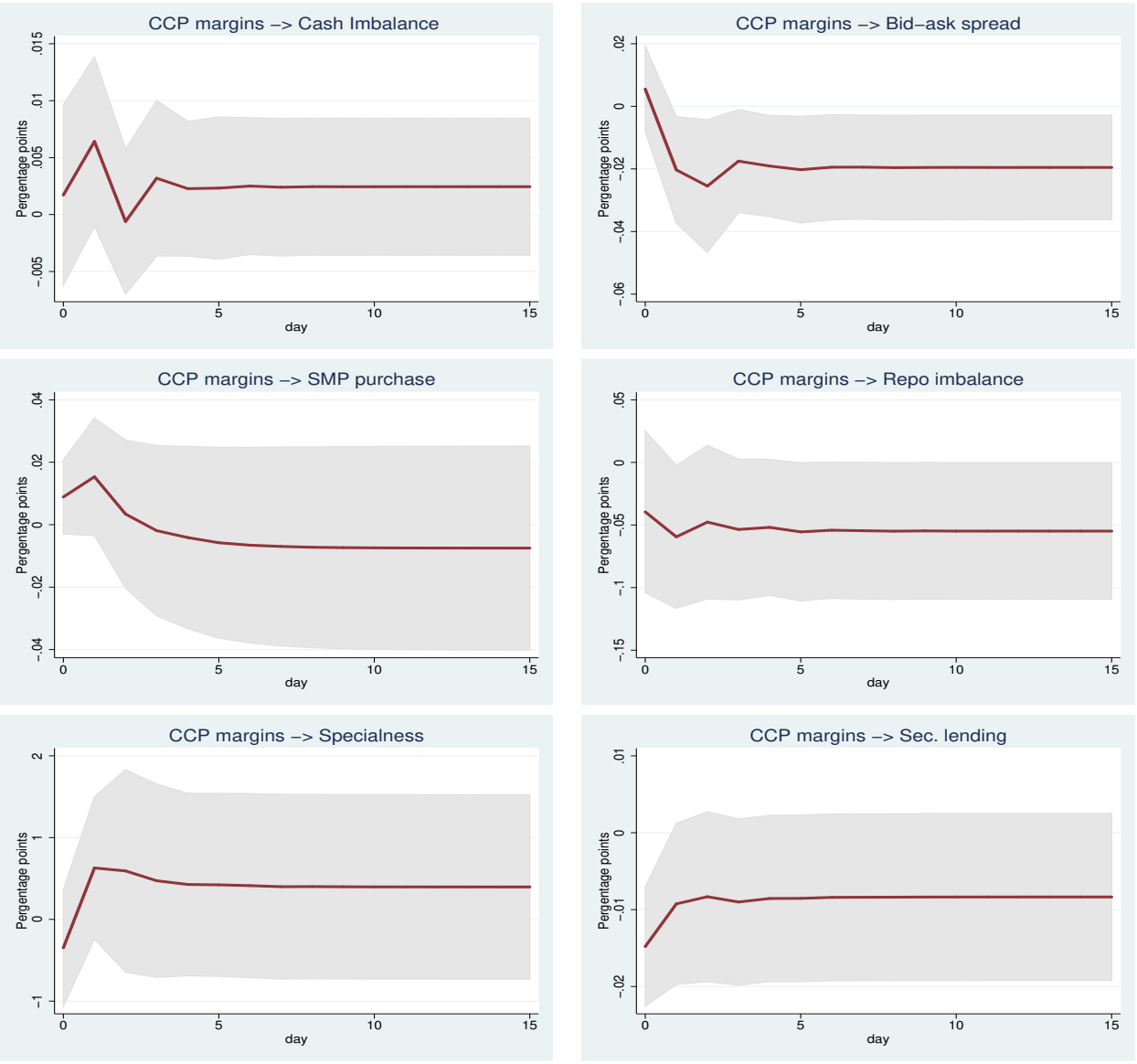

Fig. 15. **Panel VAR Cumulative IRFs - CCP margin** The figure plots the cumulative impulse response functions to a CCP margin shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP bond, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel B - Cash imbalance

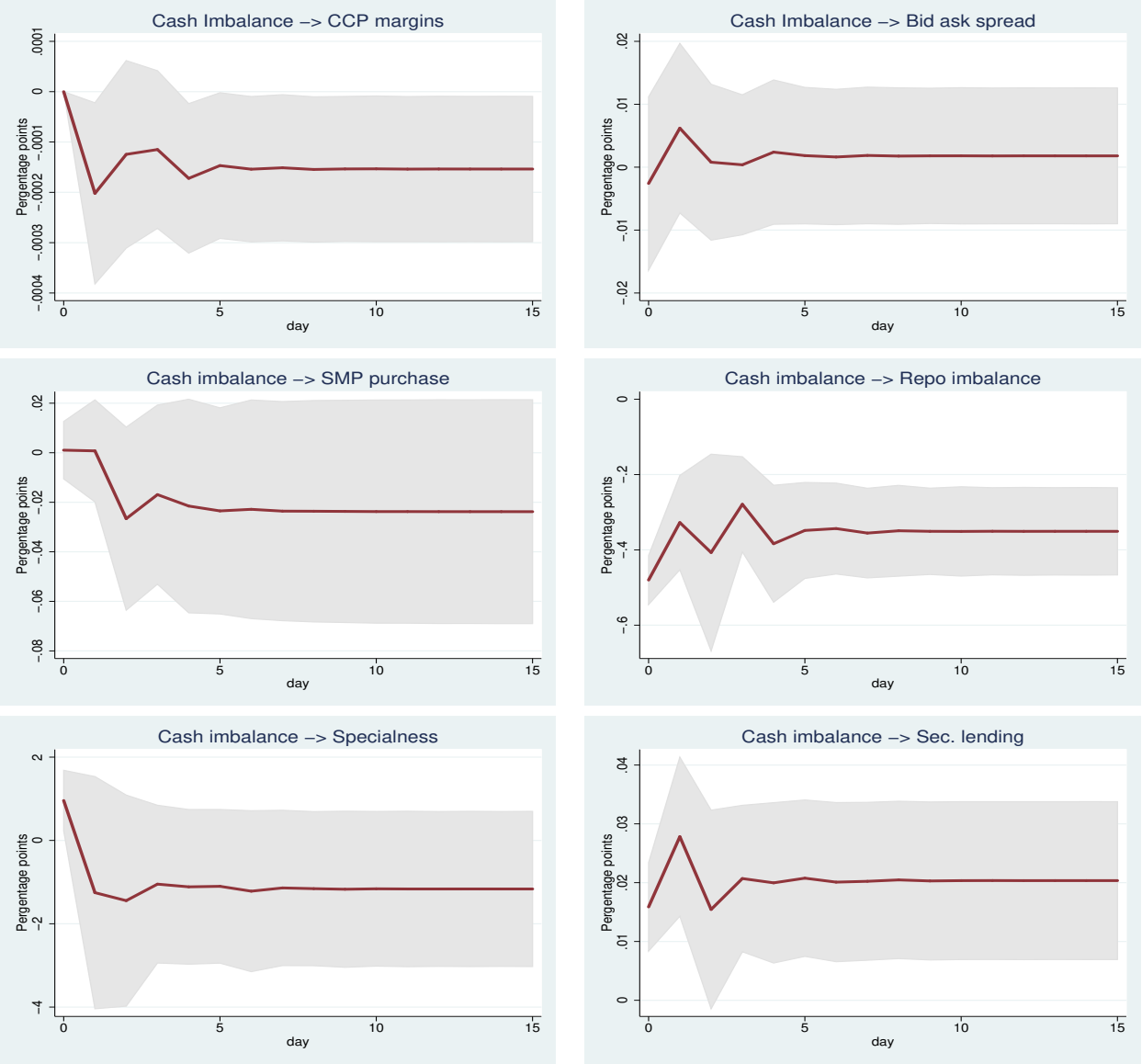

Fig. 16. **Panel VAR Cumulative IRFs - Cash imbalance** The figure plots the cumulative impulse response functions to a cash imbalance shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP margin, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel C - Bid-ask spread

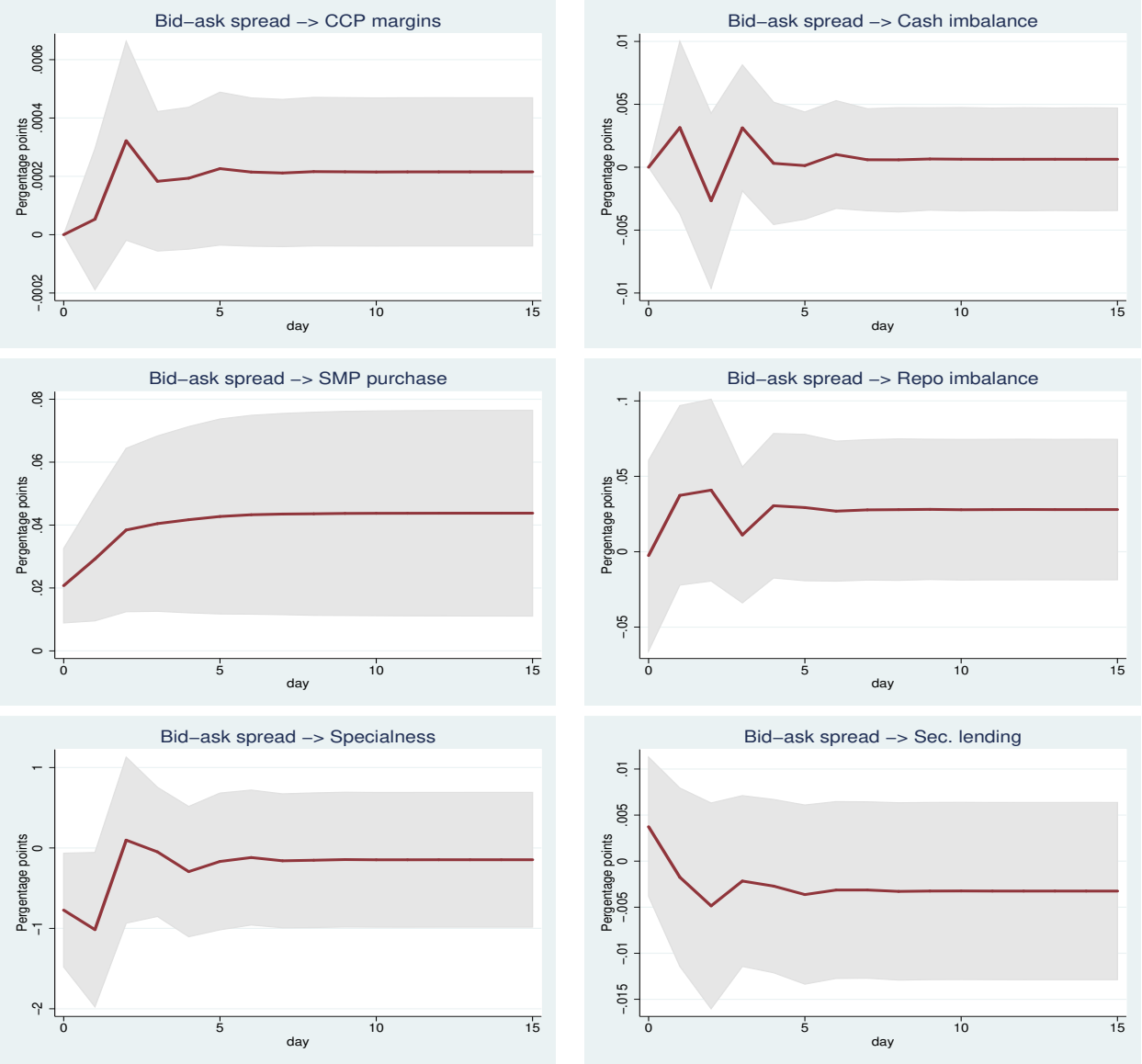

Fig. 17. **Panel VAR Cumulative IRFs - Bid-ask spread** The figure plots the cumulative impulse response functions to a bid-ask spread shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP margin, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel D - SMP purchase

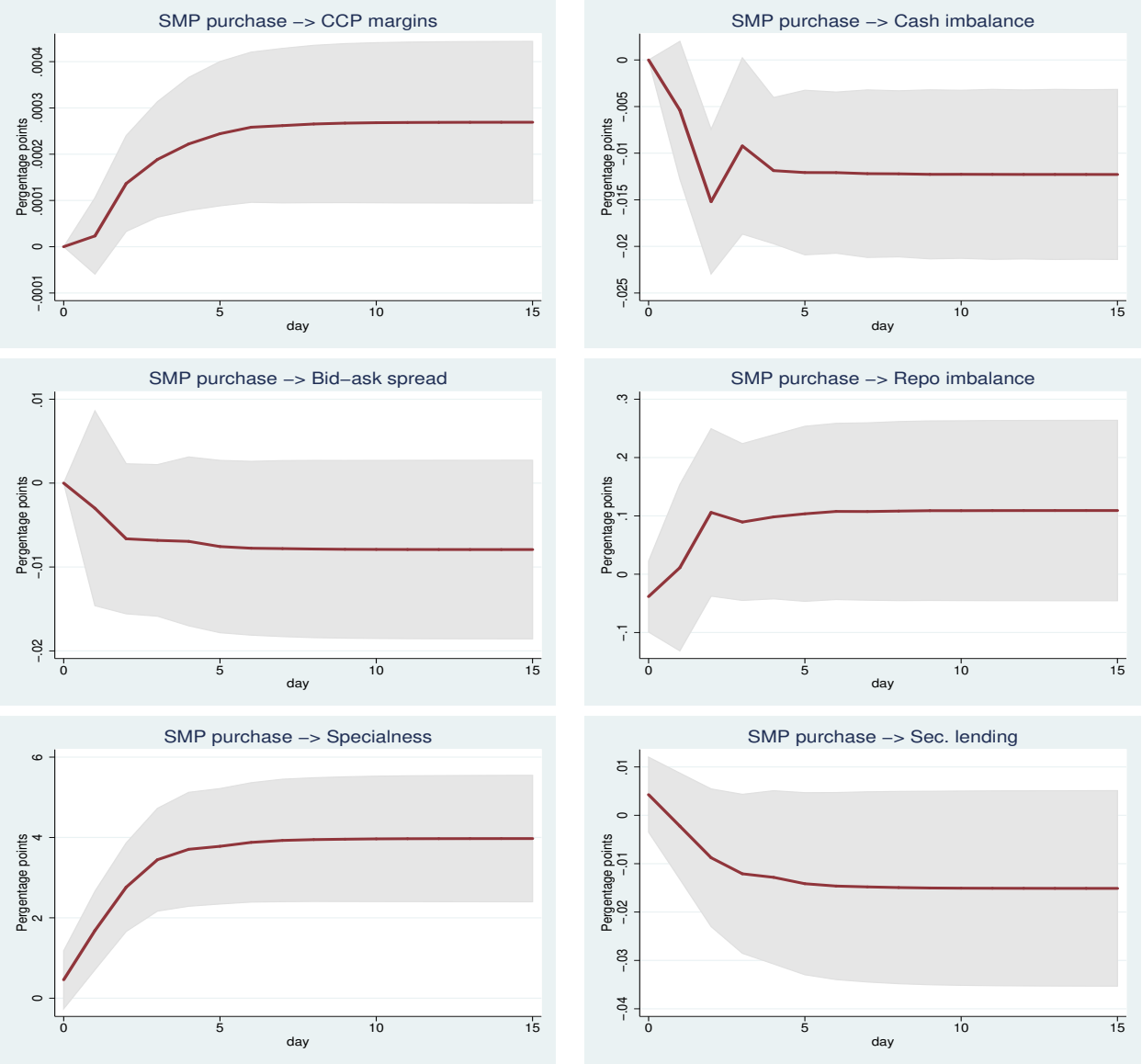

Fig. 18. **Panel VAR Cumulative IRFs - SMP purchase** The figure plots the cumulative impulse response functions to a SMP purchase shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP margin, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel E - Repo imbalance

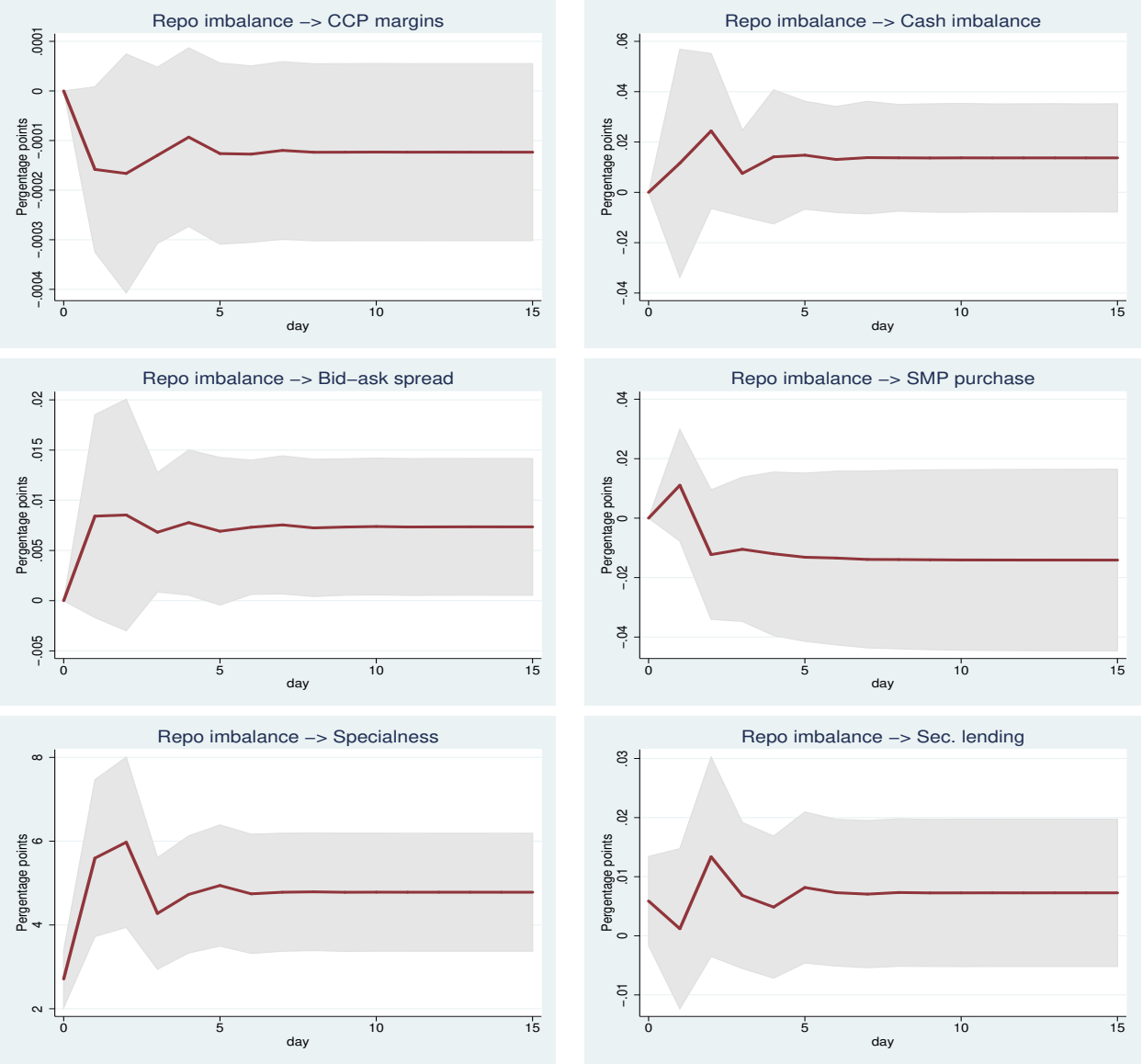

Fig. 19. **Panel VAR Cumulative IRFs - Repo imbalance** The figure plots the cumulative impulse response functions to a repo imbalance shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP margin, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel F - Specialness

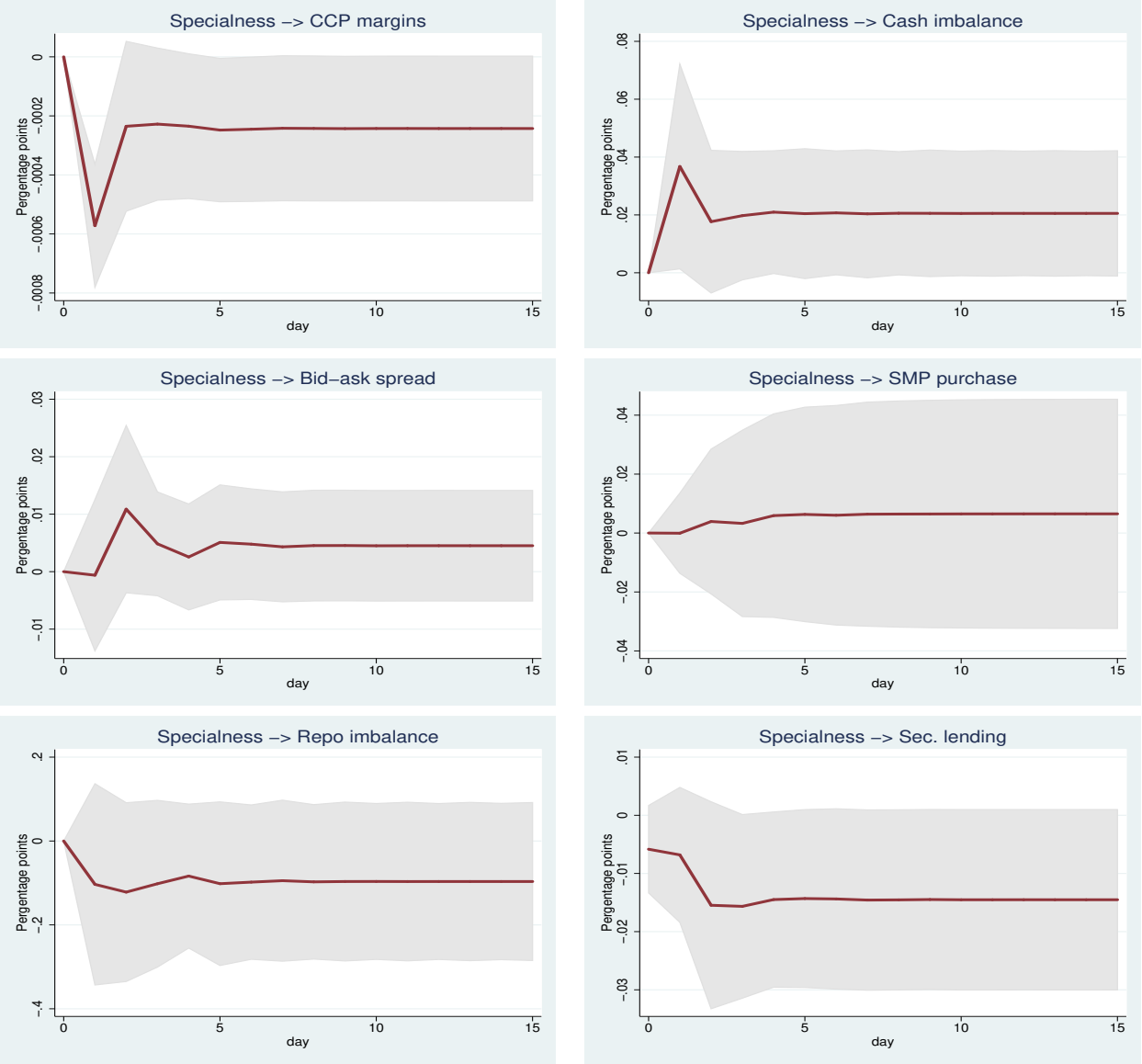

Fig. 20. **Panel VAR Cumulative IRFs - Specialness** The figure plots the cumulative impulse response functions to a specialness shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP margin, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.

Panel G - Available lending

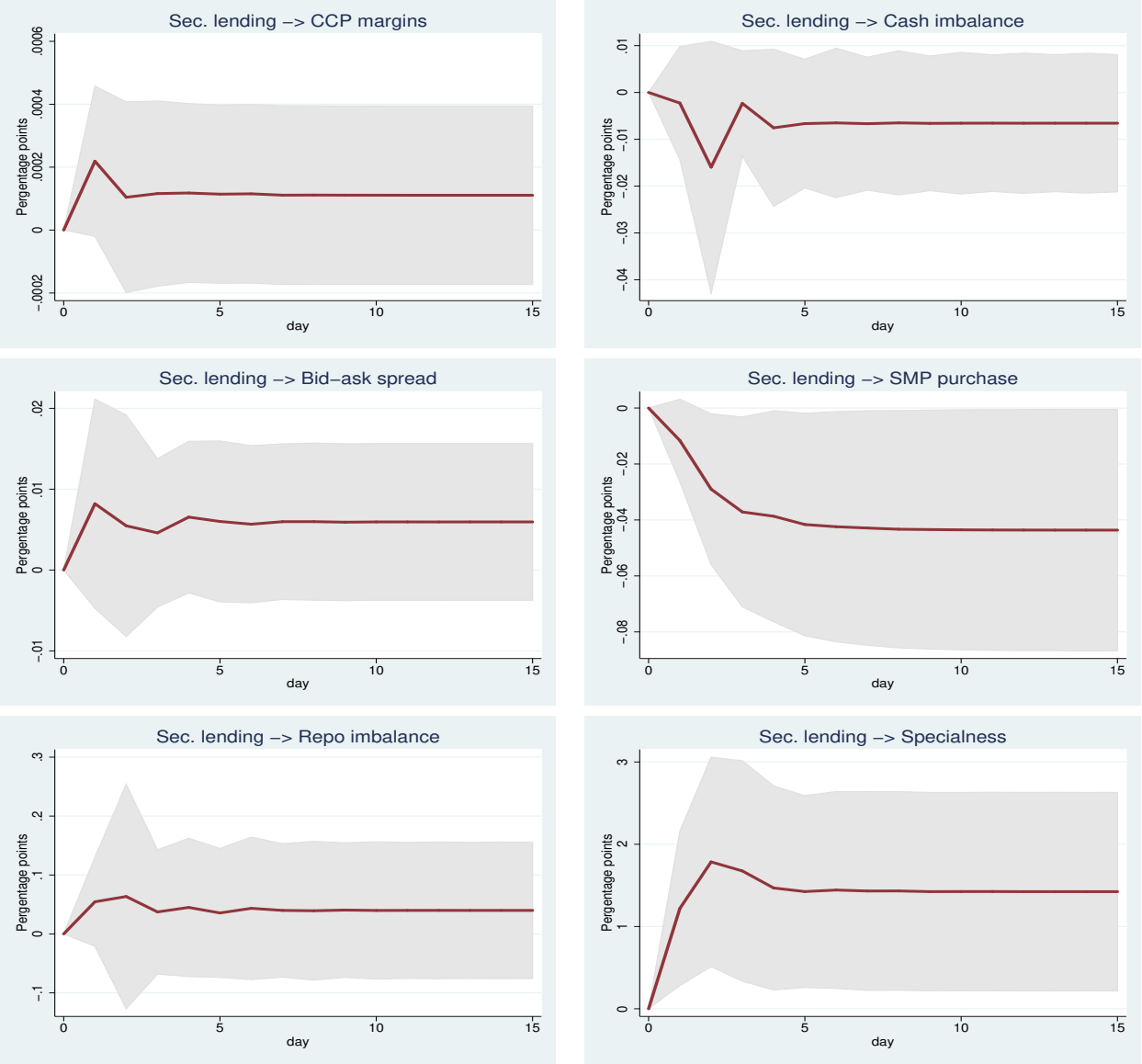

Fig. 21. **Panel VAR Cumulative IRFs - Available lending** The figure plots the cumulative impulse response functions to a available for lending shock of 1% and 90% bootstrapped confidence intervals (grey dashed lines) based on 1,000 replications. The cumulative impulse response functions are estimated from a panel VAR model in first-difference including the following variables: CCP margin, cash imbalance, bid-ask spread, SMP purchase, repo imbalance, specialness and available for lending of the bonds purchased under the SMP from 8 August 2011 to 21 December 2011.