

Private Debt Overhang and the Government Spending
Multiplier: Evidence for the United States

ONLINE APPENDIX

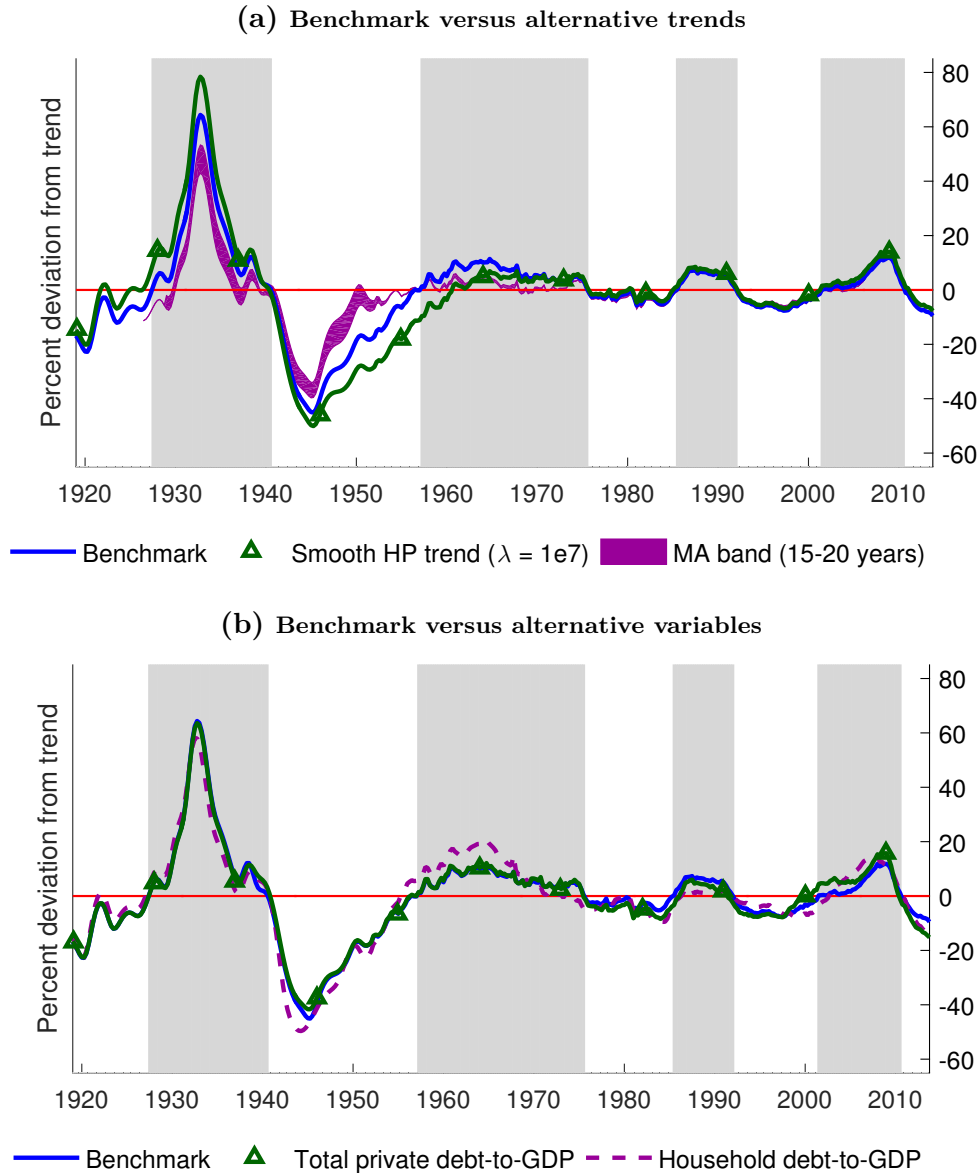
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1 Alternative measures of private debt overhang

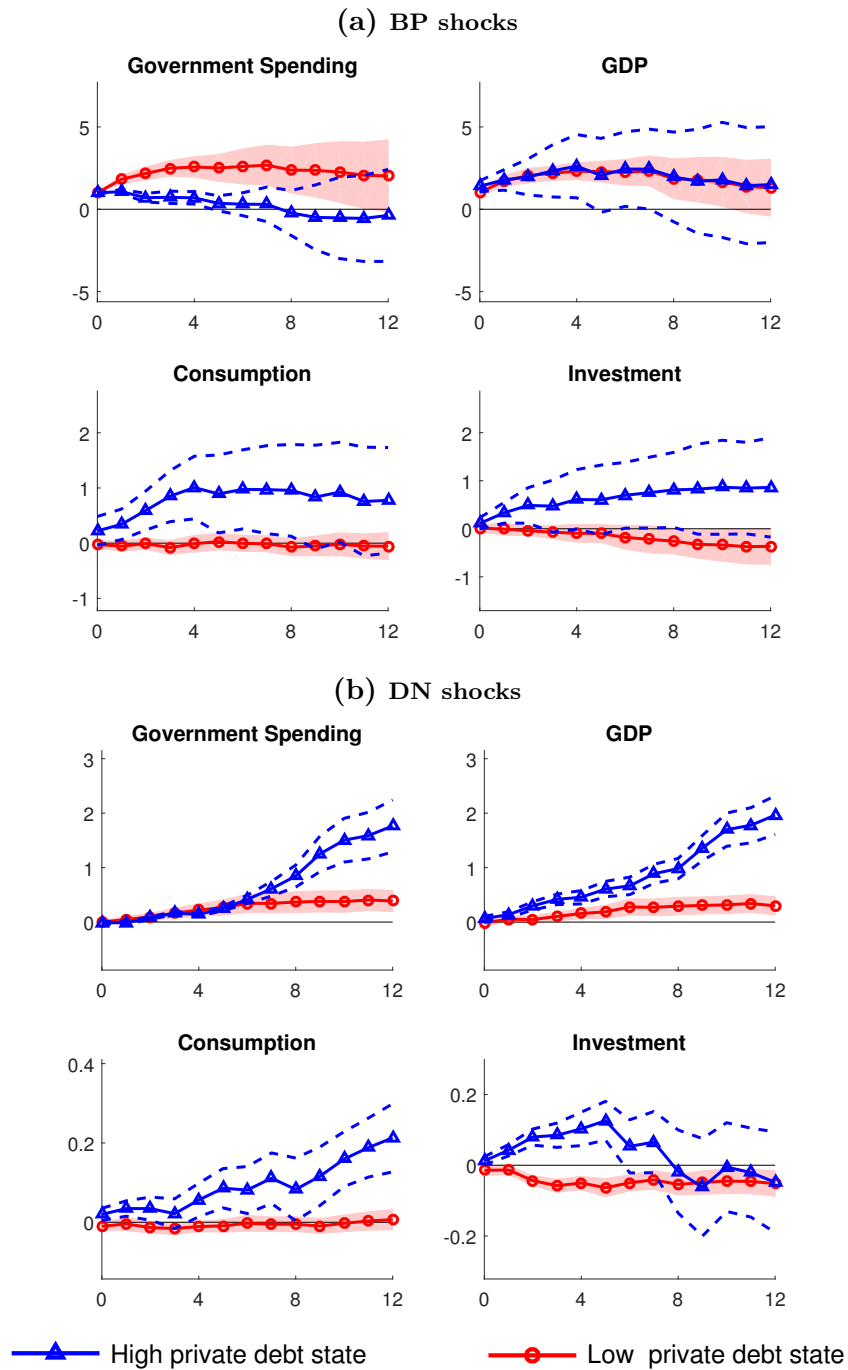
In this section, we report the full set of robustness checks concerning the definition of high and low private debt states. The alternative measures of private debt overhang are derived using different trends and variables.

Figure 1. Alternative measures of private debt overhang



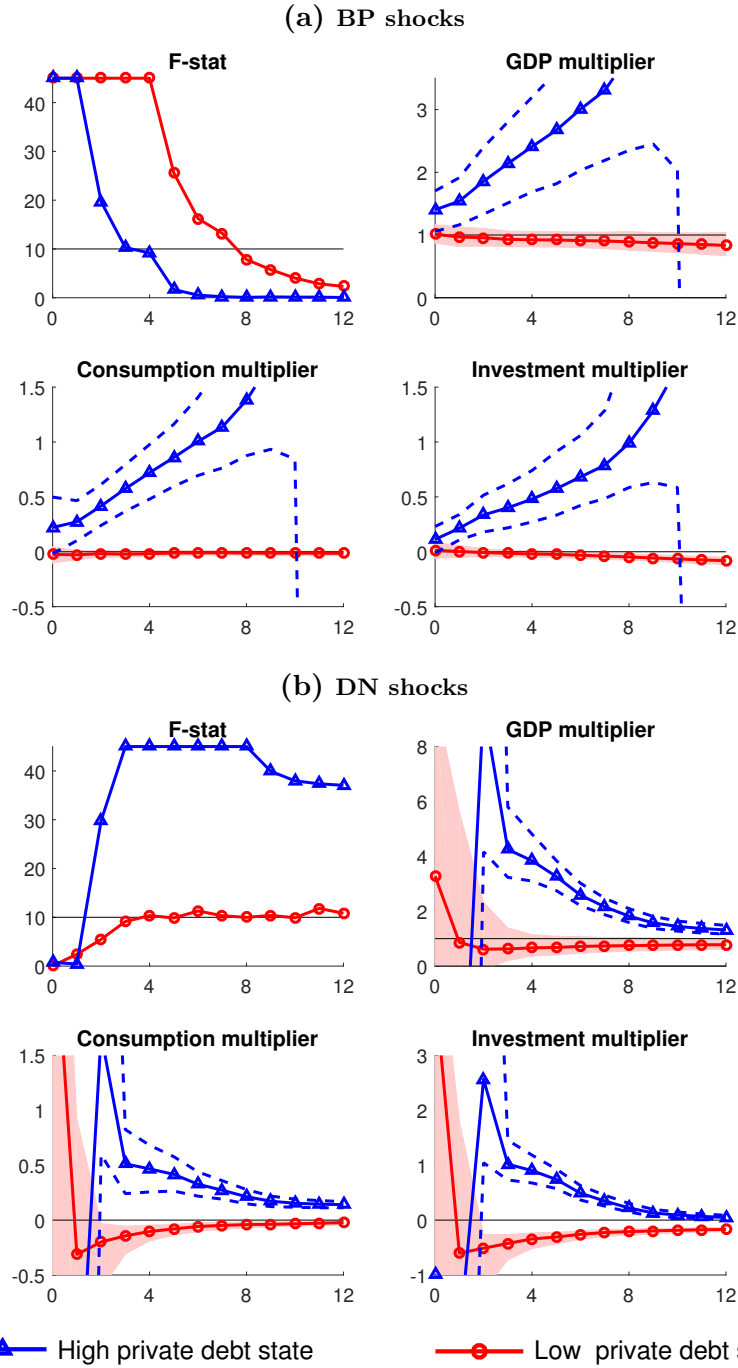
Note. Gray bars are the identified periods of high private debt. The figure compares the benchmark percent deviation from trend with alternative measures obtained using different trends (a) and variables (b).

Figure 2. Effects of spending shocks using an extreme smooth HP trend



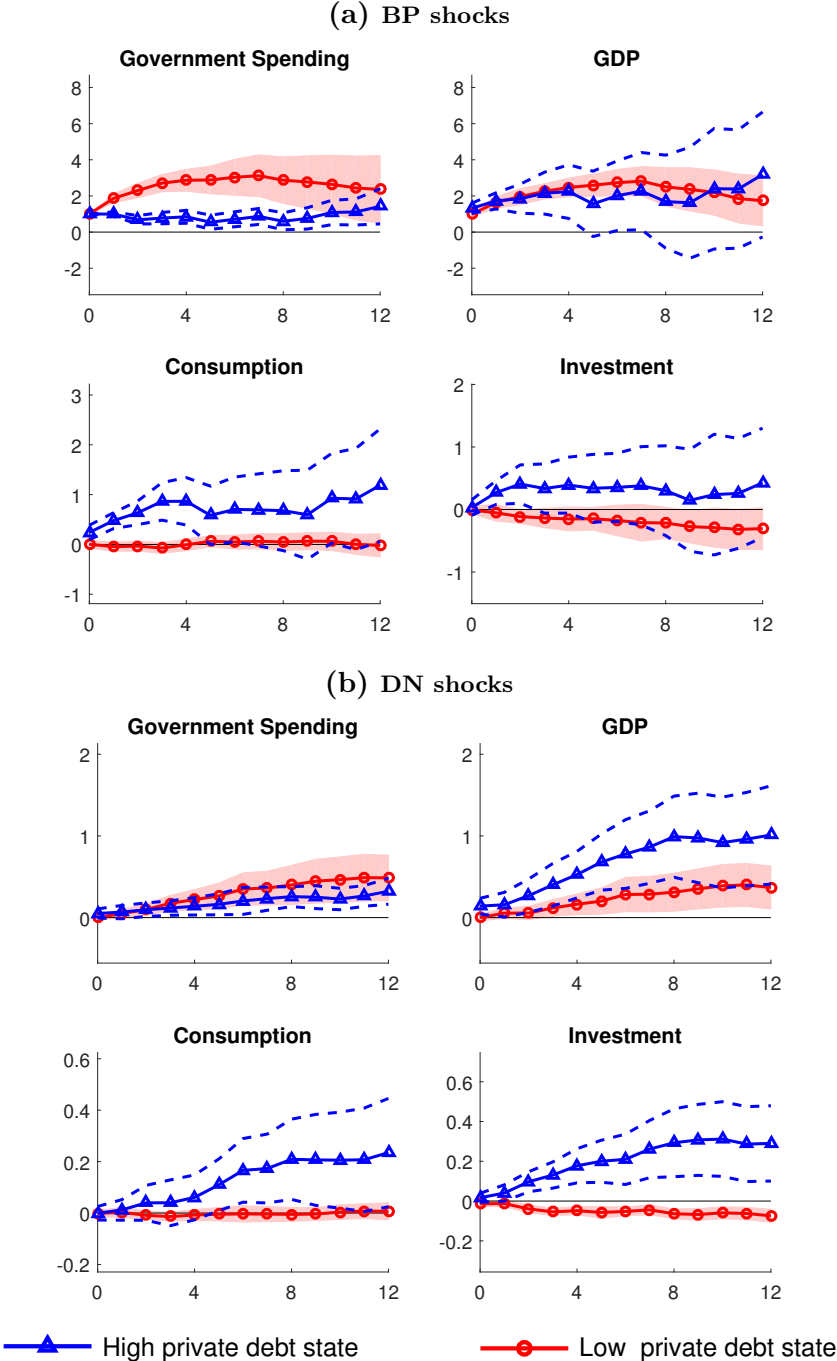
Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the \$ change. The bands show the 90% confidence interval.

Figure 3. Cumulative spending multipliers using an extreme smooth HP trend



Note. Panels show the F-stats (capped at 45) and the cumulative multipliers for Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock). Cumulative multipliers are calculated as $\frac{\sum_{h=0}^H \beta_{S,h}^Z}{\sum_{h=0}^H \beta_{S,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B\}$ at horizon h . The bands show the 90% confidence interval.

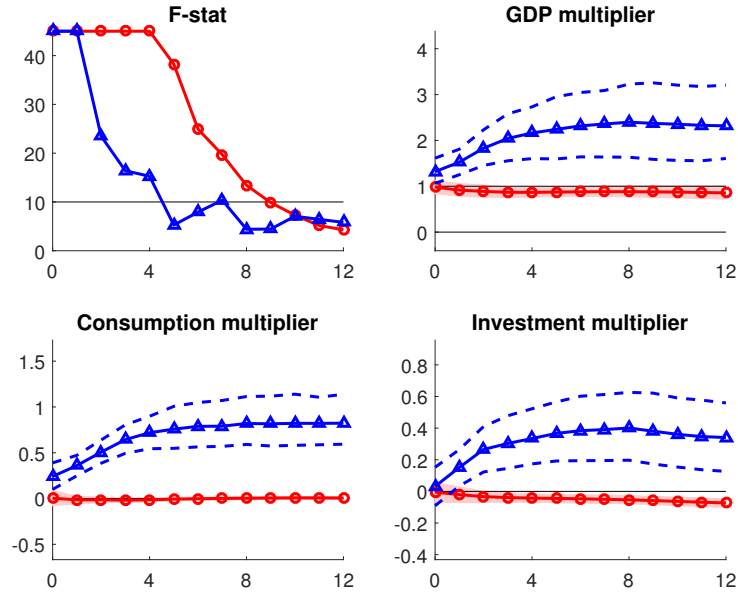
Figure 4. Effects of spending shocks using a MA band (15-20 years)



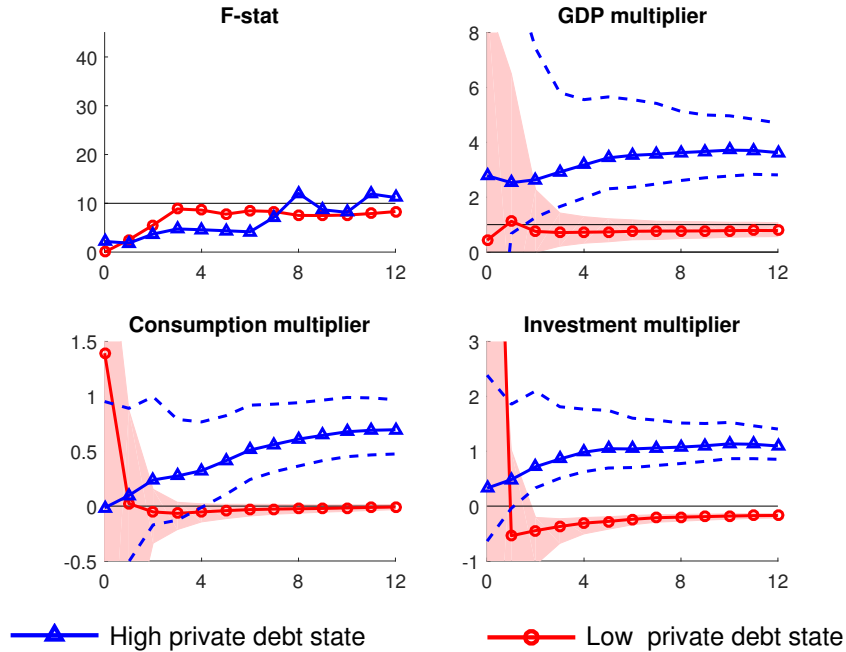
Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey’s Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the \$ change. The bands show the 90% confidence interval.

Figure 5. Cumulative spending multipliers using a MA band (15-20 years)

(a) BP shocks

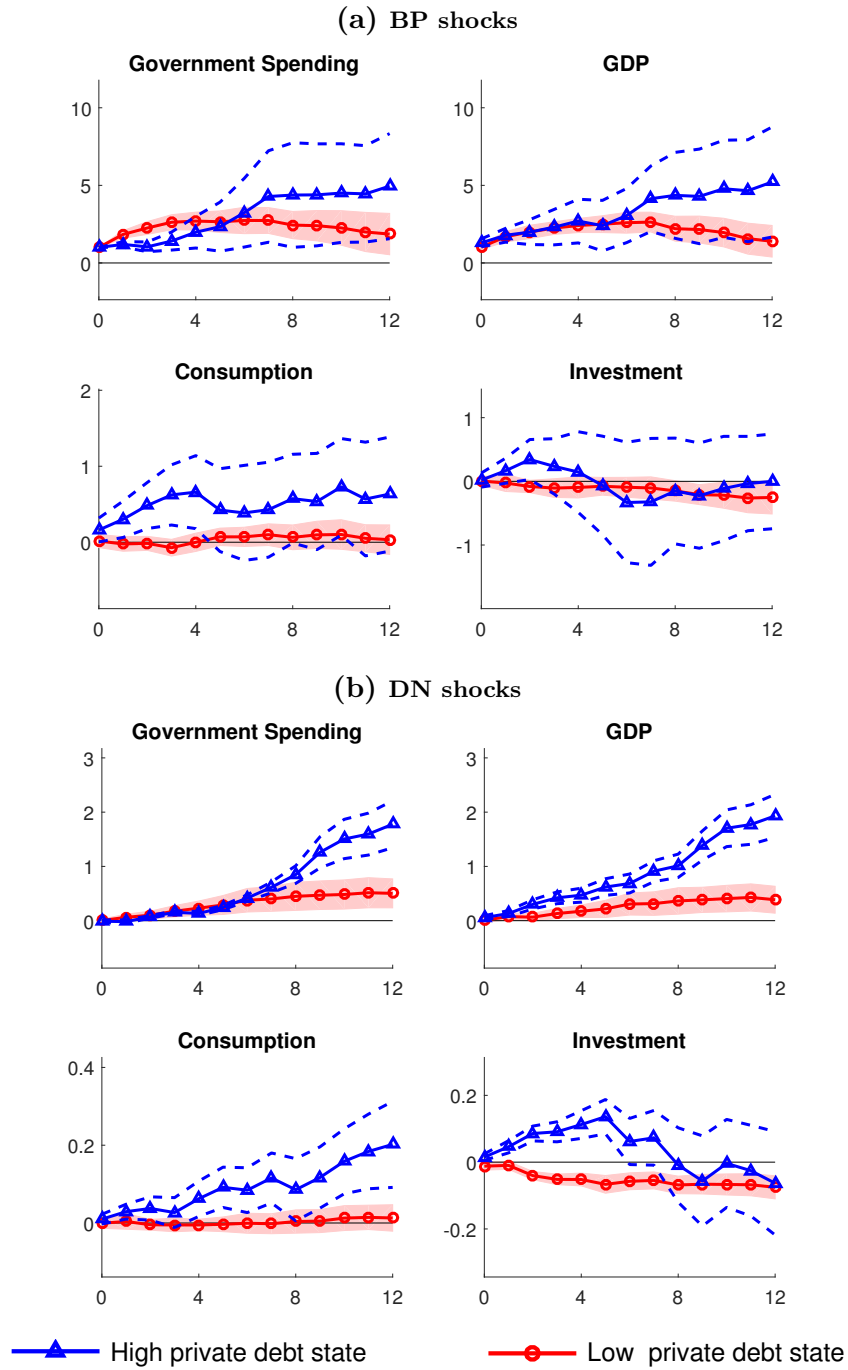


(b) DN shocks



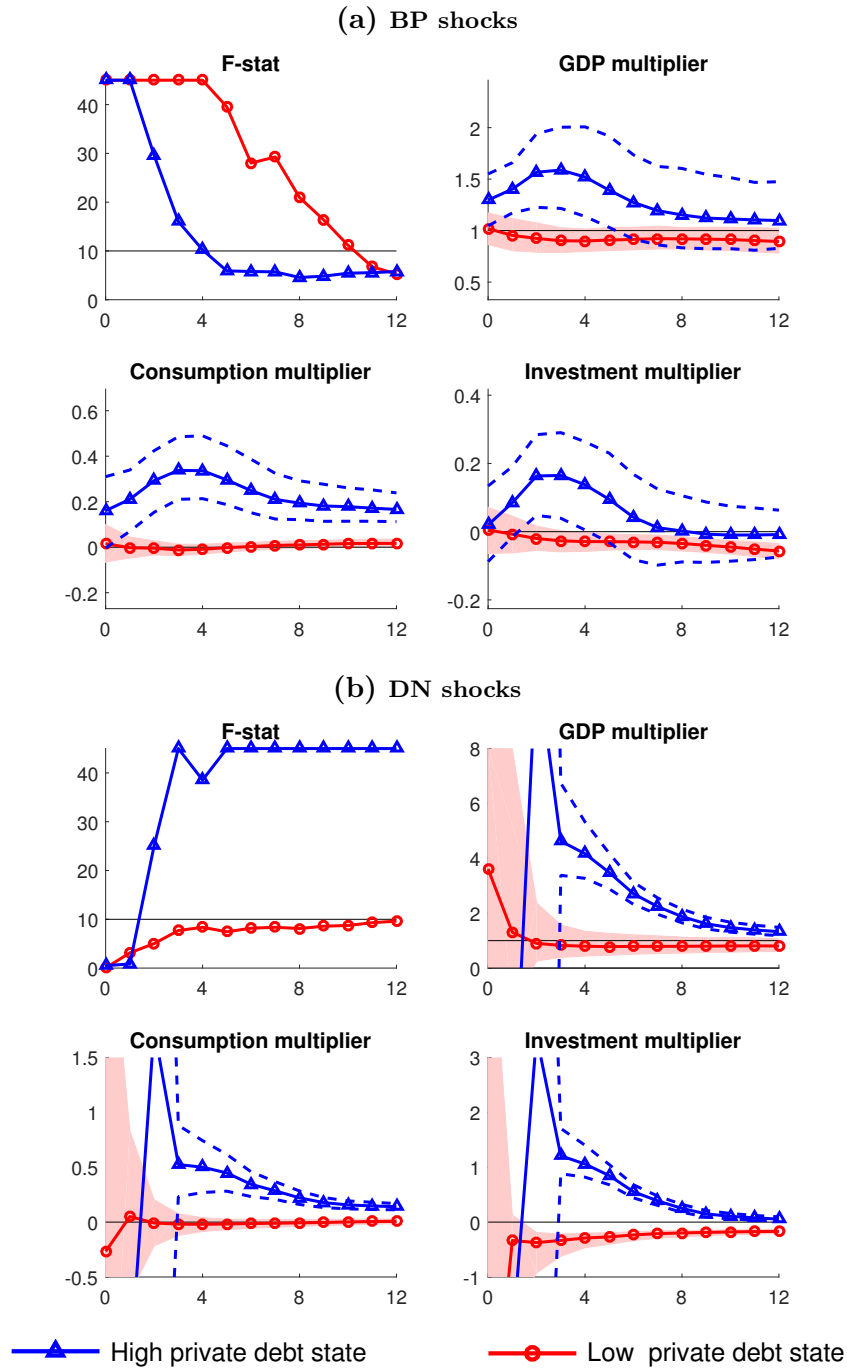
Note. Panels show the F-stats (capped at 45) and the cumulative multipliers for Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock). Cumulative multipliers are calculated as $\frac{\sum_{h=0}^H \beta_{S,h}^Z}{\sum_{h=0}^H \beta_{S,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B\}$ at horizon h . The bands show the 90% confidence interval.

Figure 6. Effects of spending shocks using total private debt-to-GDP



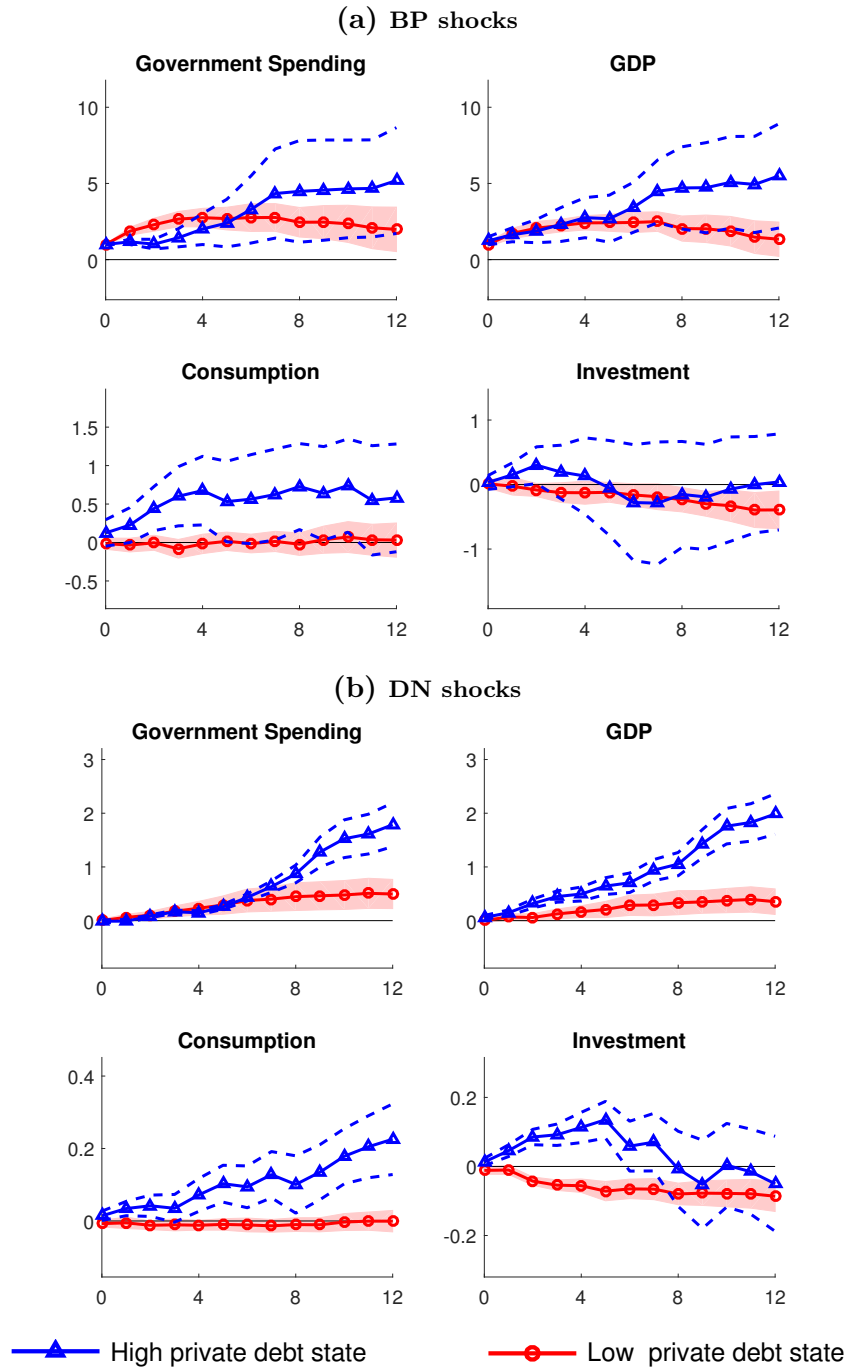
Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the \$ change. The bands show the 90% confidence interval.

Figure 7. Cumulative spending multipliers using total private debt-to-GDP



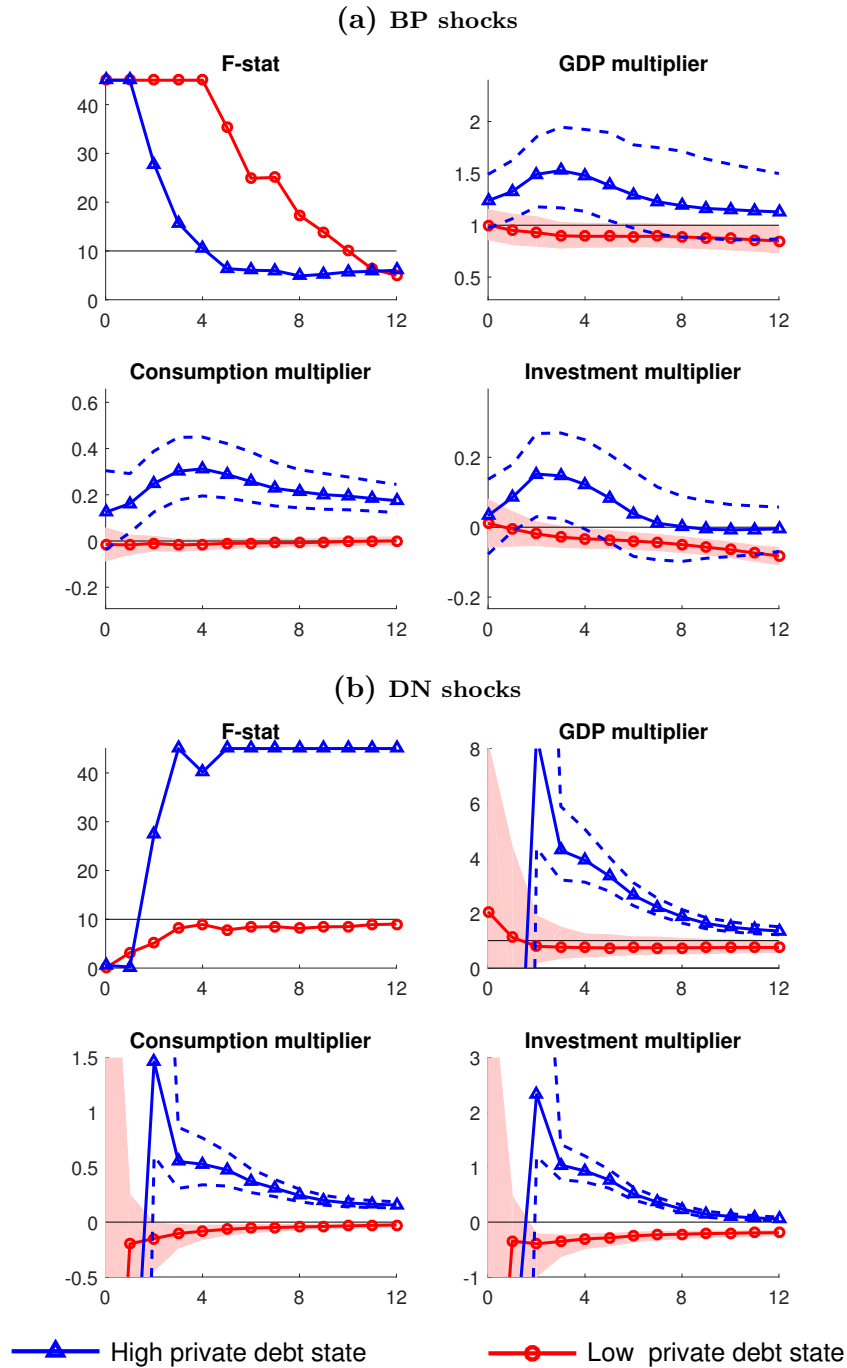
Note. Panels show the F-stats (capped at 45) and the cumulative multipliers for Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock). Cumulative multipliers are calculated as $\frac{\sum_{h=0}^H \beta_{S,h}^Z}{\sum_{h=0}^H \beta_{S,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B\}$ at horizon h . The bands show the 90% confidence interval.

Figure 8. Effects of spending shocks using household debt-to-GDP



Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the \$ change. The bands show the 90% confidence interval.

Figure 9. Cumulative spending multipliers using household debt-to-GDP



Note. Panels show the F-stats (capped at 45) and the cumulative multipliers for Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock). Cumulative multipliers are calculated as $\frac{\sum_{h=0}^H \beta_{S,h}^Z}{\sum_{h=0}^H \beta_{S,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B\}$ at horizon h . The bands show the 90% confidence interval.

2 Post-wars samples: effects on income variables and cumulative multipliers

In this section, we report the full set of estimation results related to the post-wars samples. The following table compares the results reported in the paper with the ones reported in the online appendix:

Table 1. Post-wars samples: Paper vs. Online Appendix

		Paper		Online appendix	
		DN shocks	BP shocks	DN shocks	BP shocks
Effects on income variables	GOV	-	-	✓	✓
	GDP	-	-	✓	✓
	CON	-	-	✓	✓
	INV	-	-	✓	✓
Cumulative spending multipliers	GDP	-	✓	✓	✓
	CON	-	✓	✓	✓
	INV	-	✓	✓	✓
Effects on other variables	INT	-	-	✓	✓
	TAX	-	-	✓	✓
	PRY	-	-	✓	✓
	GVY	-	-	✓	✓

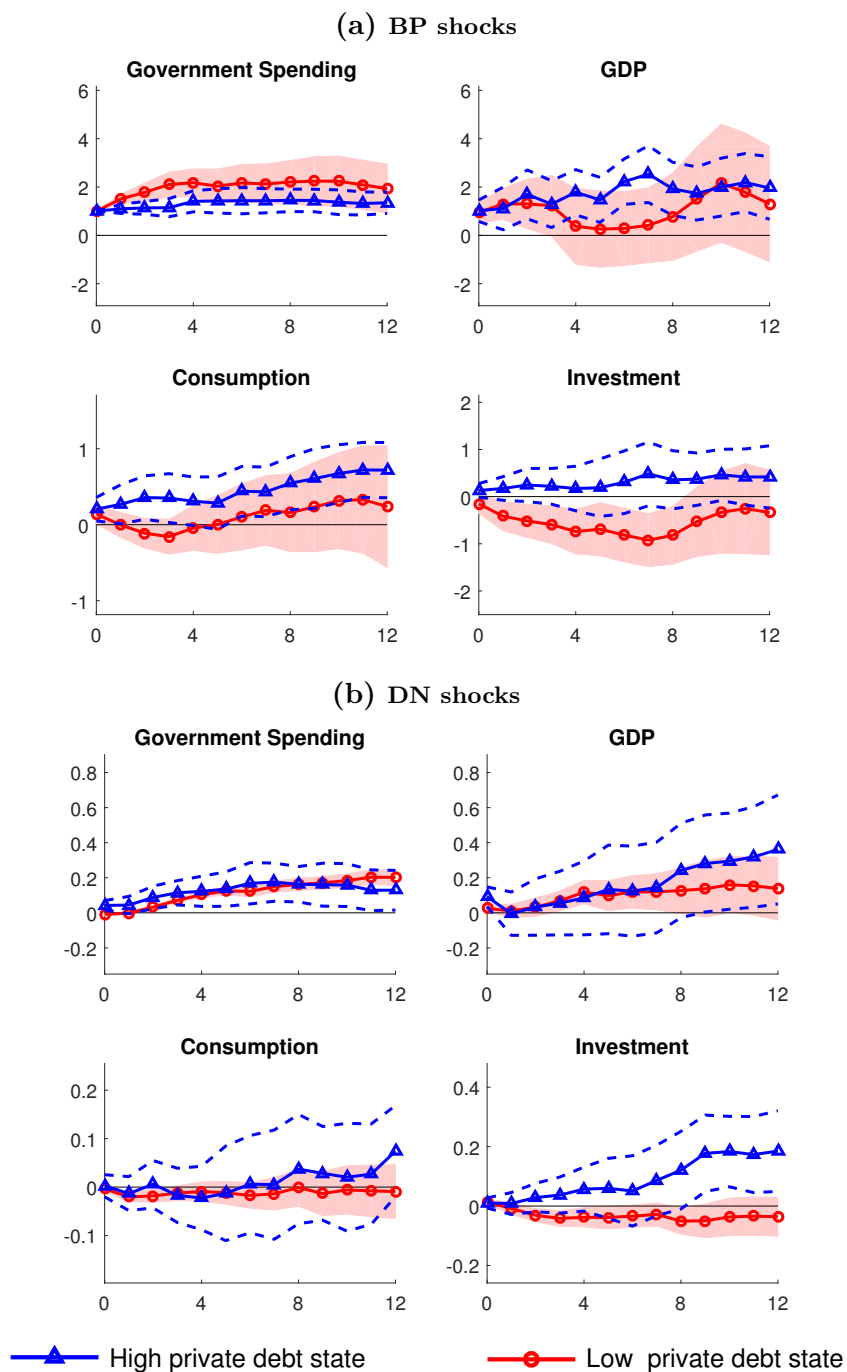
In particular, while in the paper we just report the cumulative spending multipliers for the Blanchard-Perotti shocks, here we also report the underlying effects on income and other variables and the results for the DN shocks.

As discussed in the paper, DN shocks contain little information in post-war sample periods and most of the time the error bands for the multipliers tend to be quite explosive.

The post-war samples are:

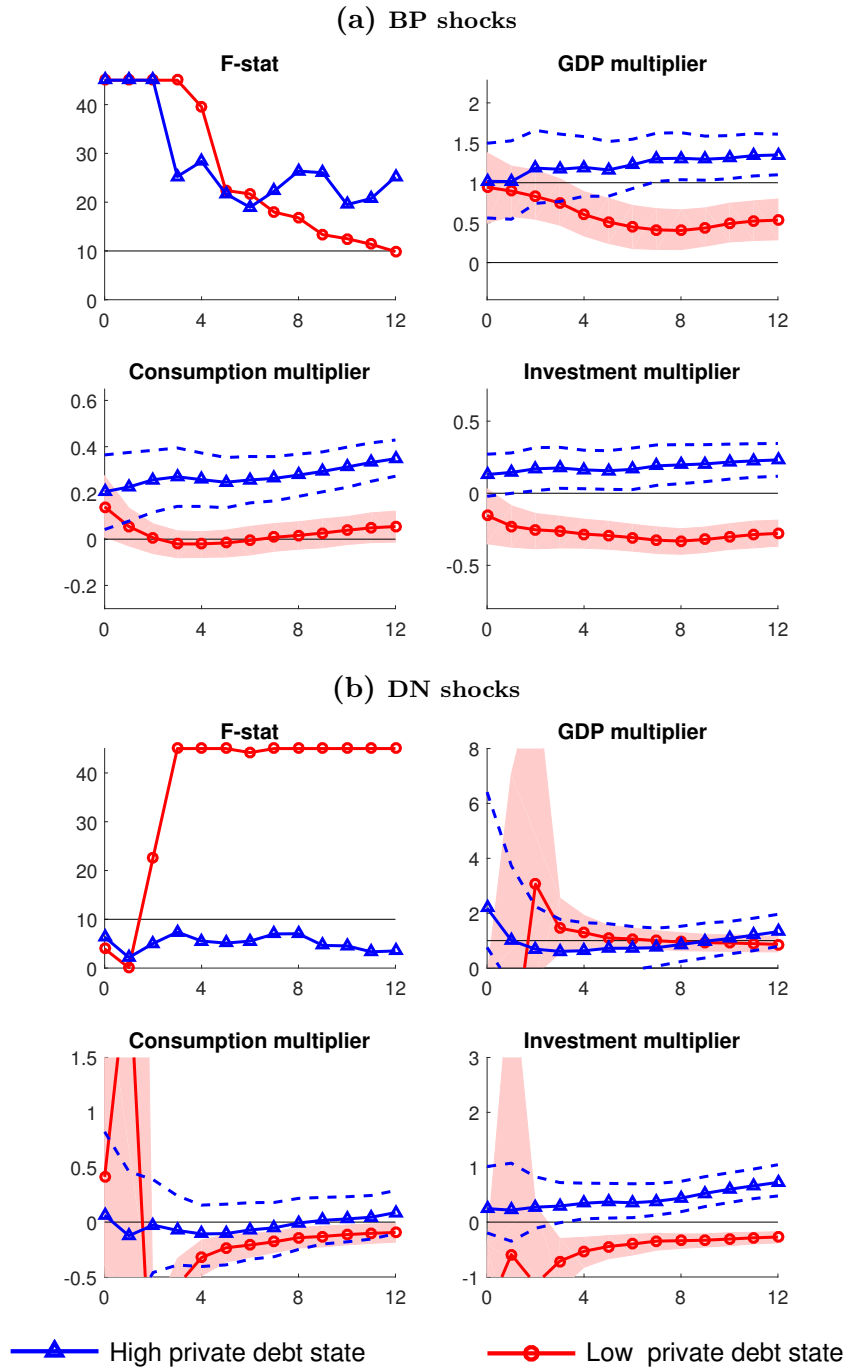
- post-WWII (1947-2013);
- post-Korean war (1954-2013).

Figure 10. Effects of spending shocks in post-WWII sample



Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the \$ change. The bands show the 90% confidence interval.

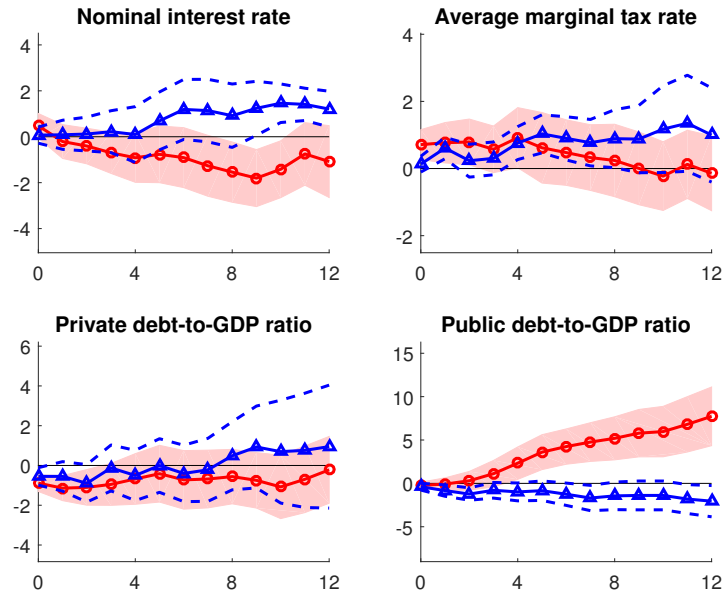
Figure 11. Cumulative spending multipliers in post-WWII sample



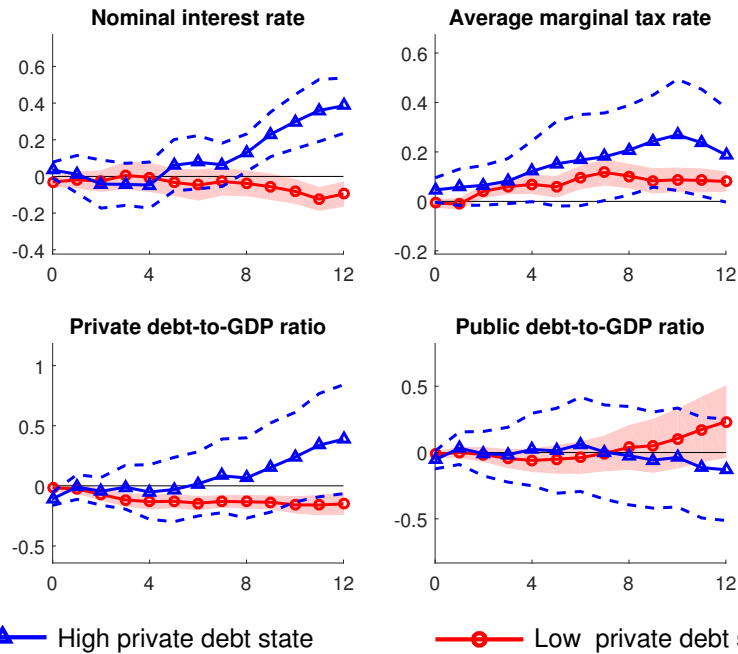
Note. Panels show the F-stats (capped at 45) and the cumulative multipliers for Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock). Cumulative multipliers are calculated as $\frac{\sum_{h=0}^H \beta_{S,h}^Z}{\sum_{h=0}^H \beta_{S,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B\}$ at horizon h . The bands show the 90% confidence interval.

Figure 12. Effects on other variables in post-WWII sample

(a) BP shocks

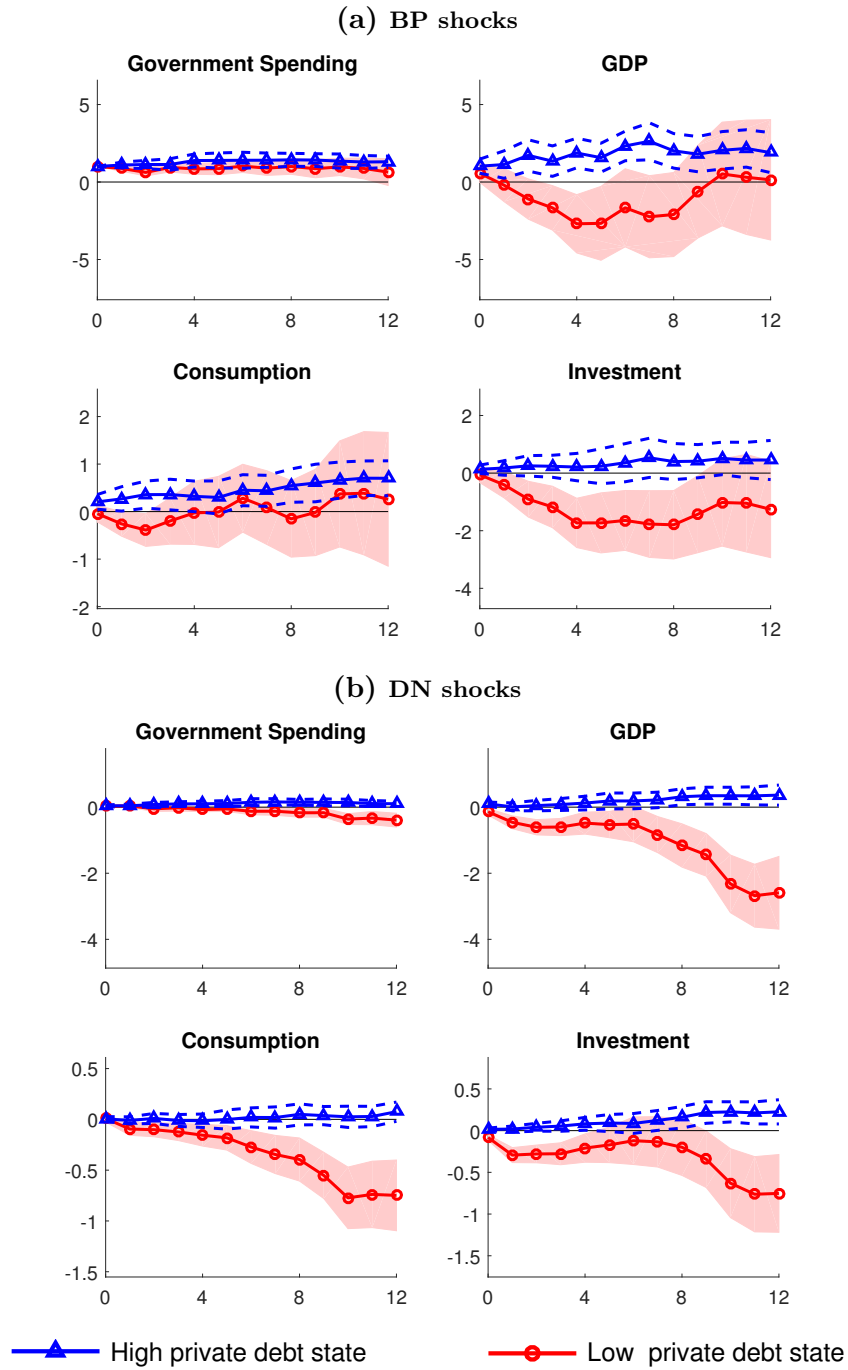


(b) DN shocks



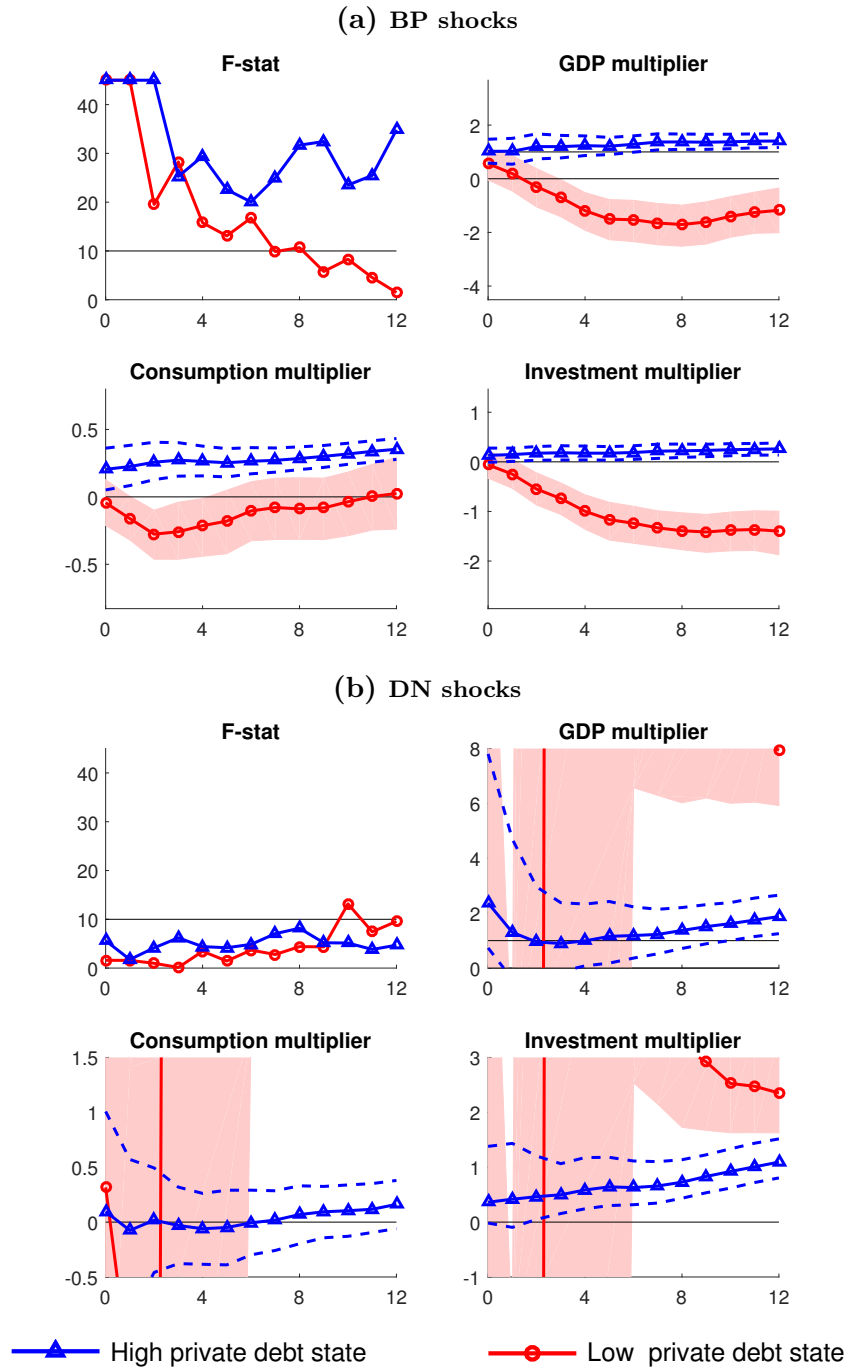
Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the % change. The bands show the 90% confidence interval.

Figure 13. Effects of spending shocks in post-Korean war sample



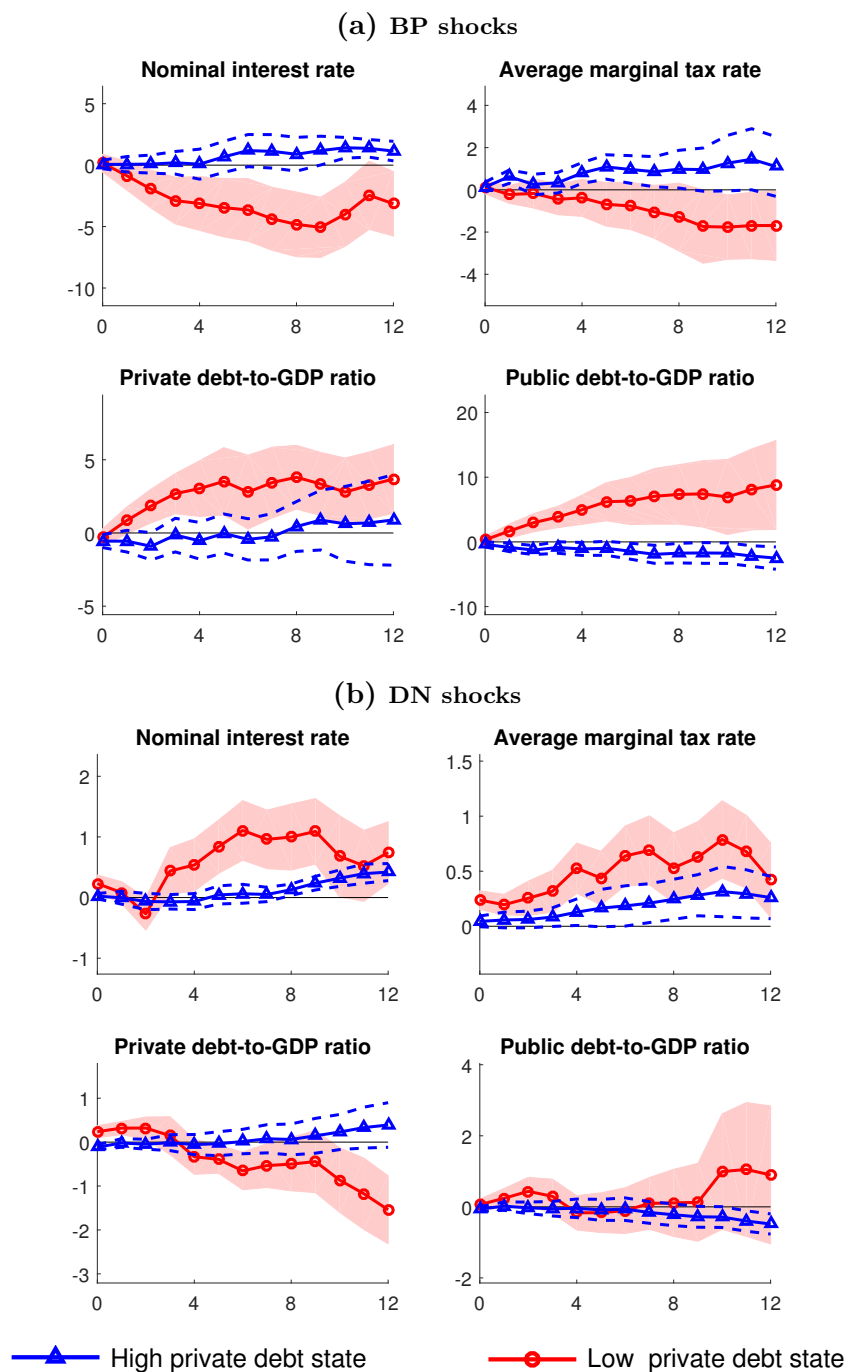
Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the \$ change. The bands show the 90% confidence interval.

Figure 14. Cumulative spending multipliers in post-Korean war sample



Note. Panels show the F-stats (capped at 45) and the cumulative multipliers for Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock). Cumulative multipliers are calculated as $\frac{\sum_{h=0}^H \beta_{S,h}^Z}{\sum_{h=0}^H \beta_{S,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B\}$ at horizon h . The bands show the 90% confidence interval.

Figure 15. Effects on other variables in post-Korean war sample



Note. Panel a) shows, respectively, the effects of Blanchard-Perotti shocks (BP) and Ramey's Defense News (DN). The horizontal axes measure the analyzed horizon (expressed in quarters after the shock) and the vertical axes measure the % change. The bands show the 90% confidence interval.

3 Controlling for other states: effects on income variables and cumulative multipliers

In this section, we report the full set of results concerning the augmented state-dependent local projection models. The following table compare the results reported in the paper with the ones reported in the online appendix:

Table 2. Augmented local projections: Paper vs. Online Appendix

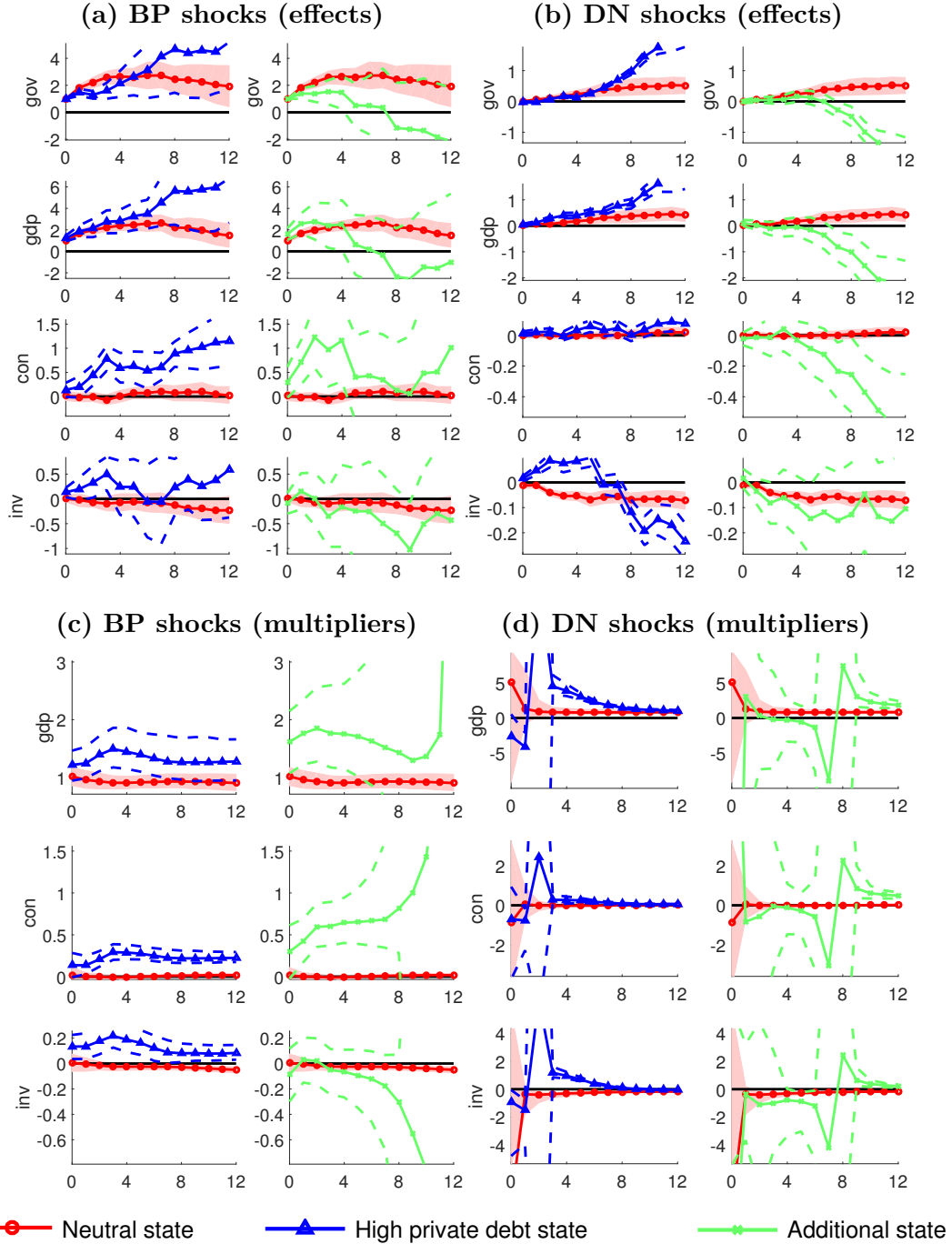
		Paper		Online appendix	
		DN shocks	BP shocks	DN shocks	BP shocks
Effects on income variables	GOV	-	-	✓	✓
	GDP	-	-	✓	✓
	CON	-	-	✓	✓
	INV	-	-	✓	✓
Cumulative spending multipliers	GDP	-	-	✓	✓
	CON	-	-	✓	✓
	INV	-	-	✓	✓

In particular, while in the paper we show a summary table, here we report the underlying effects on the income variables and the cumulative multipliers.

The additional states are:

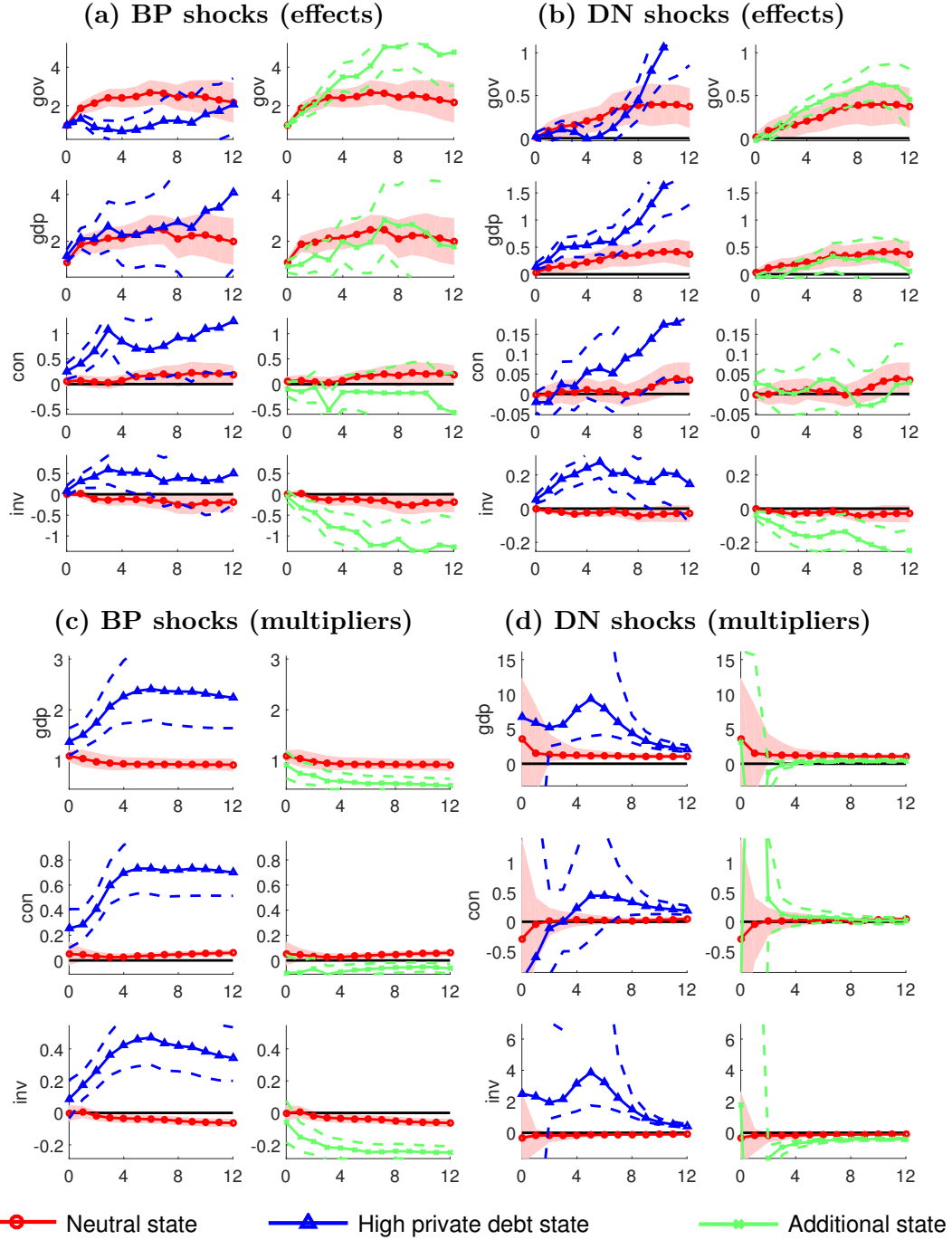
- Banking crises
- Stock market crashes;
- Deleveraging periods (peak-to-trough);
- Unemployment slack;
- AG recessions;
- NBER recessions;
- Zero lower bound periods;
- High government debt.

Figure 16. Effects and cumulative spending multipliers during high private debt and *banking crises* states



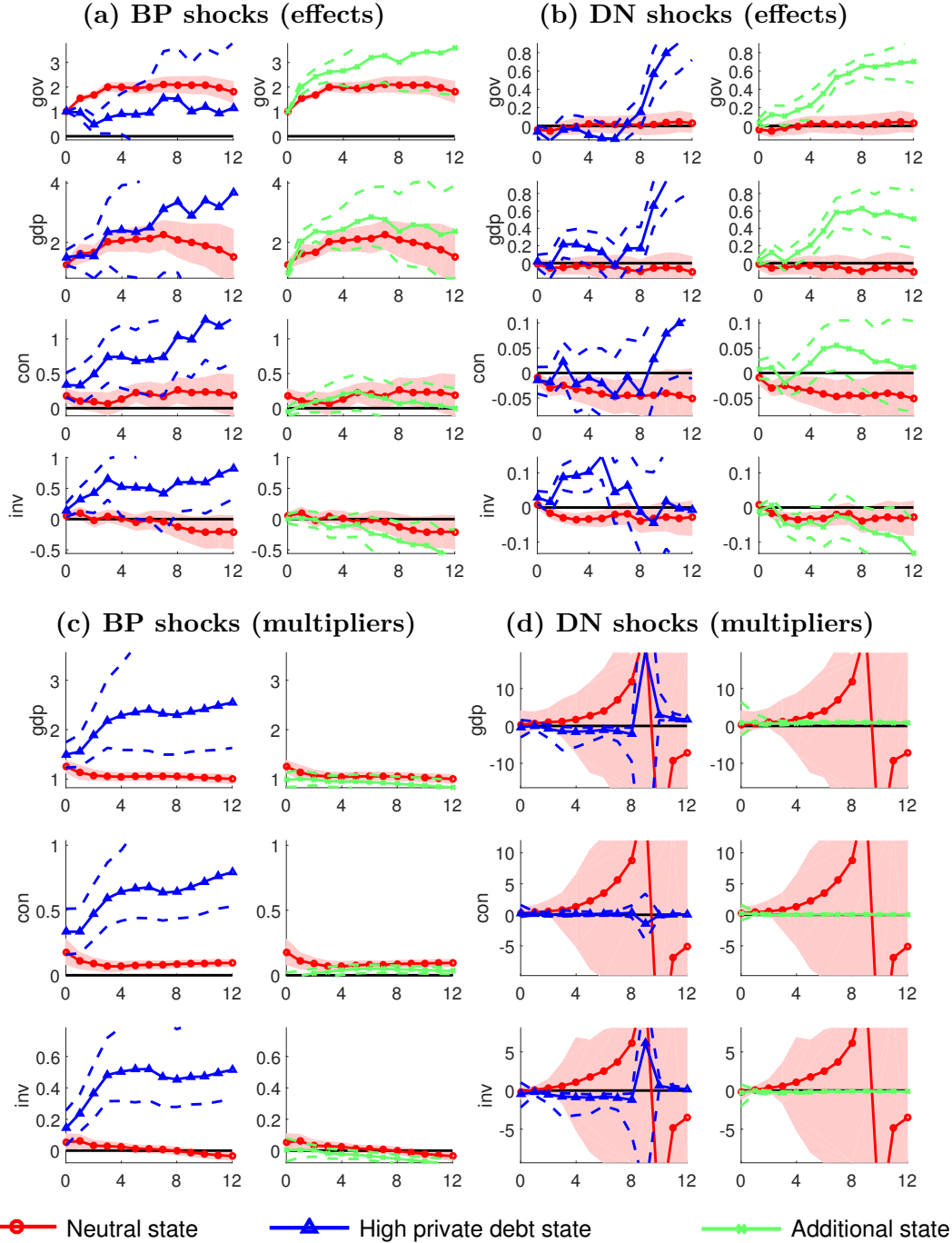
Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z Y}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 17. Effects and cumulative spending multipliers during high private debt and *stock market crashes* states



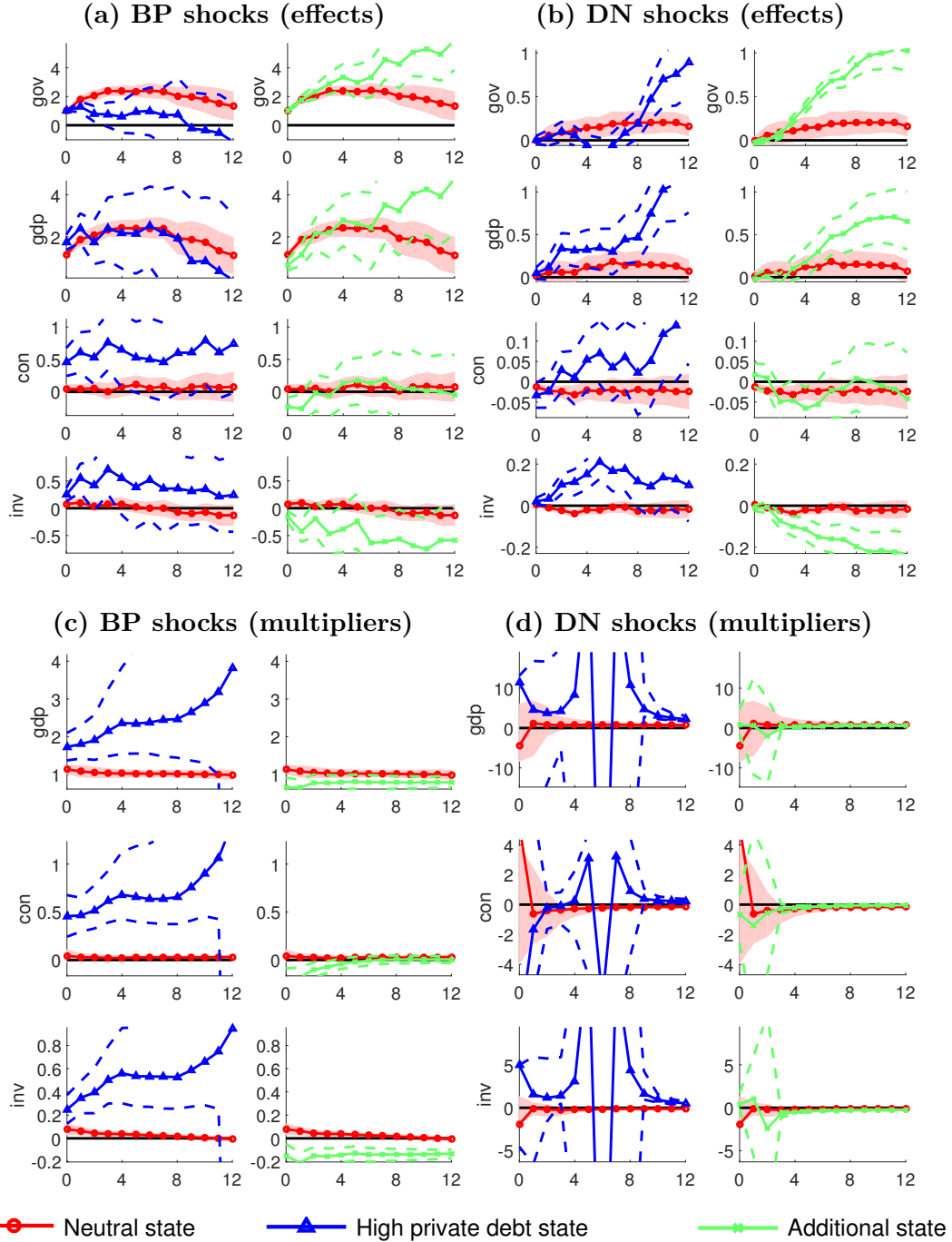
Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 18. Effects and cumulative spending multipliers during high private debt and *deleveraging* states



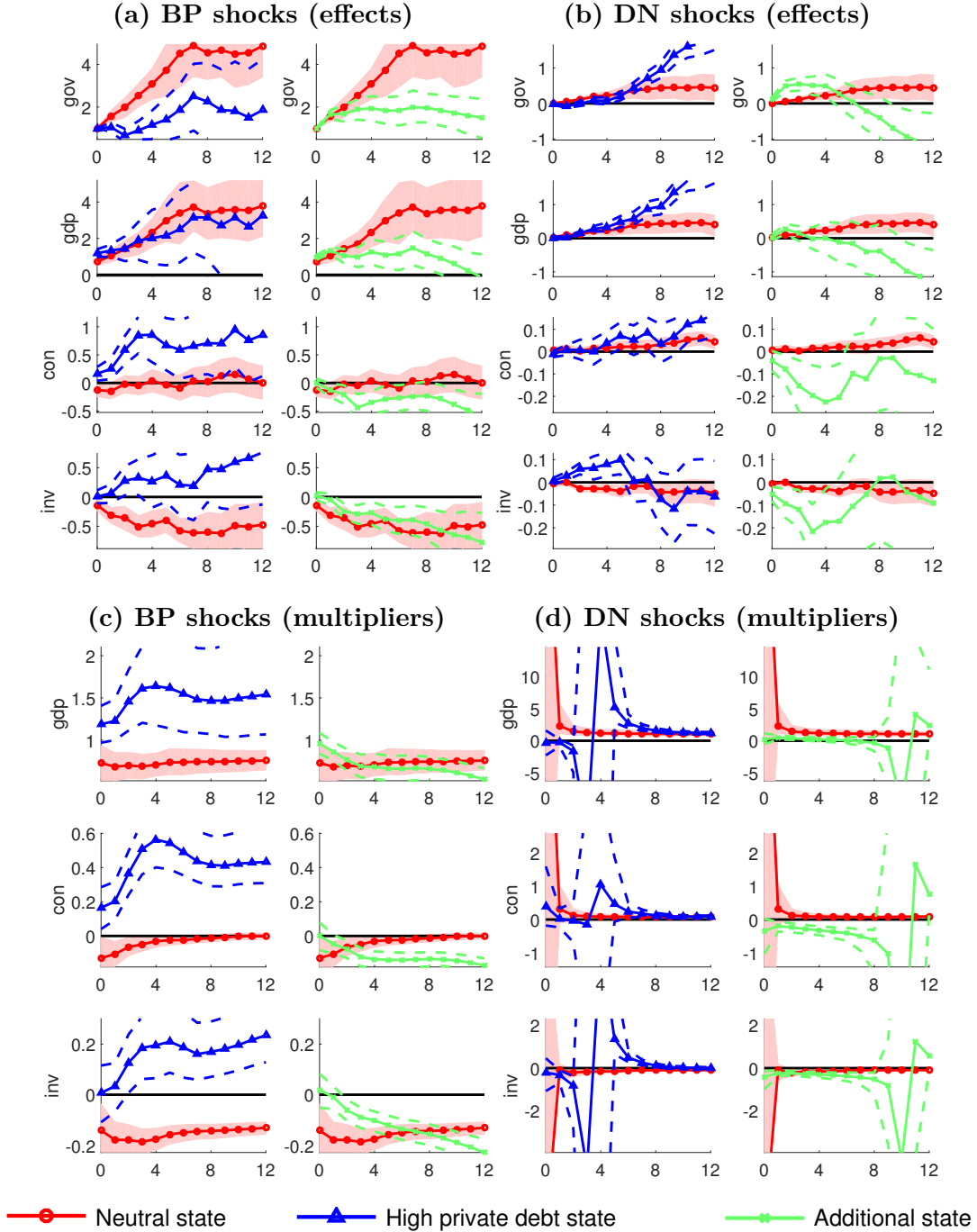
Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 19. Effects and cumulative spending multipliers during high private debt and *unemployment slack* states



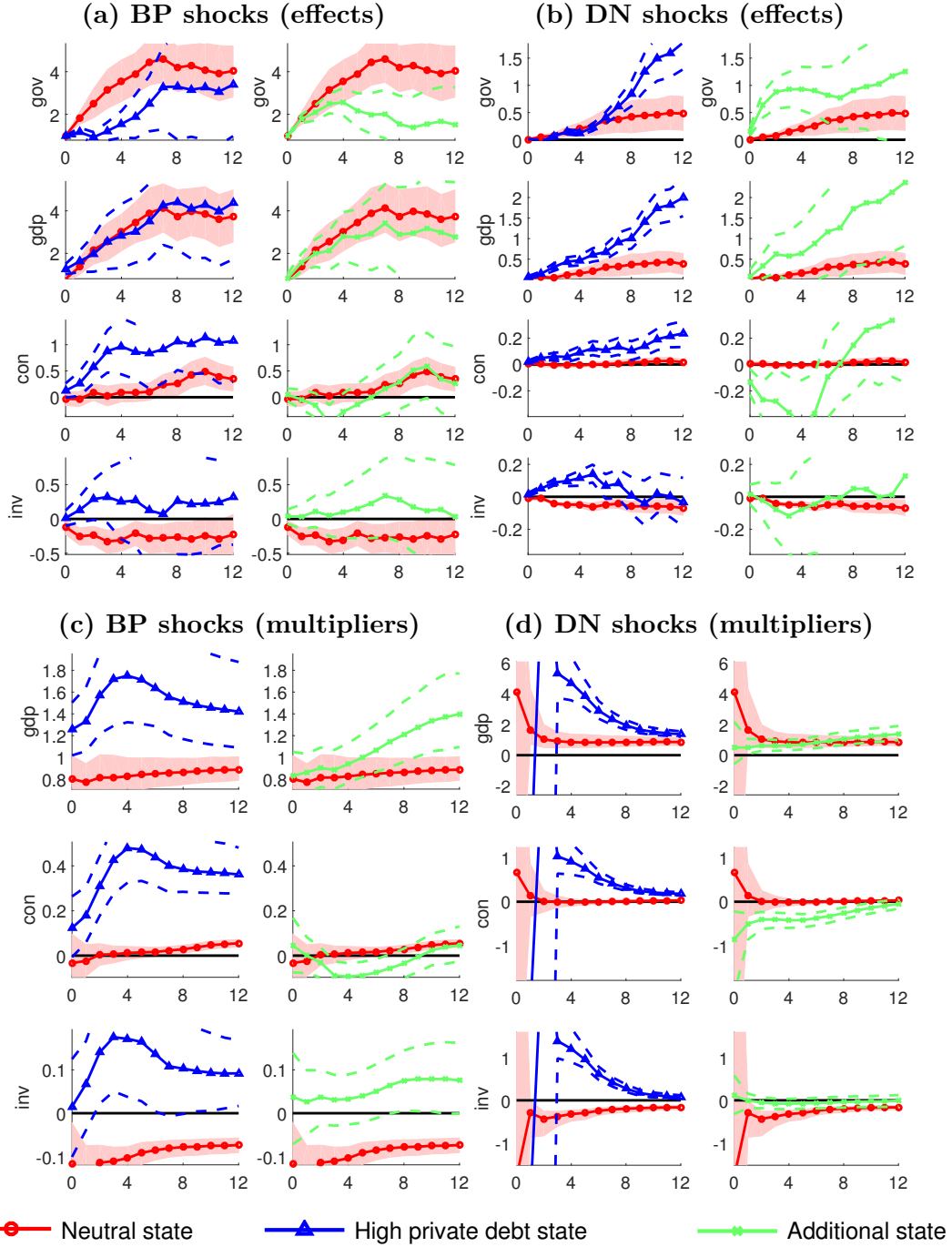
Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 20. Effects and cumulative spending multipliers during high private debt and *AG* recessions states



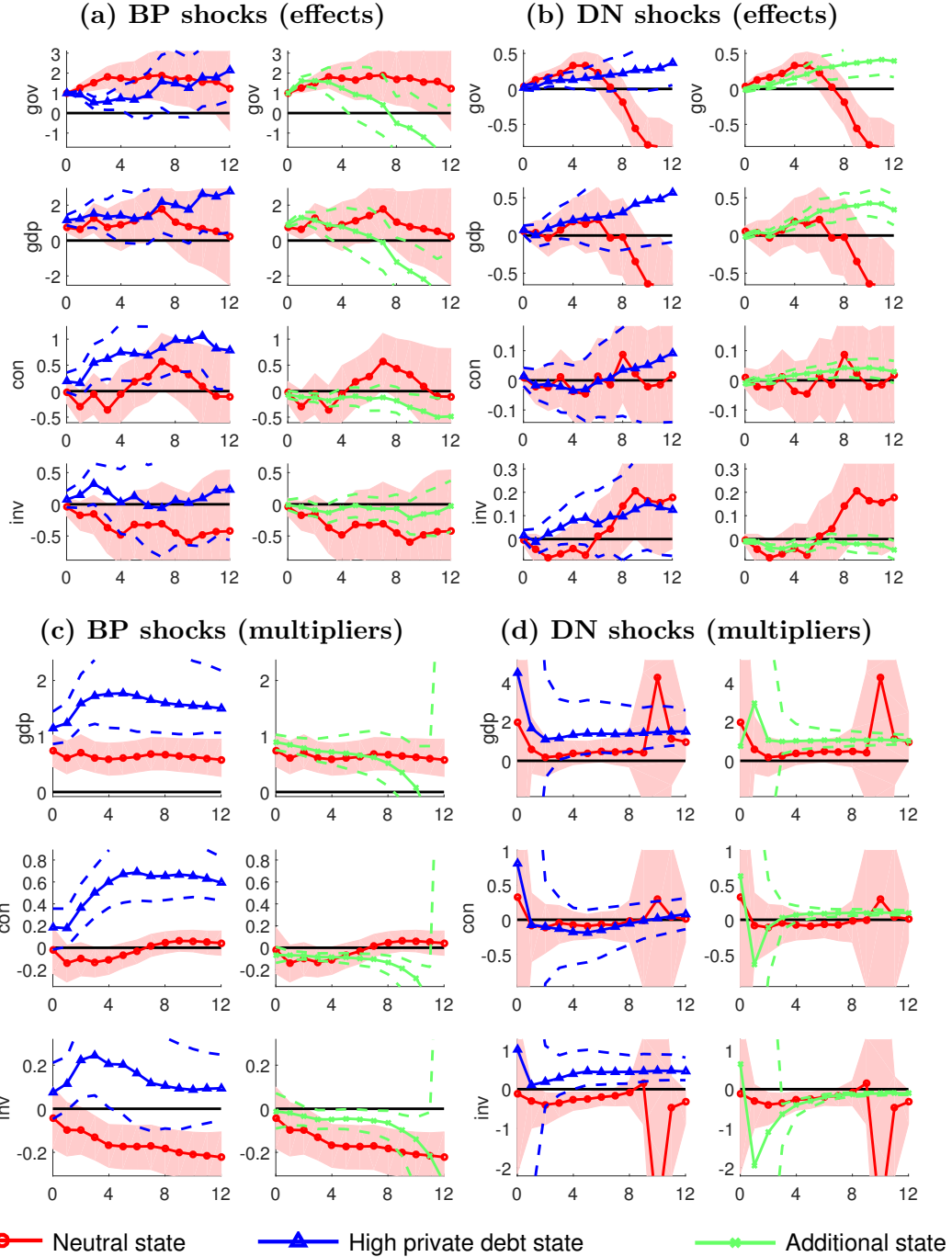
Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 21. Effects and cumulative spending multipliers during high private debt and *NBER recessions* states



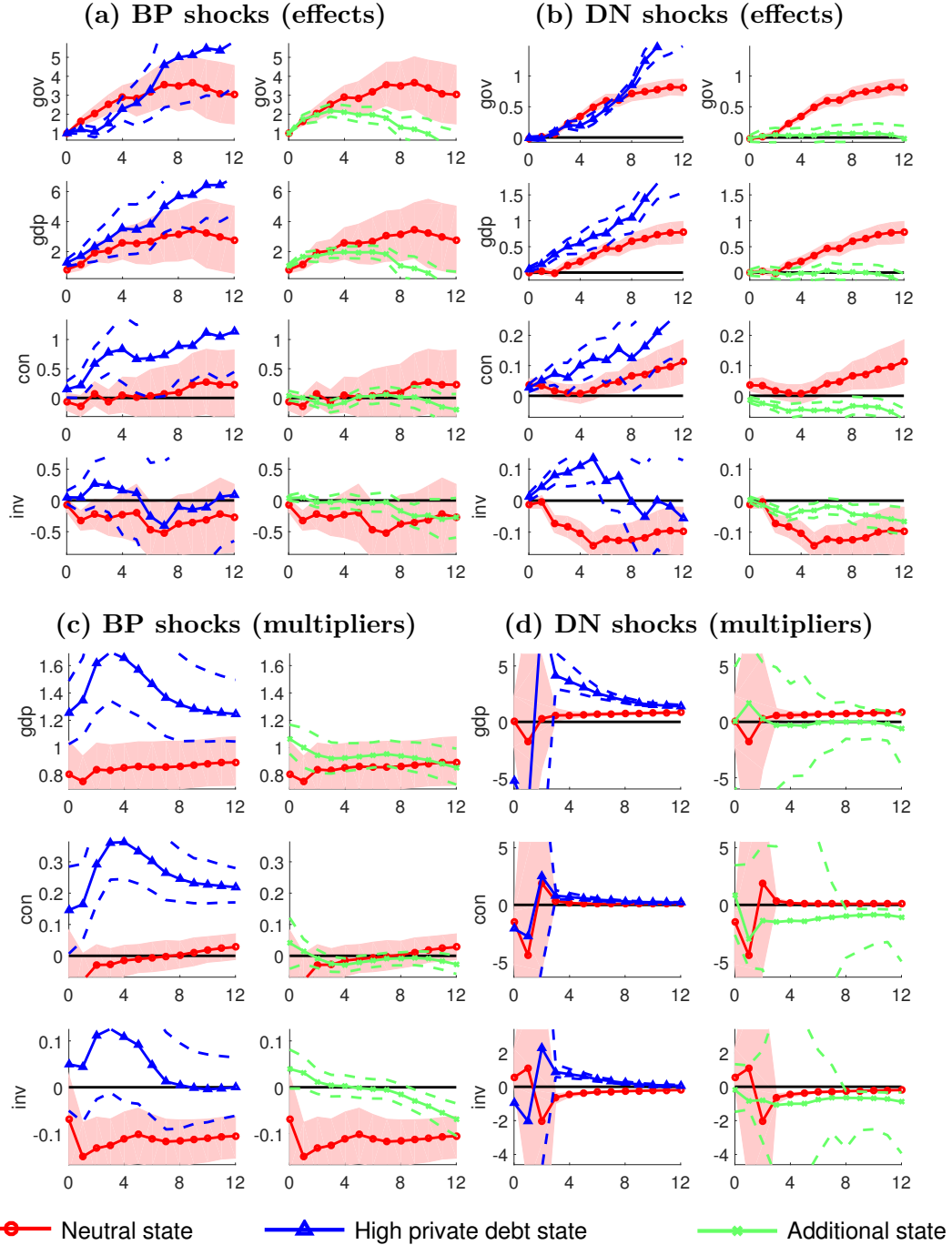
Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 22. Effects and cumulative spending multipliers during high private debt and zero lower bound states



Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z Y}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.

Figure 23. Effects and cumulative spending multipliers during high private debt and *high government debt* states



Note. Cumulative multipliers in the augmented states are calculated as $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{B,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{B,h}^G}$ and $\frac{\sum_{h=0}^H \beta_{A,h}^Z + \beta_{C,h}^Z}{\sum_{h=0}^H \beta_{A,h}^G + \beta_{C,h}^G}$, where $\beta_{S,h}^Z$ and $\beta_{S,h}^G$ are the effects of a government spending shock on an income variable Z and government spending G , in the state $S = \{A, B, C\}$ at horizon h . The bands show the 90% confidence interval.