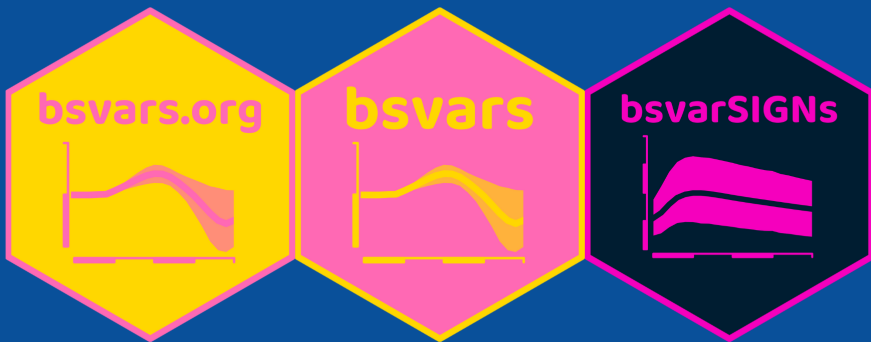


Structural and Predictive Monetary Policy Analyses Using the R packages bsvars.org

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R packages for Bayesian Structural Vector Autoregressions



a case for software packages

objectives and incentives

academia

- ▶ marginal contributions
- ▶ performance excellence
- ▶ focus on detail
- ▶ one-point case
- ▶ result reproducibility

governance institutions

- ▶ decision-making support
- ▶ application/data driven
- ▶ reporting & communication
- ▶ broad interpretability
- ▶ accountability

mutual benefits

- ▶ knowledge & experience exchange
- ▶ strategic synergies
- ▶ relevance
- ▶ publishable outputs
- ▶ research dissemination

a case for software packages


- ▶ potential for bridging the mismatch
- ▶ joint development benefiting from specialisations
- ▶ respectful of parties' objectives and needs
- ▶ strategically planned development and rollout

bsvars.org features

bsvars.org features

bsvars: Bayesian Estimation of Structural Vector Autoregressive Models

Provides fast and efficient procedures for Bayesian analysis of Structural Vector Autoregressions. This package estimates a wide range of models, including homo-, heteroskedastic, and non-normal specifications. Structural models can be identified by adjustable exclusion restrictions, time-varying volatility, or non-normality. They all include a flexible three-level equation-specific local-global hierarchical prior distribution for the estimated level of shrinkage for autoregressive and structural parameters. Additionally, the package facilitates predictive and structural analyses such as impulse responses, forecast error variance and historical decompositions, forecasting, verification of heteroskedasticity, non-normality, and hypotheses on autoregressive parameters, as well as analyses of structural shocks, volatilities, and fitted values. Beautiful plots, informative summary functions, and extensive documentation including the vignette by Woźniak (2024) <[doi:10.48550/arXiv.2410.15090](https://doi.org/10.48550/arXiv.2410.15090)> complement all this. The implemented techniques align closely with those presented in Lütkepohl, Shang, Uzeda, & Woźniak (2024) <[doi:10.48550/arXiv.2404.11057](https://doi.org/10.48550/arXiv.2404.11057)>, Lütkepohl & Woźniak (2020) <[doi:10.1016/j.jedc.2020.103862](https://doi.org/10.1016/j.jedc.2020.103862)>, and Song & Woźniak (2021) <[doi:10.1093/acrefore/9780190625979.013.174](https://doi.org/10.1093/acrefore/9780190625979.013.174)>. The 'bsvars' package is aligned regarding objects, workflows, and code structure with the R package 'bsvarSIGNs' by Wang & Woźniak (2024) <[doi:10.32614/CRAN.package.bsvarSIGNs](https://doi.org/10.32614/CRAN.package.bsvarSIGNs)>, and they constitute an integrated toolset.

Version:	3.2
Depends:	R (≥ 3.5.0)
Imports:	Rcpp (≥ 1.0.7), RcppProgress (≥ 0.1), RcppTN, GiGrvg, R6, stochvol
LinkingTo:	Rcpp, RcppProgress, RcppArmadillo, RcppTN
Suggests:	knitr, tinytest
Published:	2024-10-24
DOI:	10.32614/CRAN.package.bsvars
Author:	Tomasz Woźniak  [aut, cre]
Maintainer:	Tomasz Woźniak < wozniak.tom.at.pm.me >
BugReports:	https://github.com/bsvars/bsvars/issues
License:	GPL (≥ 3)
URL:	https://bsvars.org/bsvars/

bsvarSIGNs: Bayesian SVARs with Sign, Zero, and Narrative Restrictions

Implements state-of-the-art algorithms for the Bayesian analysis of Structural Vector Autoregressions (SVARs) identified by sign, zero, and narrative restrictions. The core model is based on a flexible Vector Autoregression with estimated hyper-parameters of the Minnesota prior and the dummy observation priors as in Giannone, Lenza, Primiceri (2015) <[doi:10.1162/REST_a.00483](https://doi.org/10.1162/REST_a.00483)>. The sign restrictions are implemented employing the methods proposed by Rubio-Ramírez, Waggoner & Zha (2010) <[doi:10.1111/j.1467-937X.2009.00578.x](https://doi.org/10.1111/j.1467-937X.2009.00578.x)>, while identification through sign and zero restrictions follows the approach developed by Arias, Rubio-Ramírez, & Waggoner (2018) <[doi:10.3982/ECTA14468](https://doi.org/10.3982/ECTA14468)>. Furthermore, our tool provides algorithms for identification via sign and narrative restrictions, in line with the methods introduced by Antolin-Díaz and Rubio-Ramírez (2018) <[doi:10.1257/aer.20161852](https://doi.org/10.1257/aer.20161852)>. Users can also estimate a model with sign, zero, and narrative restrictions imposed at once. The package facilitates predictive and structural analyses using impulse responses, forecast error variance and historical decompositions, forecasting and conditional forecasting, as well as analyses of structural shocks and fitted values. All this is complemented by colourful plots, user-friendly summary functions, and comprehensive documentation. The 'bsvarSIGNs' package is aligned regarding objects, workflows, and code structure with the R package 'bsvars' by Woźniak (2024) <[doi:10.32614/CRAN.package.bsvars](https://doi.org/10.32614/CRAN.package.bsvars)>, and they constitute an integrated toolset.

Version:	1.0.1
Depends:	R (≥ 2.10), RcppArmadillo, bsvars
Imports:	Rcpp (≥ 1.0.12), RcppProgress, R6
LinkingTo:	Rcpp, RcppArmadillo, RcppProgress, bsvars
Suggests:	tinytest
Published:	2024-08-17
DOI:	10.32614/CRAN.package.bsvarSIGNs
Author:	Xiaolei Wang  [aut, cre], Tomasz Woźniak  [aut]
Maintainer:	Xiaolei Wang < cadamwang15@gmail.com >
BugReports:	https://github.com/bsvars/bsvarSIGNs/issues
License:	GPL (≥ 3)
URL:	https://bsvars.github.io/bsvarSIGNs/

bsvars.org features

- ▶ Bayesian estimation of Structural VARs
- ▶ coherent code structure, workflows, and objects
- ▶ excellent computational speed
- ▶ frontier econometric & numerical techniques
- ▶ written in **C++** using **Rcpp** and **RcppArmadillo**
- ▶ data analysis in **R**

bsvars.org features

Structural Vector Autoregressions

VAR eq.: $\mathbf{y}_t = \mathbf{A}\mathbf{x}_t + \boldsymbol{\epsilon}_t$

structural eq.: $\mathbf{B}_0\boldsymbol{\epsilon}_t = \mathbf{u}_t$

structural shocks: $\mathbf{u}_t \sim \mathcal{N}(\mathbf{0}, \text{diag}(\boldsymbol{\sigma}_t^2))$

bsvars.org features



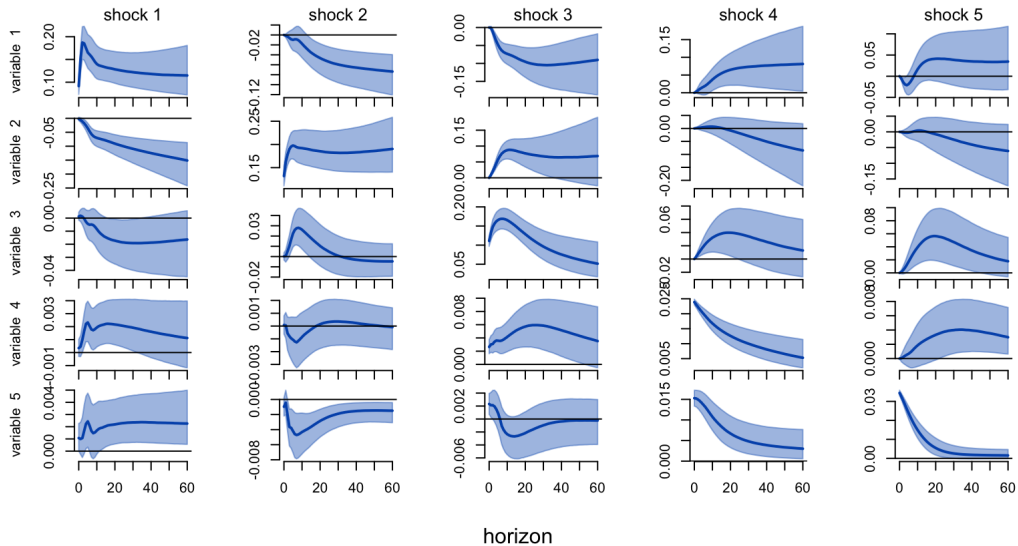
- ▶ based on own research
- ▶ exclusion restrictions
- ▶ heteroskedasticity, and
- ▶ non-normality
- ▶ 5 volatility & 3 non-normal models
- ▶ Priors: 3-level eq-specific local-global shrinkage



- ▶ based on top-field papers
- ▶ sign restrictions
- ▶ sign & zero restrictions
- ▶ narrative restrictions
- ▶ flexible Bayesian VAR
- ▶ Priors: Minnesota with dummy observations and estimated shrinkage

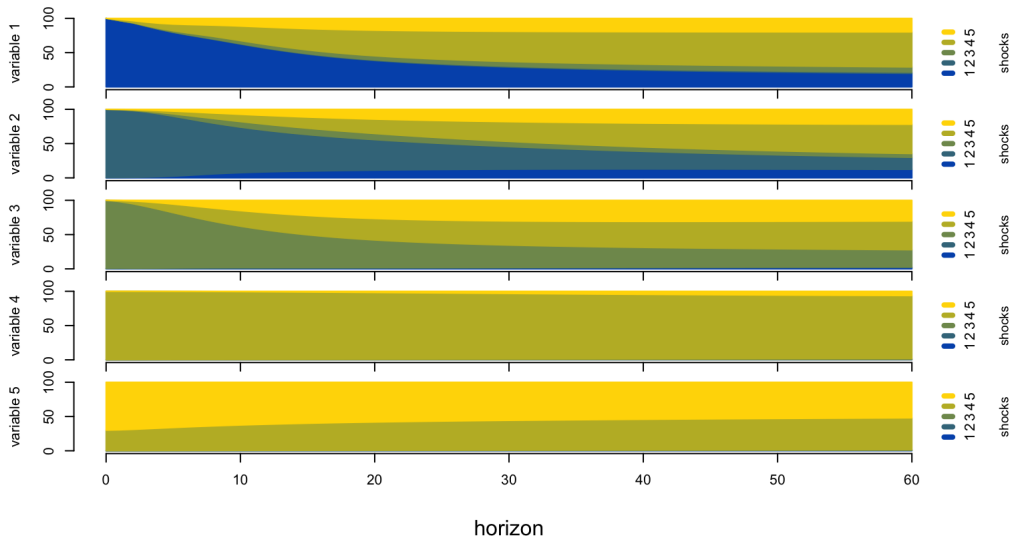
bsvars.org features

Impulse Responses



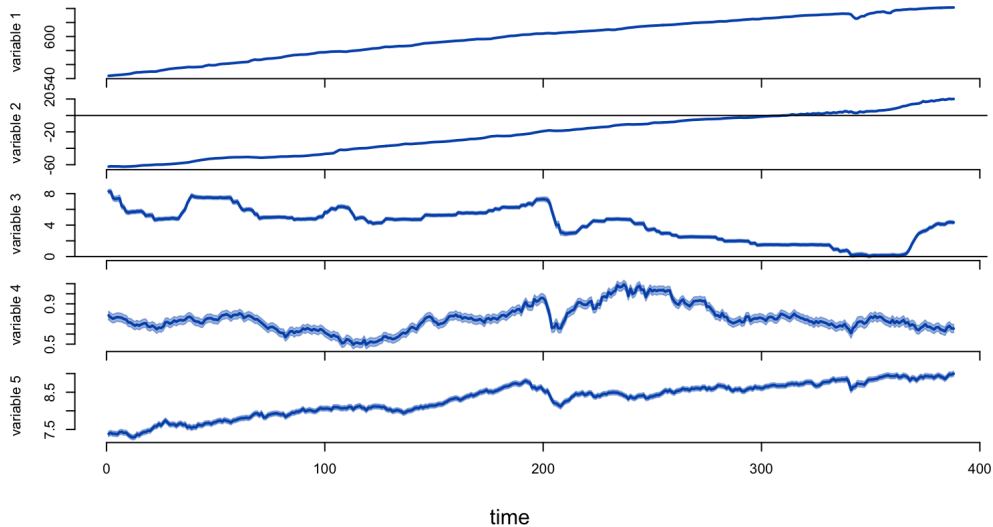
bsvars.org features

Forecast Error Variance Decompositions



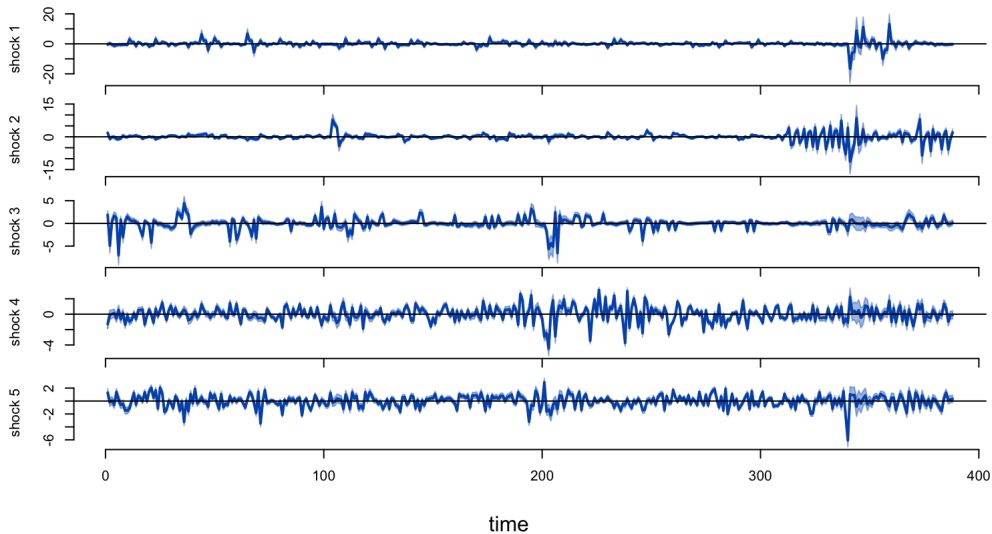
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Fitted Values of Dependent Variables



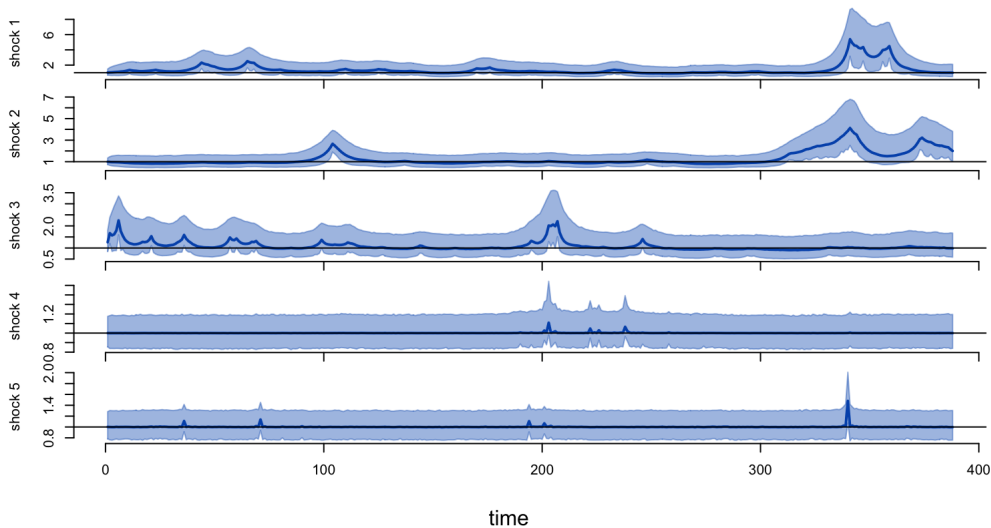
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Structural Shocks



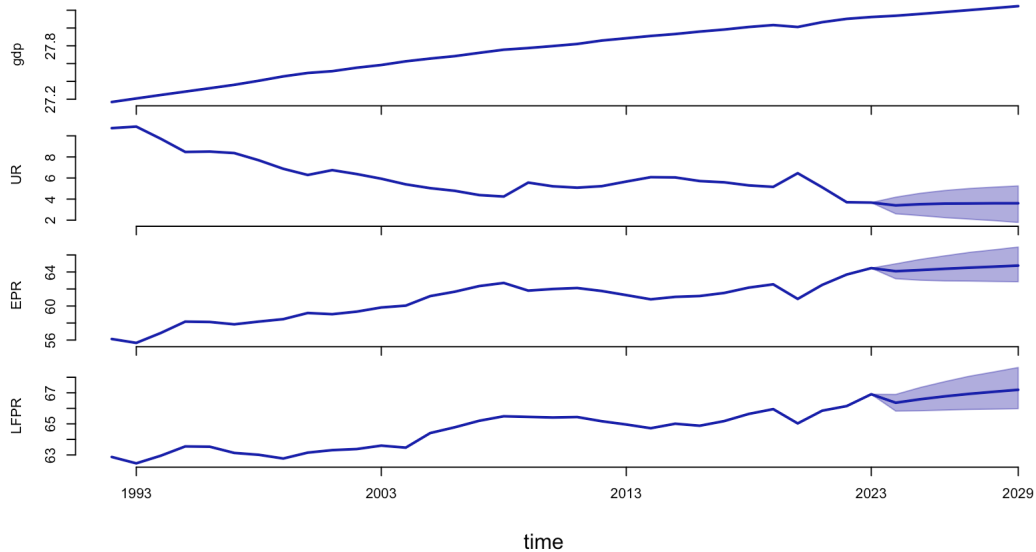
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Structural Shocks' Conditional Standard Deviations



bsvars.org features

Forecasts for Australia



bsvars.org roadmap

- ▶ R package **bvarPANELs**

Forecasting with Bayesian Hierarchical Panel VARs

- ▶ R package **bsvarTVPs**

Bayesian SVARs with Time-Varying Identification

- ▶ R package **bsvarCFs**

Conditional Forecasting for Bayesian Structural VARs



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