Title

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irf — Create and analyze IRFs, dynamic-multiplier functions, and FEVDs

Description

`irf` creates and manipulates IRF files that contain estimates of the IRFs, dynamic-multiplier functions, and forecast-error variance decompositions (FEVDs) created after estimation by `var`, `svar`, `ivsvar`, or `vec`; see [TS] **var**, [TS] **var svar**, [TS] **var ivsvar**, or [TS] **vec**.

`irf` creates and manipulates IRF files that contain estimates of the IRFs created after estimation by `arima`, `arfima`, `lpirf`, `dsge`, or `dsgenl`; see [TS] **arima**, [TS] **arfima**, [TS] **lpirf**, [DSGE] **dsge**, or [DSGE] **dsgenl**.

IRFs and FEVDs are described below, and the process of analyzing them is outlined. After reading this entry, please see [TS] **irf create**.

Quick start

Fit a vector autoregressive model

```
var y1 y2 y3
```

Create impulse–response function `myirf` and IRF file `myirfs.irf`

```
irf create myirf, set(myirfs)
```

Graph orthogonalized impulse–response function for dependent variables `y1` and `y2` given a shock to `y1`

```
irf graph oirf, impulse(y1) response(y1 y2)
```

Same as above, but present results in a table

```
irf table oirf, impulse(y1) response(y1 y2)
```

Note: `irf` commands can be used after `var`, `svar`, `ivsvar`, `vec`, `arima`, `arfima`, `lpirf`, `dsge`, or `dsgenl`; see [TS] **var**, [TS] **var svar**, [TS] **var ivsvar**, [TS] **vec**, [TS] **arima**, [TS] **arfima**, [TS] **lpirf**, [DSGE] **dsge**, or [DSGE] **dsgenl**.

See [TS] **irf add**, [TS] **irf cgraph**, [TS] **irf ctable**, [TS] **irf describe**, [TS] **irf drop**, [TS] **irf graph**, [TS] **irf ograph**, [TS] **irf rename**, [TS] **irf set**, and [TS] **irf table** for additional Quick starts.

Syntax

```
irf subcommand ... [ , ... ]
```

subcommand	Description
`create`	create IRF file containing IRFs, dynamic-multiplier functions, and FEVDs
`set`	set the active IRF file
`graph`	graph results from active file
`cgraph`	combine graphs of IRFs, dynamic-multiplier functions, and FEVDs
`ograph`	graph overlaid IRFs, dynamic-multiplier functions, and FEVDs
`table`	create tables of IRFs, dynamic-multiplier functions, and FEVDs from active file
`ctable`	combine tables of IRFs, dynamic-multiplier functions, and FEVDs
`describe`	describe contents of active file
`add`	add results from an IRF file to the active IRF file
`drop`	drop IRF results from active file
`rename`	rename IRF results within a file

IRF stands for impulse–response function; FEVD stands for forecast-error variance decomposition.

`irf` can be used after `var`, `svar`, `ivsvar`, `vec`, `arima`, `arfima`, `lpirf`, `dsge`, or `dsgenl`; see [TS] **var**, [TS] **var svar**, [TS] **var ivsvar**, [TS] **vec**, [TS] **arima**, [TS] **arfima**, [TS] **lpirf**, [DSGE] **dsge**, or [DSGE] **dsgenl**.

Remarks and examples

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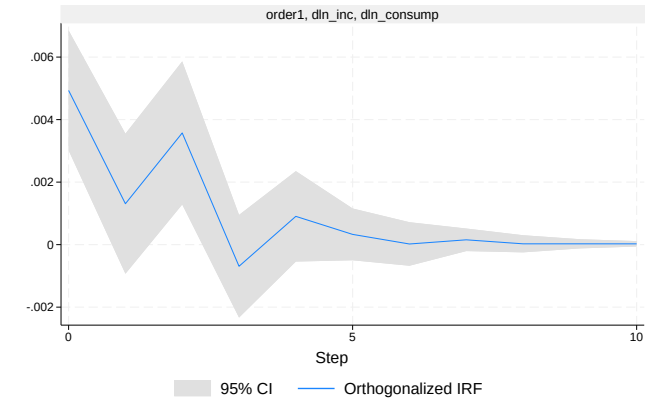
An IRF measures the effect of a shock to an endogenous variable on itself or on another endogenous variable; see Lütkepohl (2005, 51–63) and Hamilton (1994, 318–323) for formal definitions. Becketti (2020) provides an approachable, gentle introduction to IRF analysis. Of the many types of IRFs, `irf create` estimates the five most important: simple IRFs, orthogonalized IRFs, cumulative IRFs, cumulative orthogonalized IRFs, and structural IRFs.

A dynamic-multiplier function, or transfer function, measures the impact of a unit increase in an exogenous variable on the endogenous variables over time; see Lütkepohl (2005, chap. 10) for formal definitions. `irf create` estimates simple and cumulative dynamic-multiplier functions after `var`.

The forecast-error variance decomposition (FEVD) measures the fraction of the forecast-error variance of an endogenous variable that can be attributed to orthogonalized shocks to itself or to another endogenous variable; see Lütkepohl (2005, 63–66) and Hamilton (1994, 323–324) for formal definitions. Of the many types of FEVDs, `irf create` estimates the two most important: Cholesky and structural.

To analyze IRFs and FEVDs in Stata, you first fit a model, then use `irf create` to estimate the IRFs and FEVDs and save them in a file, and finally use `irf graph` or any of the other `irf` analysis commands to examine results:

```
. use https://www.stata-press.com/data/r18/lutkepohl2
(Quarterly SA West German macro data, Bil DM, from Lutkepohl 1993 Table E.1)
. var dln_inv dln_inc dln_consump if qtr<=tq(1978q4), lags(1/2) dfk
  (output omitted)
. irf create order1, step(10) set(myirf1, new)
(file myirf1.irf created)
(file myirf1.irf now active)
(file myirf1.irf updated)
. irf graph oirf, impulse(dln_inc) response(dln_consump)
```

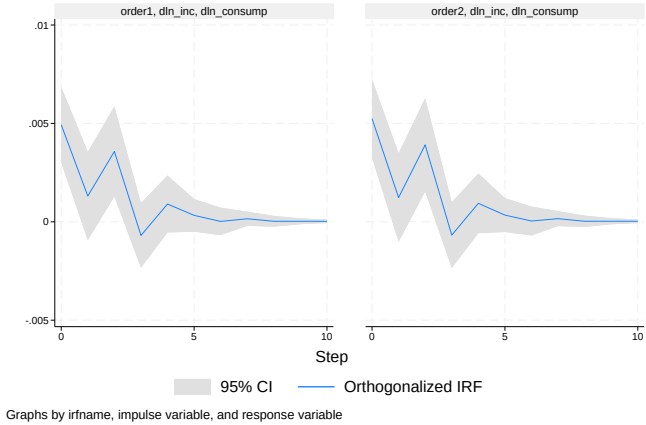


Multiple sets of IRFs and FEVDs can be placed in the same file, with each set of results in a file bearing a distinct name. The `irf create` command above created file `myirf1.irf` and put one set of results in it, named `order1`. The `order1` results include estimates of the simple IRFs, orthogonalized IRFs, cumulative IRFs, cumulative orthogonalized IRFs, and Cholesky FEVDs.

IRF files are just files: they can be erased by `erase`, listed by `dir`, and copied by `copy`; see [D] **erase**, [D] **dir**, and [D] **copy**.

Below we use the same estimated `var` but use a different Cholesky ordering to create a second set of IRF results, which we will save as `order2` in the same file, and then we will graph both results:

```
. irf create order2, step(10) order(dln_inc dln_inv dln_consump)
(file myirf1.irf updated)
. irf graph oirf, irf(order1 order2) impulse(dln_inc) response(dln_consump)
```



Graphs by irfname, impulse variable, and response variable

We have compared results for one model under two different identification schemes. We could just as well have compared results of two different models. We now use `irf table` to display the results tabularly:

```
. irf table oirf, irf(order1 order2) impulse(dln_inc) response(dln_consump)
Results from order1 and order2
```

Step	(1) oirf	(1) Lower	(1) Upper
0	.004934	.003016	.006852
1	.001309	-.000931	.003549
2	.003573	.001285	.005862
3	-.000692	-.002333	.00095
4	.000905	-.000541	.002351
5	.000328	-.0005	.001156
6	.000021	-.000675	.000717
7	.000154	-.000206	.000515
8	.000026	-.000248	.0003
9	.000026	-.000121	.000174
10	.000026	-.000061	.000113

Step	(2) oirf	(2) Lower	(2) Upper
0	.005244	.003252	.007237
1	.001235	-.001011	.003482
2	.00391	.001542	.006278
3	-.000677	-.002347	.000993
4	.00094	-.000576	.002456
5	.000341	-.000518	.001201
6	.000042	-.000693	.000777
7	.000161	-.000218	.00054
8	.000027	-.000261	.000315
9	.00003	-.000125	.000184
10	.000027	-.000065	.00012

95% lower and upper bounds reported.
(1) irfname = order1, impulse = dln_inc, and response = dln_consump.
(2) irfname = order2, impulse = dln_inc, and response = dln_consump.

Both the table and the graph show that the two orthogonalized IRFs are essentially the same. In both functions, an increase in the orthogonalized shock to `dln_inc` causes a short series of increases in `dln_consump` that dies out after four or five periods.

References

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Hamilton, J. D. 1994. *Time Series Analysis*. Princeton, NJ: Princeton University Press.

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Also see

[TS] **arfima** — Autoregressive fractionally integrated moving-average models

[TS] **arima** — ARIMA, ARMAX, and other dynamic regression models

[TS] **lpirf** — Local-projection impulse–response functions

[TS] **var** — Vector autoregressive models+

[TS] **var intro** — Introduction to vector autoregressive models

[TS] **var ivsvar** — Instrumental-variables structural vector autoregressive models+

[TS] **var svar** — Structural vector autoregressive models

[TS] **varbasic** — Fit a simple VAR and graph IRFs or FEVDs

[TS] **vec** — Vector error-correction models

[TS] **vec intro** — Introduction to vector error-correction models

[DSGE] **dsge** — Linear dynamic stochastic general equilibrium models

[DSGE] **dsgenl** — Nonlinear dynamic stochastic general equilibrium models