

# Inference in Shift-Share Designs

Michal Kolesár

2019-08-07

The package **BartikSE** implements confidence intervals proposed by Adão, Kolesár, and Morales (2019) for inference in shift-share least squares and instrumental variables regressions, in which the regressor of interest (or the instrument) has a shift-share structure, as in Bartik (1991). A shift-share variable has the structure  $X_i = \sum_{s=1}^S w_{is} \mathcal{X}_s$ , where  $i$  indexes regions,  $s$  indexes sectors,  $\mathcal{X}_s$  are sectoral shifters (or shocks), and  $w_{is}$  are shares, such as initial share of region  $i$ 's employment in sector  $s$ .

This vignette illustrates the use of the package using a dataset from Autor, Dorn, and Hanson (2013) (ADH hereafter). The dataset is included in the package as the list **ADH**. The first element of the list, **ADH\$reg** is a data-frame with regional variables, the second element, **ADH\$sic** is a vector of SIC codes for the sectors, and **ADH\$W** is a matrix of shares. See **?ADH** for a description of the dataset.

We now replicate column (1) of Table 5 in Adão, Kolesár, and Morales (2019). First we load the package, define the vector of controls, and define a vector of 3-digit SIC codes:

```
library("BartikSE")
ctrls <- "t2 + l_shind_manuf_cbp + l_sh_popedu_c + l_sh_popfborn +
         l_sh_empl_f + l_sh_routine33 + l_task_outsource + division"
sic <- floor(ADH$sic/10)
```

We cluster the standard errors at the 3-digit SIC code (using the option **sector\_cvar**), and, following ADH, weight the data using the weights **ADH\$reg\$weights**. See **?lmBartik** and **?IVBartik** for full description of the options.

The first-stage regression:

```
lmBartik(as.formula(paste("shock ~ ", ctrl)), W = ADH$W,
         X = IV, data = ADH$reg, weights = weights, region_cvar = statefip,
         sector_cvar = sic, method = "all")
#> Estimate: 0.6310409
#>
#> Inference:
#>
#> Std. Error      p-value Lower CI Upper CI
#> Homoscedastic 0.02732516 0.000000e+00 0.5774846 0.6845973
#> EHW           0.08700719 4.083400e-13 0.4605100 0.8015719
#> Reg. cluster  0.09142372 5.113909e-12 0.4518537 0.8102281
#> AKM           0.05296055 0.000000e+00 0.5272402 0.7348417
#> AKM0          0.07671358 1.282891e-03 0.5375710 0.8382827
```

Note that for "AKM0", "Std. Error" corresponds to the normalized standard error, i.e. the length of the confidence interval divided by  $2z_{1-\alpha/2}$ .

The reduced-form and IV regressions:

```
lmBartik(as.formula(paste("d_sh_empl ~", ctrl)), W = ADH$W,
         X = IV, data = ADH$reg, region_cvar = statefip, weights = weights,
         sector_cvar = sic, method = "all")
#> Estimate: -0.4885687
#>
#> Inference:
#>
#> Std. Error      p-value Lower CI Upper CI
#> Homoscedastic 0.06332778 1.221245e-14 -0.6126889 -0.3644485
```

```

#> EHW          0.11244360 1.392685e-05 -0.7089541 -0.2681833
#> Reg. cluster 0.07578147 1.140306e-10 -0.6370977 -0.3400398
#> AKM          0.16419445 2.924641e-03 -0.8103839 -0.1667535
#> AKMO         0.25437489 4.218033e-04 -1.2368853 -0.2397541
ivBartik(as.formula(paste("d_sh_empl ~", ctrl, "| shock")),
  W = ADH$W, X = IV, data = ADH$reg, region_cvar = statefip,
  weights = weights, sector_cvar = sic, method = "all")
#> Estimate: -0.7742267
#>
#> Inference:
#>          Std. Error      p-value   Lower CI   Upper CI
#> Homoscedastic 0.1069532 4.523049e-13 -0.9838511 -0.5646022
#> EHW          0.1647892 2.623532e-06 -1.0972075 -0.4512459
#> Reg. cluster 0.1758096 1.063809e-05 -1.1188071 -0.4296462
#> AKM          0.2403730 1.277718e-03 -1.2453492 -0.3031041
#> AKMO         0.3318966 4.218033e-04 -1.6903240 -0.3893132

```

## References

- Adão, Rodrigo, Michal Kolesár, and Eduardo Morales. 2019. “Inference in Shift-Share Designs: Theory and Inference.” <https://arxiv.org/abs/1806.07928>.
- Autor, David H., David Dorn, and Gordon H. Hanson. 2013. “The China Syndrome: Local Labor Market Effects of Import Competition in the United States.” *American Economic Review* 103 (6): 2121–68.
- Bartik, Timothy J. 1991. *Who Benefits from State and Local Economic Development Policies?* Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.