

## Forecasting Regional Data Using Spatial Vars

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**Abstract :** Since the 1980s, spatial correlation models have been used more often to model regional indicators. An increasingly popular method for studying regional indicators is modeling taking into account spatial relationships between objects that are part of the same economic zone. In 2000s the new class of model – spatial vector autoregressions was developed. The main difference between standard and spatial vector autoregressions is that in the spatial VAR (SpVAR), the values of indicators at time  $t$  may depend on the values of explanatory variables at the same time  $t$  in neighboring regions and on the values of explanatory variables at time  $t-k$  in neighboring regions. Thus, VAR is a special case of SpVAR in the absence of spatial lags, and the spatial panel data model is a special case of spatial VAR in the absence of time lags. Two specifications of SpVAR were applied to Russian regional data for 2000-2017. The values of GRP and regional CPI are used as endogenous variables. The lags of GRP, CPI and the unemployment rate were used as explanatory variables. For comparison purposes, the standard VAR without spatial correlation was used as “naïve” model. In the first specification of SpVAR the unemployment rate and the values of depending variables, GRP and CPI, in neighboring regions at the same moment of time  $t$  were included in equations for GRP and CPI respectively. To account for the values of indicators in neighboring regions, the adjacency weight matrix is used, in which regions with a common sea or land border are assigned a value of 1, and the rest - 0. In the second specification the values of depending variables in neighboring regions at the moment of time  $t$  were replaced by these values in the previous time moment  $t-1$ . According to the results obtained, when inflation and GRP of neighbors are added into the model both inflation and GRP are significantly affected by their previous values, and inflation is also positively affected by an increase in unemployment in the previous period and negatively affected by an increase in GRP in the previous period, which corresponds to economic theory. GRP is not affected by either the inflation lag or the unemployment lag. When the model takes into account lagged values of GRP and inflation in neighboring regions, the results of inflation modeling are practically unchanged: all indicators except the unemployment lag are significant at a 5% significance level. For GRP, in turn, GRP lags in neighboring regions also become significant at a 5% significance level. For both spatial and “naïve” VARs the RMSE were calculated. The minimum RMSE are obtained via SpVAR with lagged explanatory variables. Thus, according to the results of the study, it can be concluded that SpVARs can accurately model both the actual values of macro indicators (particularly CPI and GRP) and the general situation in the regions

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