Synthetic Controls with Many Time-Varying Covariates

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Abstract :
This paper presents a new method for incorporating many time-varying covariates into the synthetic controls method. As introduced in Abadie and Gardeazabal (2003) and Abadie, Dia- mond, and Hainmueller (2010), the standard synthetic control method uses a small number of predictors that are not time varying (or are constructed to be such by averaging over time). We propose a model in which the untreated potential outcomes and covariates have a shared factor structure. Unit-specific loadings on these factors then form suitable variables that can be used in the construction of synthetic control weights. We estimate these factor loadings from the product of the untreated potential outcomes matrix Y (N units by T0 periods) and the covariate tensor X (N units, T0 periods, K covariates). We provide a rate for the estimation of the factor loadings from this tensor, and show how they can be used in the standard synthetic controls framework.