Nickell Bias in Panel Local Projection: Financial Crises Are Worse Than You Think

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1 Motivation

In recent years, Local projection (LP) (Jordà, 2005) has been one of the most important estimation techniques in macroeconomics. Panel LP (pLP) with country fixed effects (FE) is a standard tool for measuring how financial crises affect output. The approach regresses $y_{i,t+h}$ on crisis indicators $x_{i,t}$ and absorbs unit heterogeneity with FE. The paper shows that, even when $x_{i,t}$ does not contain lagged $y_{i,t}$, the dynamic structure inherent in predictive specifications makes the fixed-effects estimator suffer from the Nickell bias. The nominal rejection probability of the t-tests from the FE estimator no longer matches the empirical rejection probabilities. In practice, FE understates crisis-driven output losses.

2 Intrinsic Nickell Bias

To demonstrate the presence of the Nickell bias, We study a panel VAR(1) prototype:

$$\begin{aligned} y_{i,t+1} &= \mu_i^{(0)y} + \beta^{(0)} x_{i,t+1} + u_{i,t+1}^{y}, \\ x_{i,t+1} &= \mu_i^{x} + \rho x_{i,t} + u_{i,t+1}^{x}. \end{aligned}$$

Iterating the system implies $y_{i,t+h}$ depends on current and lagged innovations in $x_{i,t}$, so the composite error $e_{i,t+h}^{(h)}$ in the pLP regression

$$y_{i,t+h} = \mu_i^{(h)y} + \beta^{(h)} x_{i,t} + u_{i,t+h}^{y}, \quad h \in \{1, 2 \ldots, H\}$$

is only *weakly exogenous*: $\mathbb{E}[e_{i,t+h}^{(h)} \mid \mathbf{x}_i^T] \neq 0$ whenever $\beta^{(0)} \neq 0$.

However, the unbiasedness of the FE estimator requires *strict exogeneity*. Proposition 1 of the paper derives the analytic bias of $\hat{\beta}^{(h)}$:

$$\hat{\beta}^{(h)} \overset{a}{\sim} \beta^{(h)} - \frac{\text{bias}}{T} + \frac{\text{Normal}(0)}{\sqrt{NT}},$$

where "bias" is a non-zero constant, and "Normal(0)" is a normally distributed random variable with finite variance and centered at 0. The bias is order $1/T$ and does not vanish in the joint limit with $N/T \to c$. Positive persistence ($\rho > 0$) yields *attenuation* ($\hat{\beta}^{(h)}$ is biased toward zero), the distortion enlarges with the horizon h and with more persistent crisis indicators, and t-statistics remain shifted even with known asymptotic variances.

3 Split-Panel Jackknife

To remove the leading bias, we recommend the split-panel jackknife (SPJ):

$$\tilde{\beta} = 2\hat{\beta}^{(h)} - \frac{\hat{\beta}_a^{(h)} + \hat{\beta}_b^{(h)}}{2}, \tag{1}$$

where the subscripts a and b denote usual FE estimates from the first and second halves (over the time dimension) of the panel.

If the main regression has multiple control variables in the specification

$$y_{i,t+h} = \mu_i^{(h)y} + \beta^{(h)\prime}\mathbf{x}_{i,t} + u_{i,t+h}^{y}, \quad h \in \{1, 2 \ldots, H\}$$

where $\mathbf{x}_{i,t}$ is a K-dimensional regressor, and thus $\beta^{(h)}$ is a K-dimensional parameter, the procedure is the same, with the three FE estimates in (1). Under standard law-of-large-numbers and CLT conditions with $N/T^3 \to 0$, our paper's Theorem 1 shows

$$\sqrt{NT}(\tilde{\beta}^{(h)} - \beta^{(h)}) \Rightarrow \mathcal{N}(0, \mathbf{\Sigma}),$$

where $\mathbf{\Sigma}$ is a $K \times K$ matrix of the asymptotic variance. SPJ is asymptotically unbiased and delivers valid t-test and Wald test. The estimator preserves the appeal of LPs—researchers still specify only the predictive regression.

Practically, we recommend SPJ for panels with $T \geq 30$ and $N/T \leq 10$.

4 Empirical Implications

Revisiting four influential cross-country crisis studies, the SPJ-based impulse responses exhibit larger and more persistent output losses than those implied by fixed effects. Hence, the conventional FE local projection systematically understates how severe and long-lasting financial crises are.

5 Takeaway

In pLP regressions, we argue against the widely used FE estimator due to the intrinsic Nickell bias in the dynamic setting. We recommend the SPJ estimator. It is easy to implement, and maintains the validity of the usual t-statistic-based hypothesis testing procedure.

We provide an R package for users to carry out the SPJ estimation with a one-line command.

References

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review 95*(1), 161–182.