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A framework for decomposing shocks and measuring volatilities derived from multi-dimensional panel data of survey forecasts

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Abstract

This work applies previously published frameworks developed for analyzing multi-dimensional panel data of survey forecasts to IPD forecasts from the Survey of Professional Forecasters. The paper expands on these frameworks, demonstrates that the frameworks imply the existence of new and richer measures of shocks and volatilities, and shows how these measures can be extracted from multi-dimensional forecast panels. Three distinct types of economic shocks (cumulative shocks, cross-sectional shocks, and discrete shocks) and implied volatility measures based on these shocks are calculated for IPD inflation over the period 1969 through 2004. GMM tests for forecaster biases are conducted using the expanded framework.

Keywords: Panel data; Shocks; Volatility; Multidimensional; Survey of Professional Forecasters; Inflation; Rationality; Error measures; Evaluating forecasts; Inflation forecasting; Volatility forecasting

1. Introduction

The existence of multi-dimensional panel data sets significantly predates methodologies for extracting maximal information from the data sets. The Survey of Professional Forecasters (SPF), instituted in late 1968, is a three-dimensional panel data set in which multiple forecasters forecast macroeconomic variables over multiple quarters and at multiple quarterly horizons (Croushore, 1993; Zarnowitz & Braun, 1993). Similarly, the Livingston Survey (LS), instituted in 1946, asks participants to forecast variables semi-annually and at multiple semi-annual horizons (Croushore, 1997). While the SPF and the LS have long histories, the relative infrequency of the forecasts (particularly in the case of the LS) combined with the facts that the forecasts are anonymous and that the participant memberships have changed over time limits the usefulness of the data. In contrast, the Blue Chip Survey of Professional Forecasters (BCS), instituted in 1976, asks multiple participants to forecast variables monthly and at multiple monthly horizons. Because the BCS forecasts are not anonymous, researchers have suggested that the BCS forecasters have greater incentive to produce accurate

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forecasts. While these (and other) multi-dimensional panel surveys have long histories, the first methodologies that fully utilized the multi-dimensionality did not appear until the 1990s.[1]

Batchelor and Dua (1991) and Swindler and Ketcher (1990) were among the first to perform panel data analyses on the BCS. However, because they employed the then typical panel data techniques, they were forced to restrict their analysis to two of the three dimensions the data set offered (Batchelor and Dua used multiple targets and multiple horizons, but single individuals, while Swindler and Ketcher used multiple individuals and multiple targets, but single horizons). Keane and Runkle (1990) perform a panel data analysis on the SPF, but similarly restrict their analysis to two of the three available dimensions (they use multiple individuals and multiple targets, but single horizons) as do De Bont and Bange (1992) who analyze the LS (they use multiple targets and multiple horizons, but aggregate individuals into consensus forecasts).[2] Keane and Runkle's (1990) attempt to analyze the SPF data set is noteworthy for the use of the generalized method of moments despite the fact that the results of their analysis are invalid due to unaddressed non-stationarity (Bonham & Cohen, 1995). Davies and Lahiri describe a methodology for analyzing what they term "multi-dimensional" panel data (i.e. panel data with more than two dimensions) and apply the methodology to the BCS data (Davies & Lahiri, 1995) and the SPF data (Davies & Lahiri, 1999). They show that by employing techniques that account for all three of the data set's dimensions, additional information can be obtained that would not otherwise be available.[3]

The purpose of this paper is to build on the Davies-Lahiri multi-dimensional analysis framework in an attempt to better describe shocks and the volatilities of shocks. In the next section, I describe the data sets I use in this paper. In Section 3, I show how the Davies-Lahiri framework implies the existence of three distinct measures of shocks. In Sections 4 and 5, I employ these measures to calculate shocks and volatilities for IPD inflation. Section 6 shows the results of GMM tests for forecaster biases. Section 7 offers a conclusion and suggestions for future research.

2. Measuring implied inflation forecasts and actual inflation

The SPF asks forecasters to forecast, each quarter, the level of the implicit price deflator (IPD) for the last quarter, the current quarter, and each of the next four quarters. Forecasters are assigned identification numbers and are thus anonymous. From 1968-IV (the inception of the survey) to 1991-IV, individuals forecasted the level of the GNP deflator. From 1992-I to 1995-IV, individuals forecasted the level of the GDP deflator, and from 1996-I to the present, individuals have forecasted the chain-weighted GDP deflator. This paper focuses on the 52 forecasters who responded at least 25% of the time over the period 1968-IV through 2005-I.[4] Each forecaster (when responding) reported one forecast for each of six forecast horizons. Fifty-two forecasters reporting six forecasts for each of 147 quarters results in 45,864 potential data points. Because all forecasters occasionally failed to respond to the survey, the data set contains 13,510 forecasts. I arrange these forecasts by individual, target (the quarter being forecast), and horizon (the number of quarters prior to the realization of the target).

To avoid problems associated with integrated data, I look at the forecasters' implied inflation forecasts (Bonham & Cohen, 1995). At a given point in time, an individual forecasts the level of IPD for the previous quarter (horizon-1), the current quarter (horizon 0), and each of the next four quarters

[1] See Lahiri (1981), Visco (1984), Lovell (1986), Pesaran (1988), and Maddala (1990) for reviews of earlier studies using these and other survey data sets.

[2] For a more recent, though not panel, analysis of the LS data, see Thomas (1999).

[3] For example, Davies and Lahiri (1999) show that restricting a three-dimensional data set to two dimensions is equivalent, among other things, to imposing restrictions on components of the error covariance matrix.

[4] Given the amount of data manipulation required, computer limitations required that I not use the entire data set. The individuals' survey identification numbers of the forecasters in the data set are 7, 8, 15, 20, 22, 30, 31, 32, 34, 35, 38, 40, 43, 44, 49, 51, 54, 60, 62, 64, 65, 66, 69, 70, 72, 73, 77, 78, 82, 84, 86, 87, 89, 94, 98, 99, 109, 125, 144, 407, 411, 420, 421, 426, 428, 429, 431, 433, 439, 446, 456, and 463.