Discussion On:

The Measurement and Characteristics of Professional Forecasters' Uncertainty

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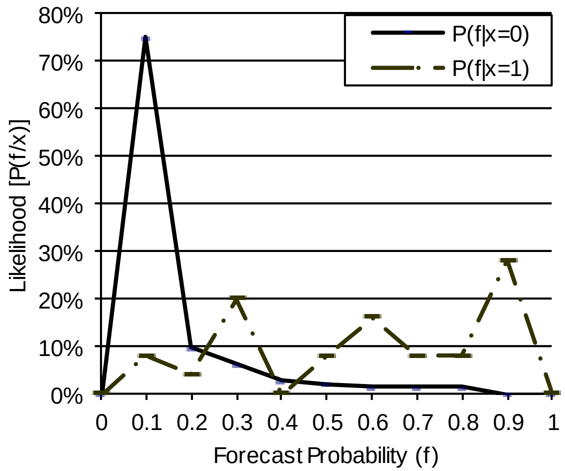
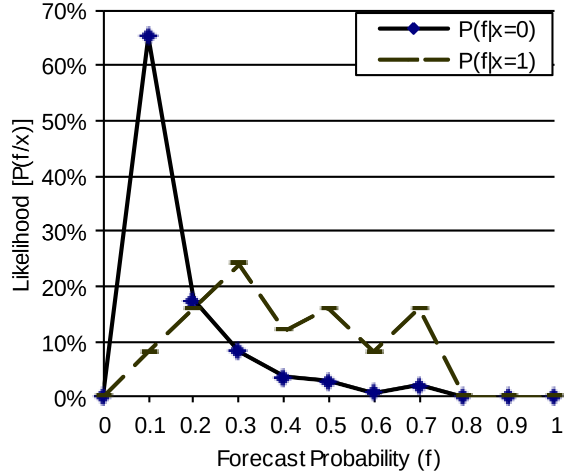
- Given that point forecasts from surveys do not have significant forecasting skills beyond one year (GDP growth) or six quarters (inflation), how good and dependable are these density forecasts measuring true uncertainty?
- In the current paper the authors consider h=5, 9 and 13 quarters.
- More work is need on this front.

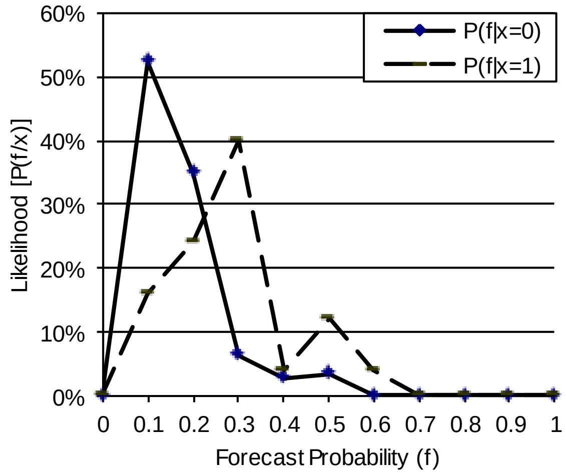
Quarter 0



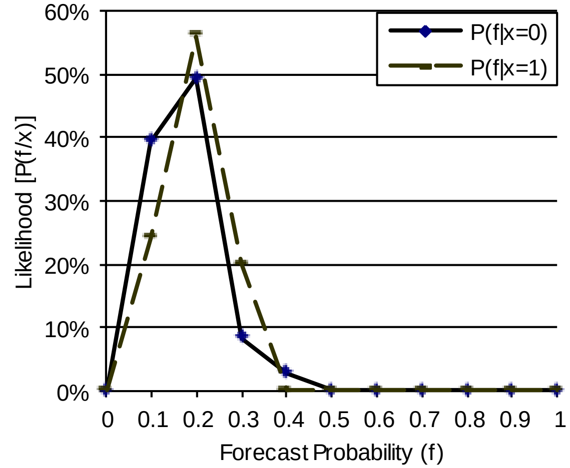
Quarter 1



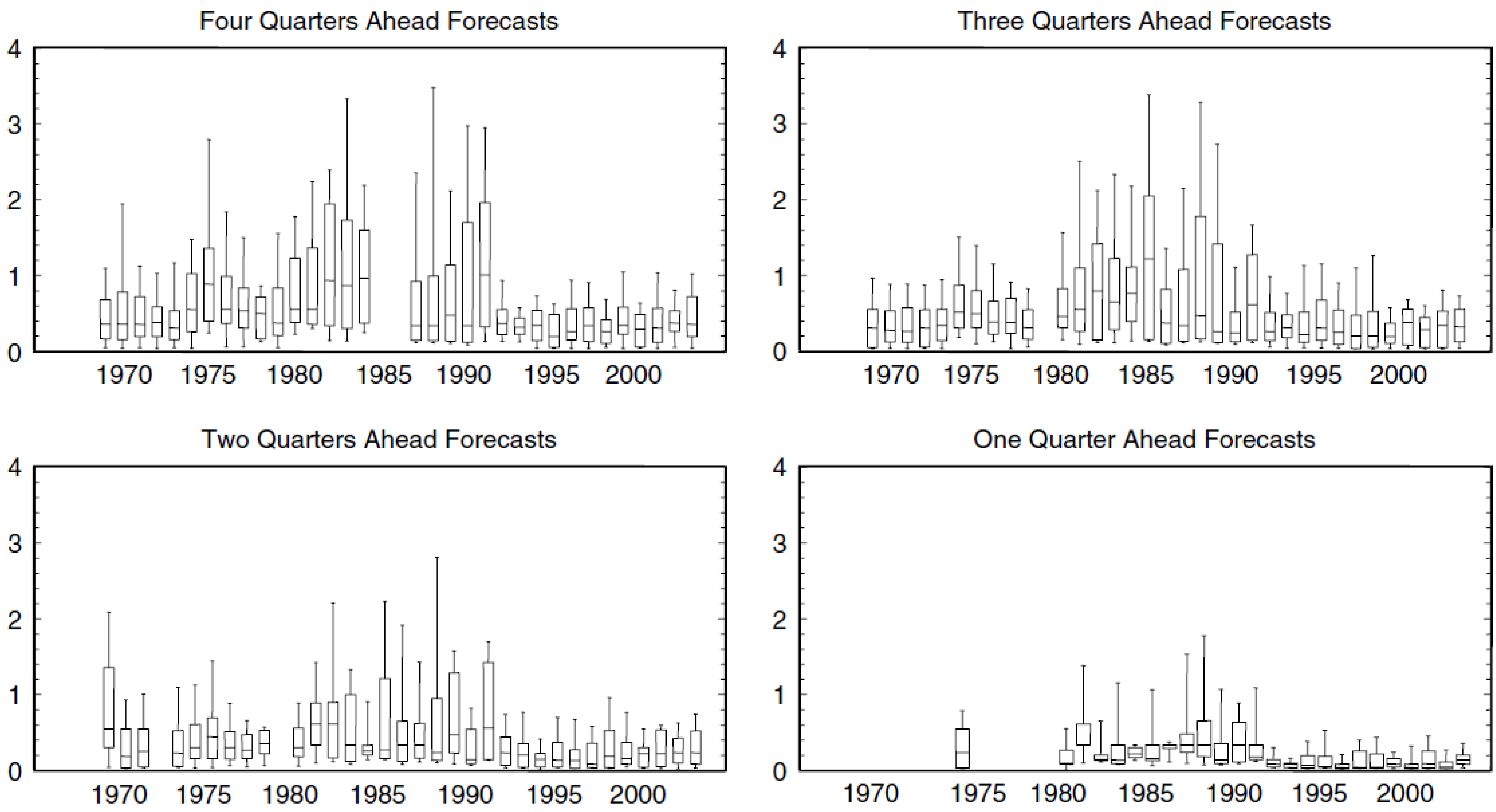
Quarter 2



Quarter 3



- Heterogeneity of cross sectional variances - point well taken.
- Variability - of - Variances (VoV) graph (a la Engle 1992)
- Lahiri and Liu (JAE 2006) has an elaborate analysis of this.


Four Quarters Ahead Forecasts
Three Quarters Ahead Forecasts
Two Quarters Ahead Forecasts
One Quarter Ahead Forecasts
0
1
2
3
4
1970
1975
1980
1985
1990
1995
2000

- Persistence: It is new finding in terms of Kendall's concordance test.
- But then this test should possibly accommodate clustering and other data dependence, cf. Harding and Pegan, Pesaran and Timmermann, etc.
- Lahiri and Liu (JAE 2006) approached the issue in terms of a dynamic panel model and found reasonable persistence. They looked at alternative ARCH type models - which is very natural in the context.
- Interestingly, in the context of Bayesian learning model developed by Lahiri and Sheng (JE, IJF), Precision should have a random walk representation with the errors representing uncertainty shocks.

- Bayes rule implies that under the normality assumption, agent *i*'s posterior mean is the weighted average of his prior mean and his estimate of the target variable conditional only on new public signal:

$$F_{ith} = \lambda_{ith} F_{ith+1} + (1 - \lambda_{ith})(L_{th} - \mu_{ith})$$

with his posterior precision $a_{ith} = a_{ith+1} + b_{ith}$, where $\lambda_{ith} = a_{ith+1} / (a_{ith+1} + b_{ith})$ is the weight attached to prior beliefs.

- Uncertainty vs. disagreement
- Authors suggest

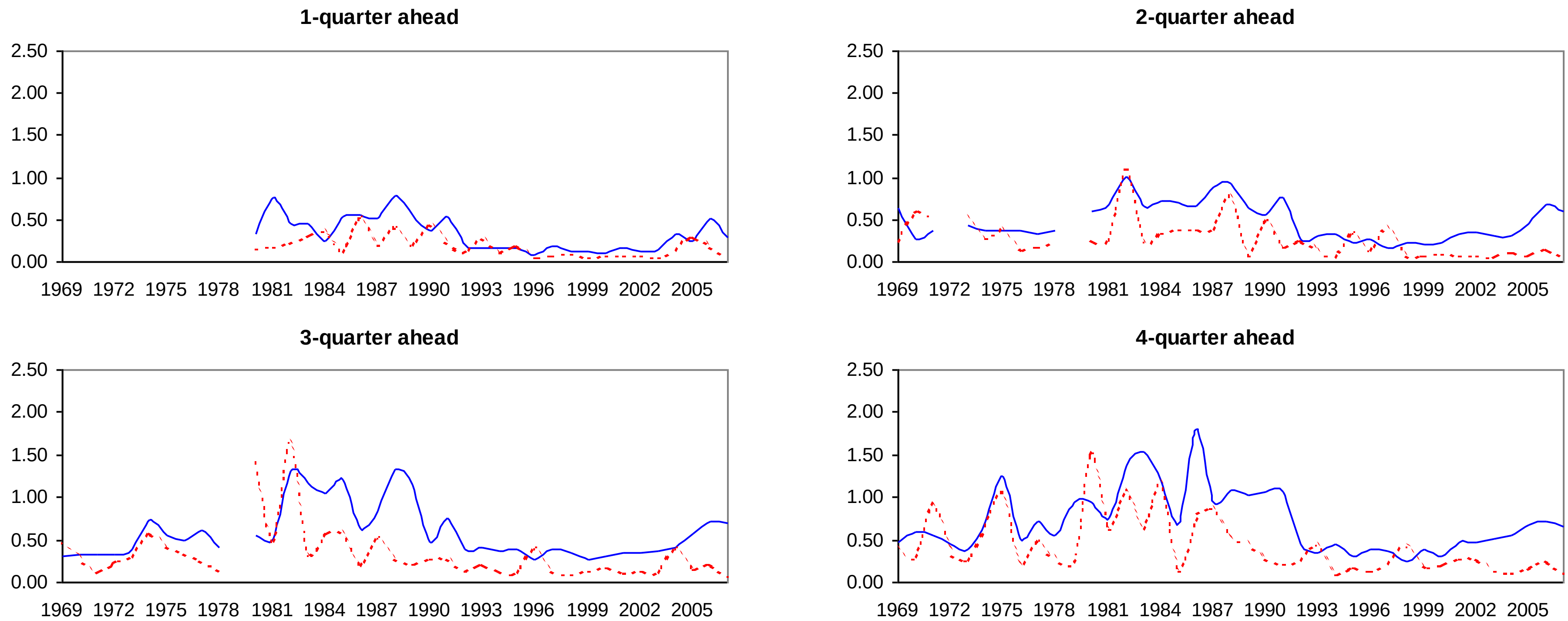
$$\text{Variance of survey average density} =$$

$$\text{average individual uncertainty} + \text{disagreement.}$$

- In incomplete panels, this will not hold.
- A natural way of looking at it to decompose the total sum of squares into between sum of squares and within sum of squares.

$$\text{Average uncertainty} = \text{variance of aggregate shocks and disagreement.}$$

- Lahiri et al (JBCB 1988), Lahiri and Sheng (JE 2008, JAE 2010, IJF 2011)


1-quarter ahead
2-quarter ahead
3-quarter ahead
4-quarter ahead
2.50
2.00
1.50
1.00
0.50
0.00
1969 1972 1975 1978 1981 1984 1987 1990 1993 1996 1999 2002 2005

- Alternative ways to compute higher moments from probability histograms:
- 1) mid points of class intervals
- 2) uniform over individual bins
- 3) normal, generalized Beta, etc.
- Fitting distributions may rule out occasional bimodality of the distributions during structural breaks and learning. Also, uniform density has certain non-information underpinning and consistent with bounds suggestion by Engelberg et al (JBES).
- Calculations using uniform density can be conducted following formula:

Calculation of the variances assuming a uniform distribution within each bin

For the open intervals at the end, I assumed them to be closed and have the same width as all the other intervals. There were few responses in which positive probability was put in these bins so hopefully it doesn't affect the results much.

Let A be the variable of interest whose variance we are trying to find. Denote by $\bar{A}$ the mean for an observation. This can be found by assigning all weight to the midpoint of each interval and multiplying the vector of midpoints by the vector of probabilities. For example, if the endpoints of the bins were 0, 2, 4 and 6, and the probabilities of falling within the bins were 0.6, 0.2 and 0.2 respectively, then the mean would be

$$1 \cdot 0.6 + 3 \cdot 0.2 + 5 \cdot 0.2 = 2.2.$$

Now, using $\bar{A}$, find an expression for the variance. Denote the support of the distribution of A by $[a, b]$. Denote each bin by $[a_i, b_i]$ for some $i = 1, ..., n$, so that

$$[a, b] = [a_1, b_1] \cup [a_2, b_2] \cup ... \cup [a_n, b_n],$$

with $a_1 = a$, $b_n = b$, and $a_i = b_{i-1}$ for $i \geq 2$.

The variance equals $\int_a^b (A - \bar{A})^2 dF(A)$, where F is the cumulative distribution function for A.

Let p_i be the probability the forecaster assigns to the bin $[a_i, b_i]$. Then assuming uniform distributions over each bin, $F(A)$ restricted to $[a_i, b_i]$ equals $\frac{Ap_i}{b_i - a_i}$, so that

$$dF(A) = \frac{p_i}{b_i - a_i}.$$

Then we have

$$\int_a^b (A-\bar{A})^2 dF(A) = \int_{a_1}^{b_1} \frac{p_1(A-\bar{A})^2}{b_1-a_1} dA + ... + \int_{a_n}^{b_n} \frac{p_n(A-\bar{A})^2}{b_n-a_n} dA.$$

Since

$$\int_{a_i}^{b_i} \frac{p_i(A-\bar{A})^2}{b_i-a_i} dA =$$

$$\frac{p_i}{b_i-a_i}\left(\frac{A^3}{3}\Big|_{a_i}^{b_i} - 2\bar{A}\frac{A^2}{2}\Big|_{a_i}^{b_i} + \bar{A}^2(b_i-a_i)\right)$$

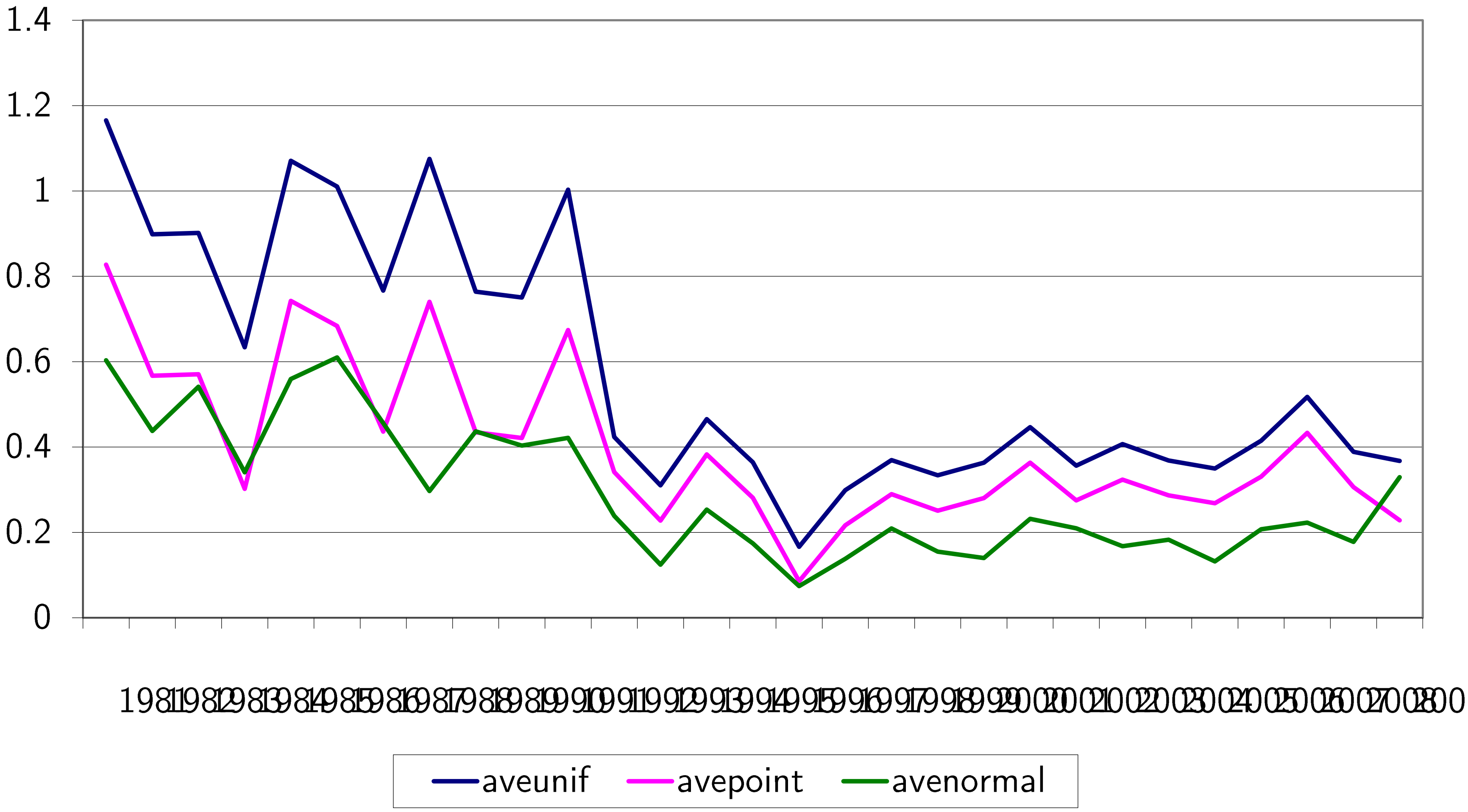
$$= p_i\left(\frac{b_i^2+a_i^2+b_ia_i}{3} - \bar{A}(b_i+a_i) + \bar{A}^2\right).$$

$$= p_iV_i.$$

So the total variance equals

$$(p_1p_2...p_n)(V_1V_2...V_n)'.$$

Average of variance of individual density forecasts made in the 4th quarter with respect to current year GDP forecasts



- Over all, the work is excellent and consistent with all their previous papers in this area. Gianna, Jeremy and Ken should be congratulated, should be urged to continue doing similar research.