Information Pooling Applied to Financial Time Series Forecasting

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ABSTRACT
Financial time series data is well known to exhibit a low signal to noise ratio. In this paper, we suggest an information pooling technique designed to help separate the desired signal from spurious correlation when modeling economic and financial time series data. Section 1 gives an overview of the background and the basis for information pooling. Section 2 applies a particular form of information pooling and compares its performance against a similar strategy without the information pooling technique. Sections 3 and 4 provide conclusions and citations, respectively.

KEYWORDS
Pooling, Shrinkage, Sensitivity, Dynamic Model, Forecasting.

1. INTRODUCTION
Pioneered by Dr. Arnold Zellner of the University of Chicago, information pooling techniques have been shown to increase the forecasting ability of econometric and financial applications [1]. Pooling can be applied in many forms; however, here we focus on sensitivity (coefficient) pooling in a multivariate setting. Modeling sensitivities simultaneously, by pooling information across equations, and by forcing parity among similar factors, can produce superior forecasts, this effect will be demonstrated in section 2 of this paper.

1.1 INFORMATION POOLING
The basis for information pooling is in the assumption that the sensitivity of a particular factor holds true across assets (equations). For example, an information pooling technique may be appropriate when modeling exchange rates using short-term rate differentials, if the model designer believes the underlying fundamental economic or financial theory holds across countries. Pooling sensitivities can take on many forms from mild to strict. Strict pooling would force sensitivities, for a particular factor (regressor variable), to one value across assets, within an asset class. A milder version of pooling would shrink the sensitivities toward a common value. In either case, efficiency can be increased and forecasting ability can be improved with information pooling techniques.

1.2 CONDITIONS FOR INFORMATION POOLING
Information pooling techniques have been shown to work best when economic or financial data exhibits the following two characteristics. First and foremost, the modeler believes a factor has a similar underlying fundamental relationship among assets within an asset class. Second, information pooling tends to yield better forecasting ability when applied to data with a low signal to noise ratio.

The first criteria, similar underlying fundamental relationships, stems from economic and financial theory. In other words, information pooling works best when applied to robust fundamental relationships as opposed to short-term factors.

Financial time series data often yield very low signal to noise ratios, which supports the second characteristic for appropriate use of information pooling. A low signal to noise ratio typically results in a high probability of detecting spurious correlation during some part of the data series. Spurious relationships can give the model designer a false sense of security in regards to model appropriateness and the relationship usually breaks down when tested out of sample. Information pooling will help to minimize this phenomenon. Information pooling may facilitate efficient use of data when applied to factors with similar relationships across equations and when dealing with low signal to noise economic or financial data.

2. INFORMATION POOLING EXAMPLE

As an example, we applied a strict sensitivity pooling technique to an already sophisticated dynamic forecasting system. A full description of the dynamic forecasting system can be found in “Financial Time Series Forecasting in a Bayesian Framework”, a P/E Investments white paper. A parallel case was run without the pooling technique. The relationship under investigation is between developed market exchange rate movements and short-term rate differentials. As most would agree, exchange rate data has a notoriously low signal to noise ratio. In addition, we assume that the fundamental economic relationship of “carry” holds true across all free floating exchange rates modeled in this example. These characteristics warrant the use of information pooling.

The simulations were run over a five year period ending on December 31, 2007. Identical forecast systems were employed in both simulations. The only difference between the two simulations was the application of a strict sensitivity pooling technique.

2.1 PERFORMANCE

The performance improvement with the information pooling technique was dramatic. Figure 2.1 illustrates the value of a $1000 investment in both simulations during the five year period. The blue line includes sensitivity pooling, while the maroon line omits the technique.

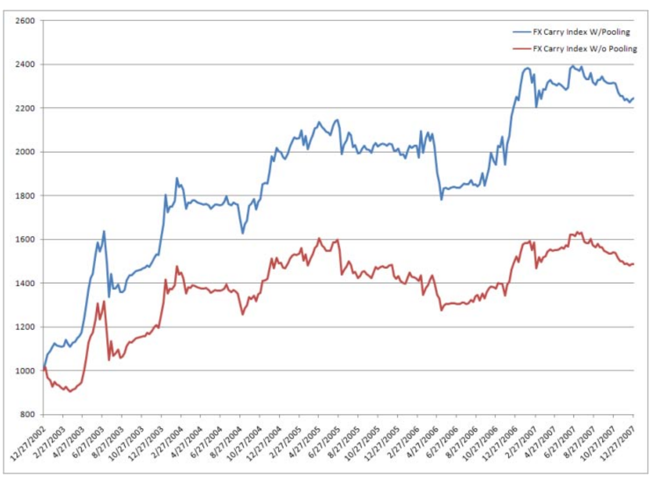

Figure 2.1 (source: P/E Investments and Bloomberg)

Table 2.1 summarizes the ex-post performance in terms of average annual return, annualized standard deviation, and information ratio. Information pooling, by method of common sensitivity, clearly outperforms its un-pooled counterpart. The information ratio more than doubles with the pooling technique applied. In addition to the dramatic gain in return for a similar amount of risk, we also note that portfolio turnover was reduced by five percent. The reduction in turnover is further confirmation that information pooling facilitates the separation of signal and spurious correlation as the portfolio exhibited increased stability.

Strategy	Average Ann. Return	Ann. Standard Deviation	Information Ratio
P/E Carry Index w/Pooling	17.5%	16.8%	1.04
P/E Carry Index w/o Pooling	8.2%	17.3%	0.48

Table 2.1 (source: P/E Investments and Bloomberg)

3. CONCLUSION

The example above demonstrates the ability of information pooling to increase forecasting accuracy. In addition, pooling techniques facilitate modeling equations simultaneously as opposed to asset by asset, which improves data processing efficiency.

4. REFERENCES

[1] Zellner, Hong, and Min 1991 “Forecasting turning points in international output growth rates using Bayesian exponentially weighted autoregression, time-varying parameters, and pooling techniques” Journal of Econometrics 49, 275-304.