Eduardo Ley: Some Reflections on Eduardo and his Research Legacy

On Monday July 1 Eduardo passed away, after a courageous struggle with a cruel and debilitating illness. He was a wonderful person and a dear friend and will be very much missed. Eduardo would always clearly see and highlight the funny side of things and his presence (even merely email contact) would invariably lift your mood. After our joint spell in Madrid in the early nineties, we did not see each-other that frequently, but over the years I was lucky enough to share with him the odd beer and pleasant discussions on a wide range of topics when we met in Washington D.C. and (most frequently) Madrid. He even managed to attend my wedding in Mallorca in 2009. Last time we met was June 18, 2011 in front of the Palace Hotel in Madrid: a lovely afternoon spent chatting with a good friend. Little did I know then it would be the last. Despite the lack of frequency of personal contact, there are many great memories... Besides being a truly inspiring, warm and caring person with a great sense of humour, he was also a gifted researcher and in the following I will comment briefly on (part of) Eduardo's academic research.

I have known Eduardo since we were colleagues at the Universidad Carlos III in Madrid, Spain from 1991-93. We were both relatively fresh PhD's at the time (Eduardo slightly fresher than me) and he immediately impressed me by his breadth of interests, covering topics from public economics to statistics. Soon we started collaborating on the interface of our areas of interest. In fact, his expertise covered such a wide range that you will hopefully forgive me for focusing mainly on his contributions in joint academic work with myself, a statistician (formerly econometrician). Others will be far more qualified in assessing his contributions in other areas and indeed in highlighting his professional achievements in international development and public policy.

We first wrote a chapter on Bayesian econometrics for a book called *Economic and Financial Modelling with Mathematica*, and I was immediately impressed by his acute understanding of statistical methods combined with very strong computing skills and a great attention to detail. Later we applied Dynamic Linear Models to the context of management teams, leading to a paper which appeared in *Managerial and Decision Economics*. This paper already illustrates that a common thread in Eduardo's work was the inventive combination of concepts and ideas from a variety of different backgrounds. This was followed by a paper in *Journal of Econometrics* (1997) with a formal Bayesian analysis of time-series models with long memory, leading to robust model-averaged inference on impulse responses.

By then we had started working on the use of Bayesian Model Averaging (BMA) in dealing with model uncertainty, a line of research collaboration which continued right until the end. This was a substantive research programme, which combined strands from

the statistical and econometric literature with ideas from computational statistics (such as the innovative use of Markov chain Monte Carlo algorithms) and involved applications to various applied fields. The basic idea was to use formal statistical methods to accurately reflect the fact that we are uncertain about which model to use for inference. The particular setting in which we worked was the linear regression model, where we often have many potential covariates and no clear guidance on which ones to use in the model. This is a very practical problem that exists in many applied contexts. In many applications the number of potential covariates can be of the same order of magnitude as the number of observations. The model space is often huge (2^p, where p is the number of covariates and can be 100 or so in economic applications), making exploration of the model space a computationally challenging problem. In addition, prior choices that appear innocuous can be extremely influential for the results, which makes it an interesting problem from a methodological point of view. The first three of our papers in this area were written jointly with Carmen Fernández. A first paper set out the statistical framework of BMA, in particular proposing useful prior structures. This paper was published in *Journal of Econometrics* (2001) and has been widely cited both in statistics and econometrics as a foundational paper in this field. A second paper in this line of research applied these BMA methods to the variable selection uncertainty in linear growth regressions (*Journal of Applied Econometrics*, 2001), and immediately became a seminal and widely cited paper which introduced economists to formal ways of dealing with model uncertainty, especially in the context of problems with very large numbers of potential models. A third paper with the same authorship appeared in the *Journal of the Royal Statistical Society, C* in 2002 and dealt with the application of these methods (with a few twists to deal with zero observations and categorical variables) to the analysis of catch in fisheries. Eduardo and myself then continued to work in this area, mostly geared towards macroeconomics and growth regressions. In particular, we investigated the issue of dependence between regressors by introducing measures of jointness (*Journal of Macroeconomics*, 2007) and analysed the crucial influence of prior choices in a paper in *Journal of applied Econometrics* (2009), which is now starting to have an impact in both the statistics and economics literatures. In this paper, we proposed more robust prior structures. Our final joint paper, which appeared in *Journal of Econometrics* in 2012 explores a further development in that direction and again blends together strands from theoretical statistics with practical implementations relevant to economists. The paper furthers our understanding of the impact of certain prior structures and assumptions on the results (in particular, the posterior model probabilities) and provides recommendations for applied users. This paper is freely available at `http://dx.doi.org/10.1016/j.jeconom.2012.06.009`. Eduardo's computing skills lead to efficient code which was made available to practitioners, as a service to the profession. In addition, Eduardo was very generous with his time and provided constructive

and motivating advice to many fellow researchers and users of BMA methods.

I am afraid I have merely sketched part of Eduardo's research achievements, and we should bear in mind that academic research was not an integral part of his job description for the last fifteen years of so, as he was mostly flying around the globe to deal with important real-life issues of international development and public policy. This makes his contributions even more remarkable.

I count myself very lucky to have met Eduardo, and to have enjoyed his inspiring company, his wonderful humour and his warm friendship for all these years. He was a person of the utmost integrity and you could always count on Eduardo, in any situation. His passing is a great loss to many and he will be remembered for lots of things: his academic and policy-related achievements surely, but perhaps more importantly as a wonderful human being, whom we all had the privilege to know.

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