

Contribution to the discussion of  
**How not to measure the efficiency of public services (and how one might)**  
read by M. Stone before the RSS on January 16, 2002

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SFA, DEA and the proposed VBA involve different sets of assumptions. In applications, these assumptions may be more or less reasonable. Stone is very critical of SFA and we thought it appropriate to note that these criticisms are, perhaps, not as damaging as he suggests. There is a burgeoning literature on SFA with multiple outputs, including some of our own Bayesian work (Fernández *et al.*, 2000,2002). In economic applications, prices often provide us with the output weights Stone desires. If these are not available, we would argue that, with a careful choice of outputs, the data-based SFA and DEA approaches will, in many cases, be less objectionable (and more practical) than somehow choosing “societal weights” for outputs (especially given Stone’s desire to “retain the goodwill of workers” and need to “obtain from each unit...how its own input costs...should be notionally divided” and “negotiate the value...with unit managers”).

We briefly comment on the “widely recognized weaknesses in ... SFA” (Section 6):

- (a) “Ignore errors in outputs.” This feature is shared by all methods, and it seems formal errors-in-variables methods can relatively easily be used in the statistical context of SFA.
- (b) “Make an arbitrary choice of the distribution of  $u$  and  $v$ .” The use of longitudinal or panel data (Schmidt and Sickles, 1984; Koop *et al.*, 1997; Fernández *et al.*, 1997) can substantially reduce the sensitivity of our results and Bayesian methods allow formal model comparison and averaging. The question is whether the assumptions are appropriate for the empirical question at hand. For example, SFA typically assumes “measurement error is Normally distributed, independently of efficiency”, whereas DEA/VBA typically assumes “measurement error is identically zero”.
- (c) “Assume a form for  $F$ .” There is a large literature on flexible functional forms which may be sensible in a given application (Stone’s use of the Cobb-Douglas really sets up a straw man) and restrictions of economic theory (e.g. monotonicity and concavity) can trivially be imposed through the prior. Alternatively, non- or semi-parametric methods can be used. See Koop *et al.* (1994).
- (d) “Environmentals” can either be included as explanatory variables in the frontier or the efficiency distribution (Koop *et al.*, 1997) or as bad outputs (Fernández *et al.*, 2002).

Finally, it is important to note that statistical methods allow for probability statements and confidence or credible intervals, which can be of great practical importance (see Kim and Schmidt, 2000).

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**Additional References:**

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