A Diagnostic Toolkit for Competitiveness Assessment

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Competitiveness “toolkits”

- Private and public institutions have built “Competitiveness Toolkits” or “Competitiveness indices”, e.g:
  - WB: Trade Competitiveness Diagnostic Toolkit and Doing Business Report
  - EC: European Competitiveness Report
  - The Latvian Competitiveness Report 2011
  - WEF: The Global Competitiveness Index, GCI
- The aim: understand the drivers in order to improve policy efficacy.
- The GCI is quantitative, used to “rank” countries
- Existing “diagnostic toolkits” more analytical, less quantitative

Our competitiveness toolkit in this context

- Similar to GCI and World Bank, LB toolkits: we look at many dimensions of competitiveness
- But not reduce competitiveness to an index or a ranking

Nonetheless more quantitative than other "toolkits":

- Distinguish clearly between competitiveness outcomes and drivers
- Apply Bayesian model averaging to evaluate the relative impact of each driver on the outcomes
- Compare performance to that of a peer group
- Tease out what variables could have most "leverage" in each specific case.

A comprehensive list of indicators

Look at many dimensions of competitiveness (cyclical and structural):

- Prices and costs
- Macroeconomic Environment
- Labour Market
- Human Capital and Innovation
- Energy, Infrastructure and Institutions
- Business Environment
- Financial Development and Openness
- Firm characteristics
- Integration in global value chains

The underlying data

- EU 27 Countries with exception of Croatia because of lack of Data.
- Data range from 2002 to 2011
- Drawing on many databases (data are comparable and refreshable):

- Eurostat
- AMECO
- WDI
- WGI
- IFS
- PWT
- BIS
- FDSD
- OECD
- ILO
- EWN
- Fraser Institute
- CEPII

The methodological approach: BMA

Apply BMA to address model uncertainty on which variables $x^j \in x$ are in the true model M_j. For each model M_j:

Static panel with country-fixed effects

$$y_{it} = \alpha_i^j + x_{it-1}^{'j}\beta^j + \epsilon_{it}^j \quad \forall t = 1, ..., T \quad i = 1, ..., n \tag{1}$$

$$E[\epsilon_{it}^j | \alpha_i^j, x_{i1}^j, ..., x_{iT}^j] = 0 \tag{2}$$

where $\beta^j \in \Re_{k_i} (0 \leq k_i \leq k)$ groups the relevant regression coefficients
ϵ_{it}^j is a gaussian *IID* error term with variance σ^2,
$\epsilon \sim \mathcal{N}(0, \sigma^2 I)$.

BMA continued

The model weights are posterior model probabilities that arise from Bayes' theorem:

$$p(M_j|y,X) = \frac{p(y|M_j,X)p(M_j)}{p(y|X)} \tag{3}$$

where:
$p(y|M_j,X)$ is the marginal likelihood of model M_j
$p(M_j)$ is its prior probability
$p(y|X)$ is constant over all models.
The marginal likelihood $p(y|M_j,X)$ in turn depends on likelihood and priors of each model parameter:
$p(\alpha_j,\sigma)$
$p(\beta_j|\alpha_j,\sigma,M_j)$

Specifying the priors

To apply BMA we need to specify priors for:

- the generic model M_j
- the model's parameters α_j, β_j and σ

Model and parameter priors

- Model prior: uniform prior over the model space
  $\rightarrow$ probability of including each regressor is 0.5
  $\rightarrow$ expected model size of k/2 is 24.5
- Improper priors on constant and error variance
  $\rightarrow$ complete uncertainty on where the prior is located
- Coefficient prior: g-prior

$$\beta_j | g \sim \mathcal{N}\left(0, \sigma^2 \left(\frac{1}{g} X_j' X_j\right)^{-1}\right)$$

$\rightarrow$ The hyper-parameter g captures uncertainty: small g means "quite certain that the coefficients are zero"

Bayesian model sampling - summary statistics

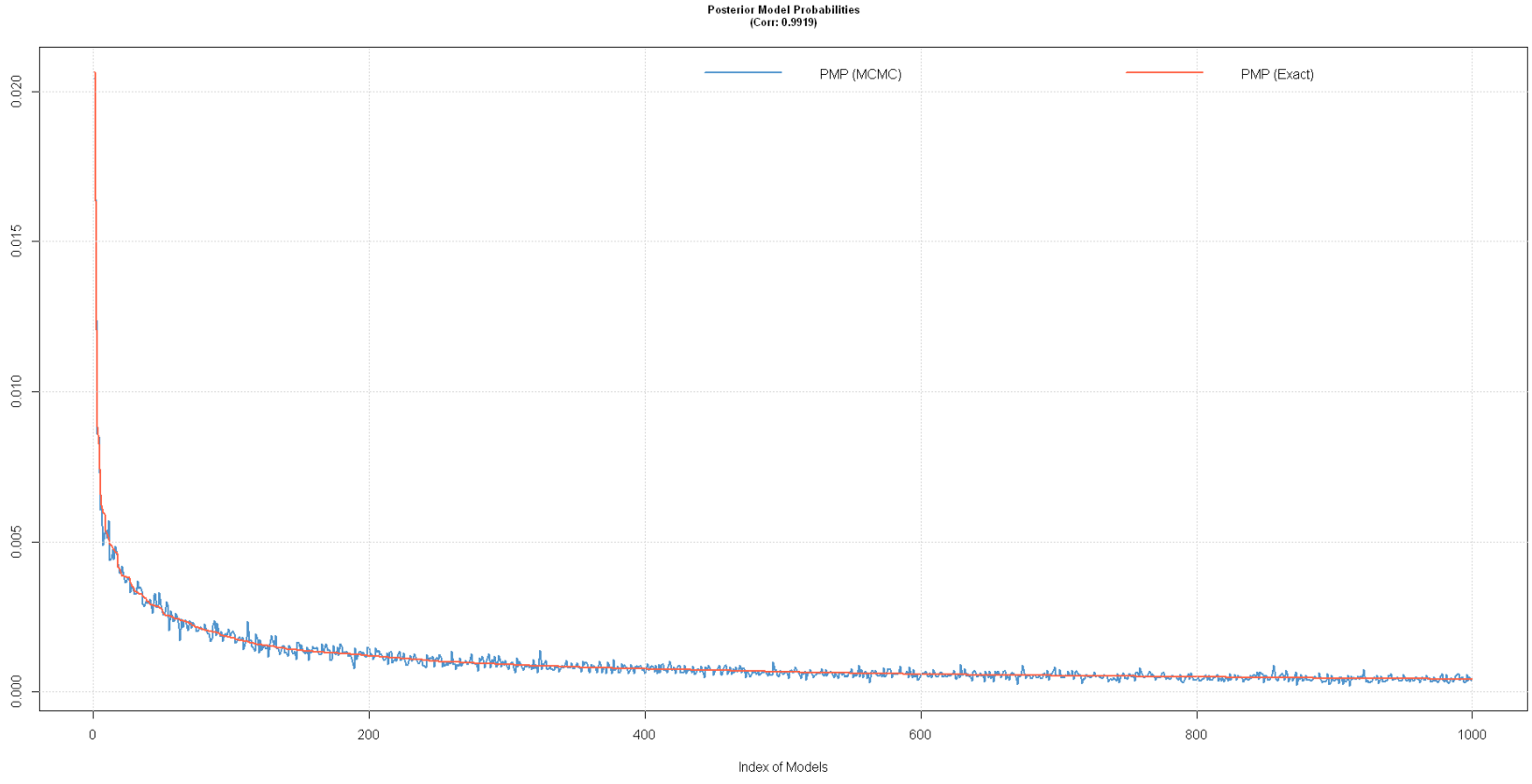
Table: Summary statistics

Mean no. regressors	15.9
Draws	10,000,000
Burnins	500,000
No. models visited	2,541,011
Modelspace 2^K	560,000,000,000,000
% visited	0.00000045
% Topmodels	5.6
Corr PMP	0.99
No. Obs.	260
Model Prior	uniform / 24.5
g-Prior	UIP

- High degree of convergence between analytical and numerical PMPs
- Only 5.6% of posterior model mass covered by top 1000 models: BMA preferable over BMS!

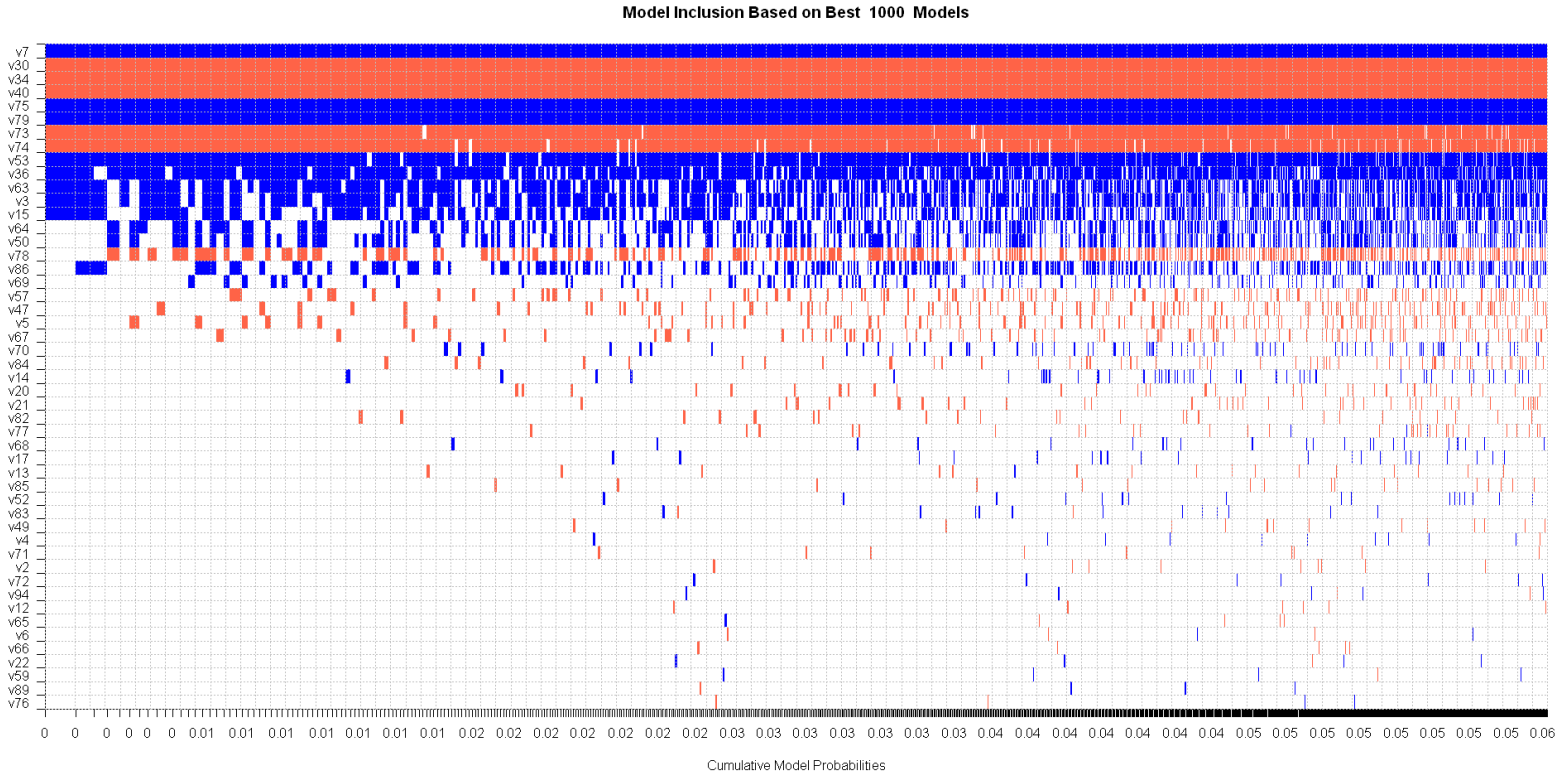
PMP-approximation for top 1000 models

Figure: Correlation of analytical and simulated posterior model probability



Cumulative model probabilities

Figure: Overview of the first 1000 models and their cumulative probabilities



Full agenda ahead

- Robustness check with respect to the choice of the parameters and model priors
- Run additional estimations for the countries included in the DO.file exercise for which micro data is available
- Try to incorporate GVC indicators if any available for the considered period and for the entire set of countries
- Analysis based on clusters of countries
- Providing competitiveness maps of Europe in terms of both thematic indicators and overall performance
- Final aim: use for policy advice