Identifying excessive credit growth and leverage

Lucia Alessi and Carsten Detken

European Central Bank

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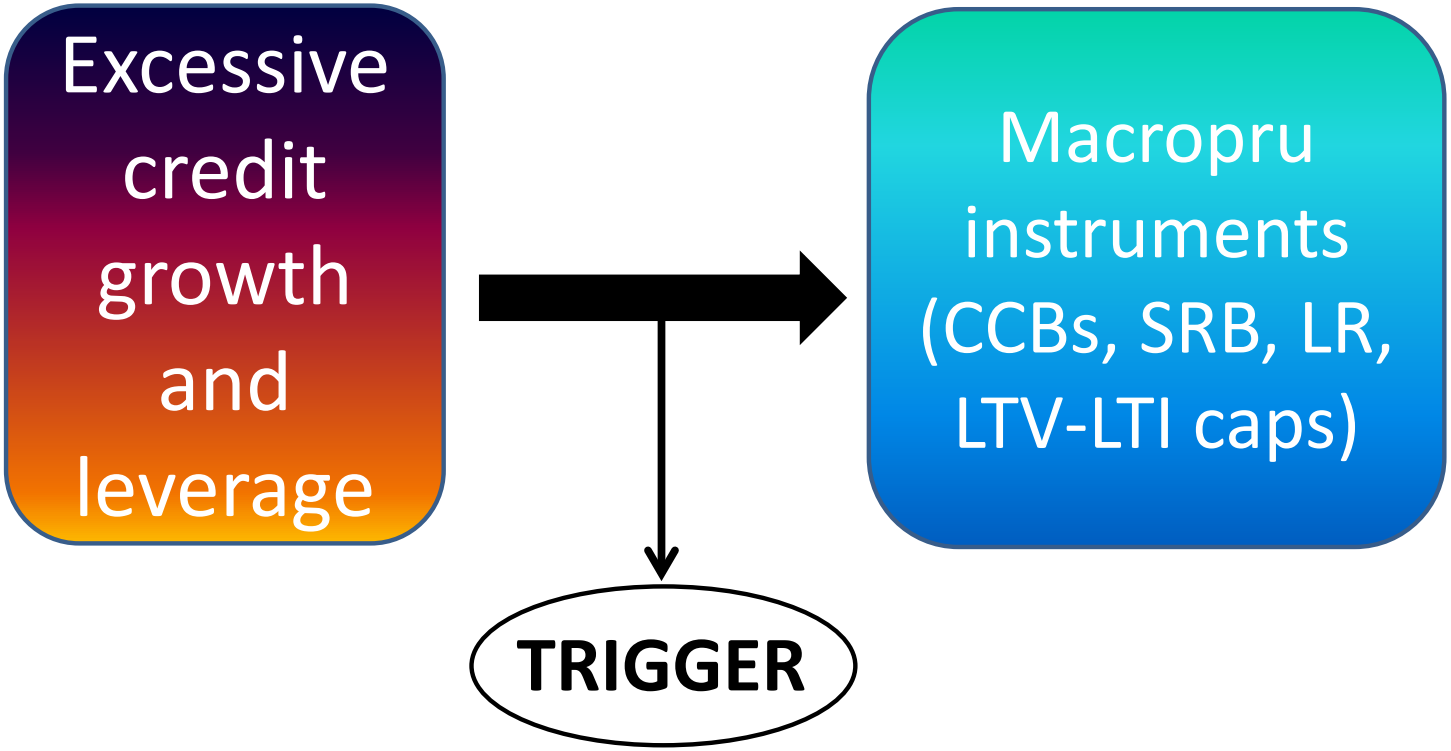
Aim of the paper

Early warning indicators for macropru instruments targeting credit



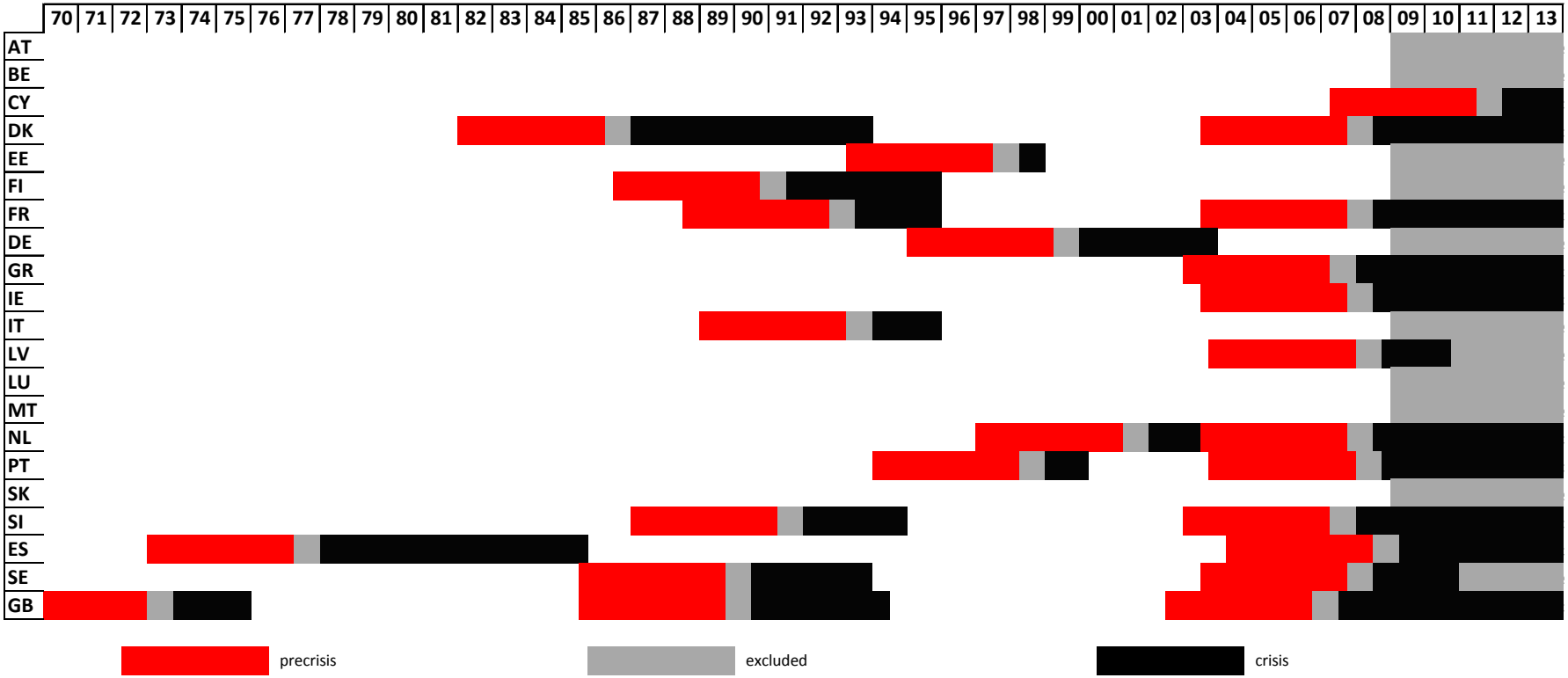
Target variable

Systemic banking crises and 'near misses'

Banking crises dataset by Expert Group:

- based on the HoR database compiled by the MaRs
- amended in order to include:
  1. *only* systemic banking crises associated with a domestic credit/financial cycle
  2. periods in which in the absence of policy action or of an external event that dampened the credit cycle a crisis as in 1. would likely have occurred

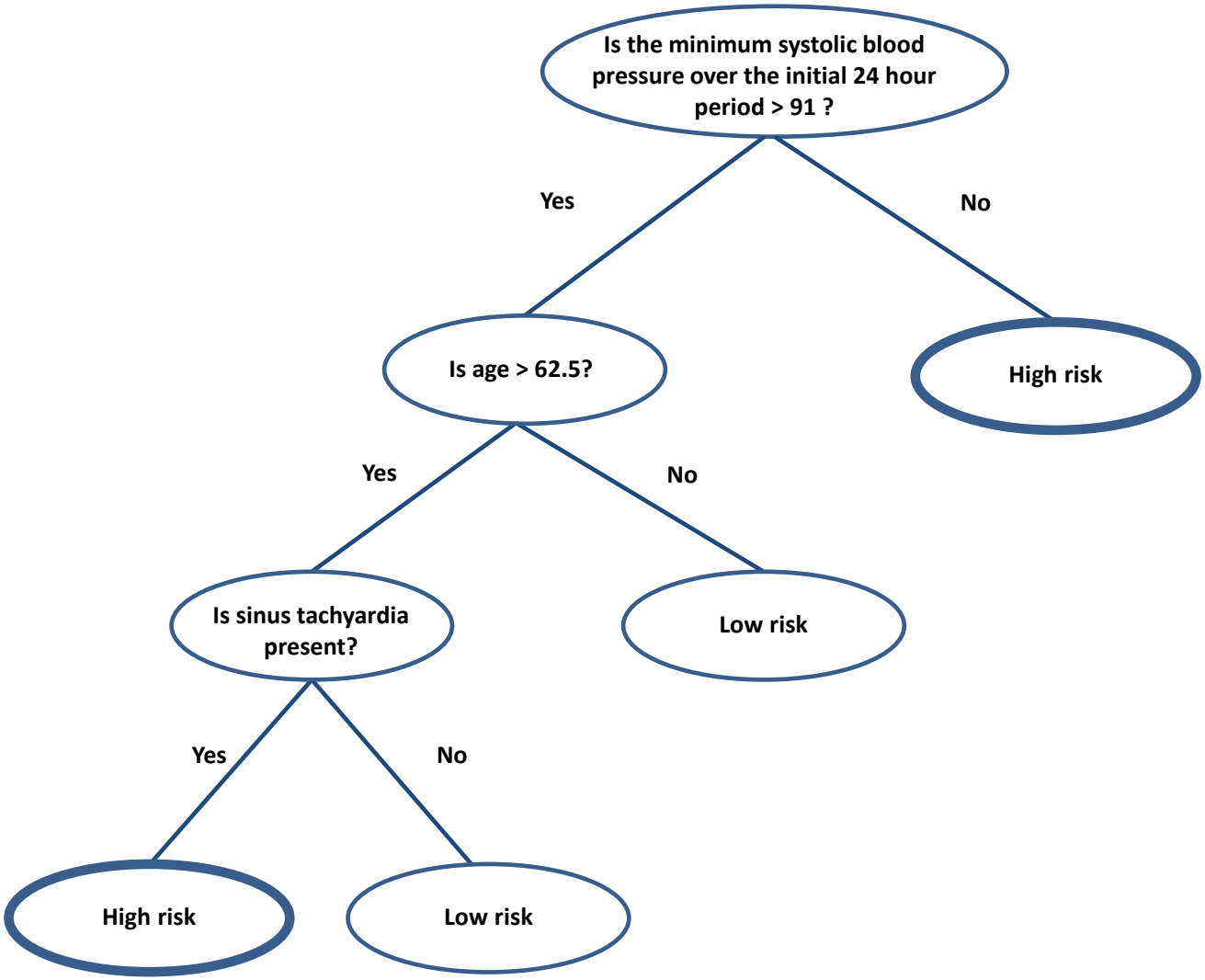
Target variable



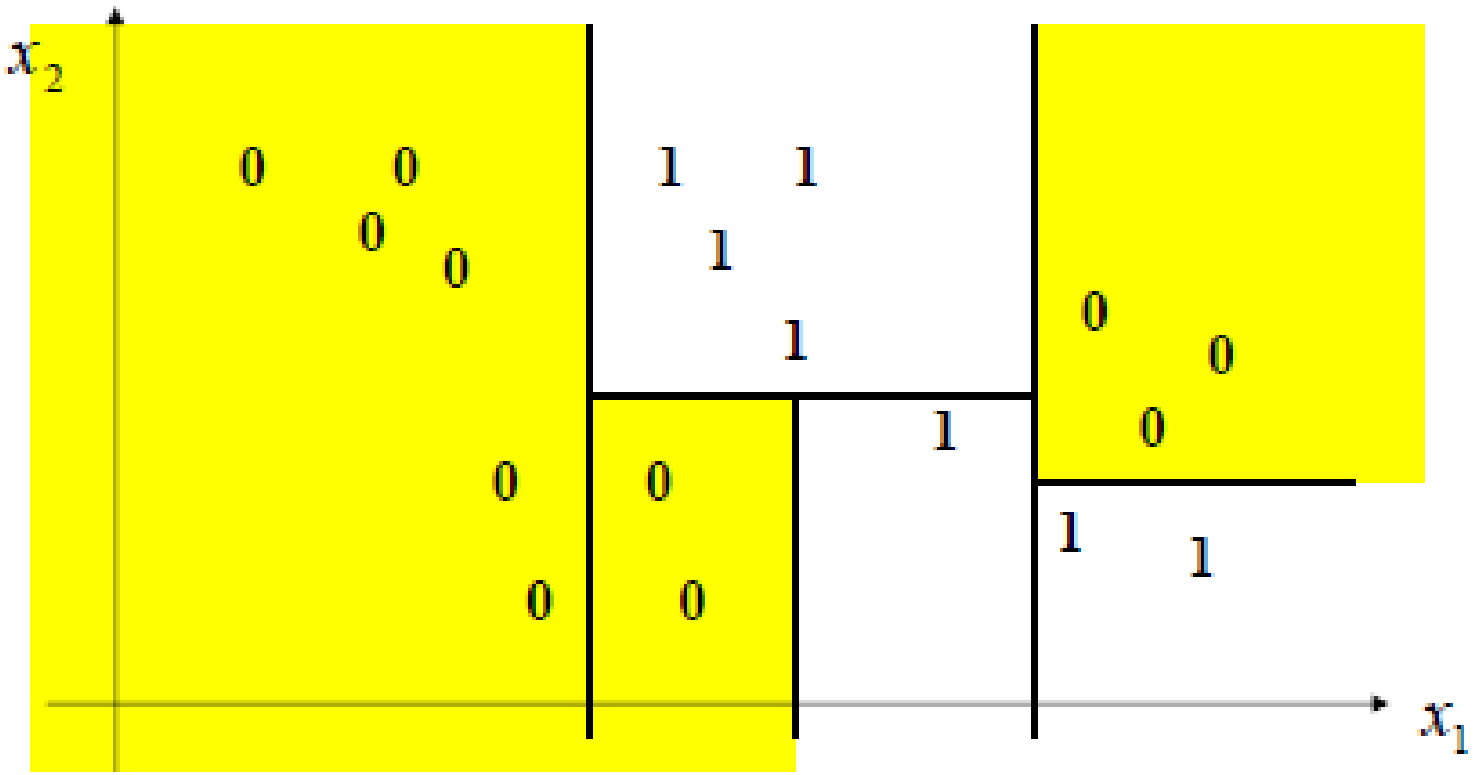
Early warning indicators

- Credit related indicators, based on total credit and bank credit, credit to households and non-financial corporations, the debt service ratio and public debt
- Real estate indicators based on residential property prices, incl. valuation measures
- Market-based indicators such as the short and long term interest rates and equity prices
- Macroeconomic variables such as real GDP growth, M3, real effective exchange rate, current account

Classification trees



Recursive partitioning



$$GINI(f) = \sum_{i=1}^{n} f_i(1 - f_i) = 1 - \sum_{i=1}^{n} f_i^2$$

The Random Forest

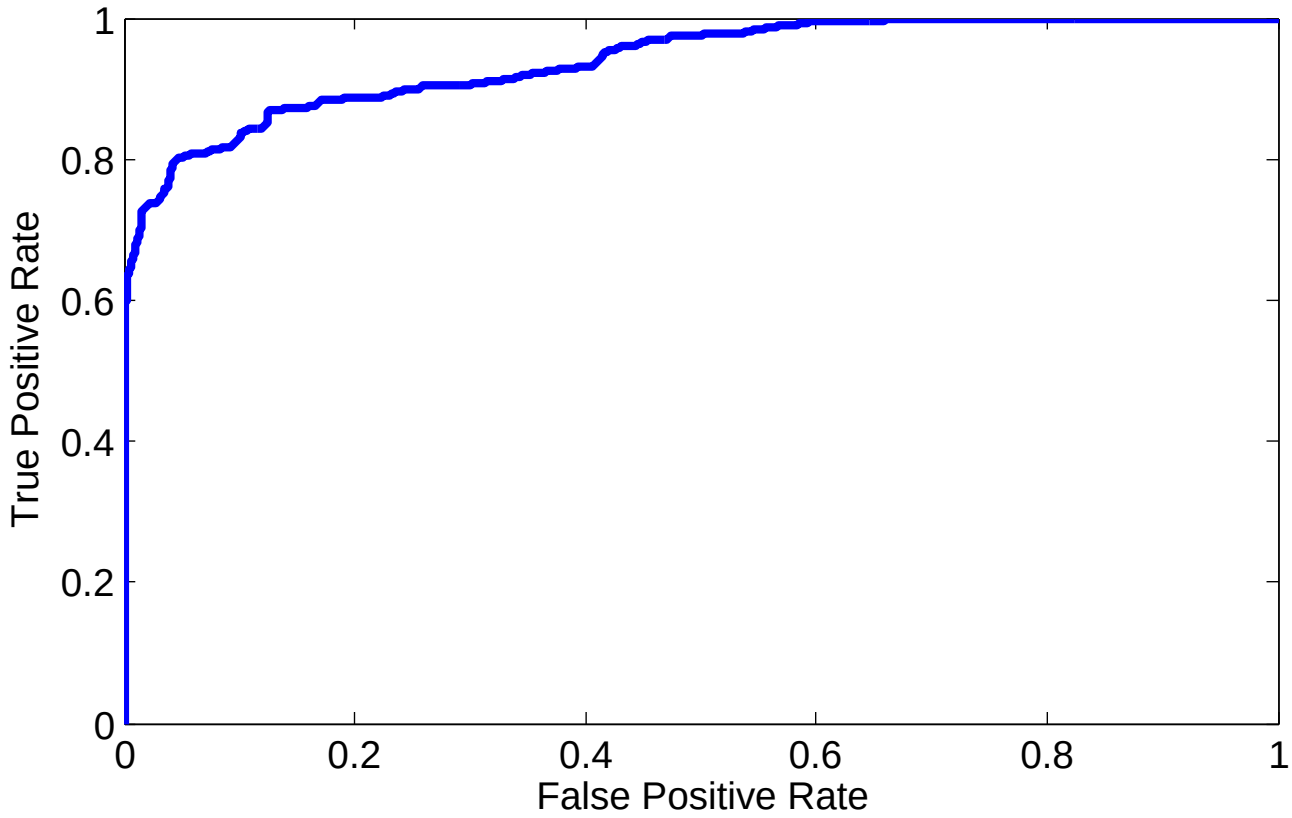
Bootstrap and aggregation of a multitude of trees, each grown on a randomly selected set of indicators and observations.

$\Downarrow$

Robust technique

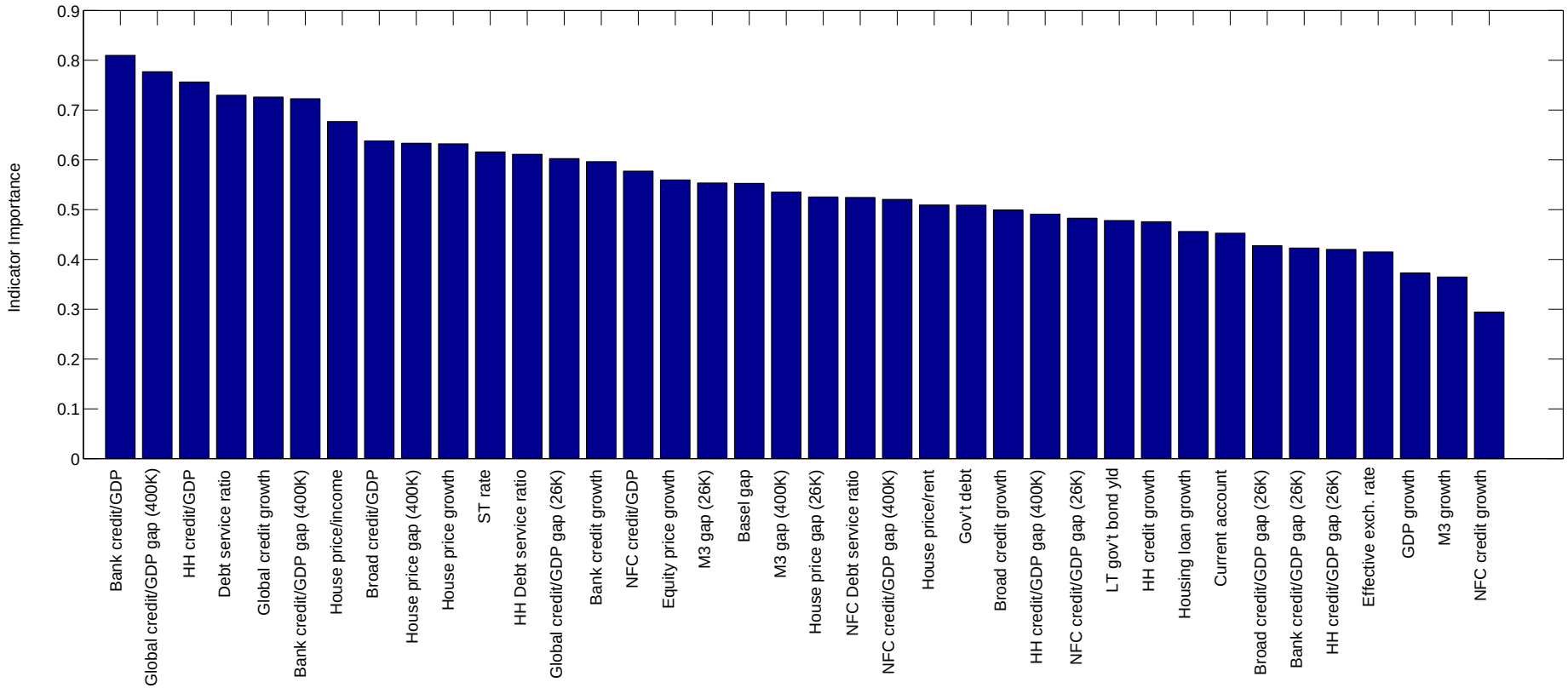
Random forest performance

AUROC=0.94, out-of-sample missclassification=7%

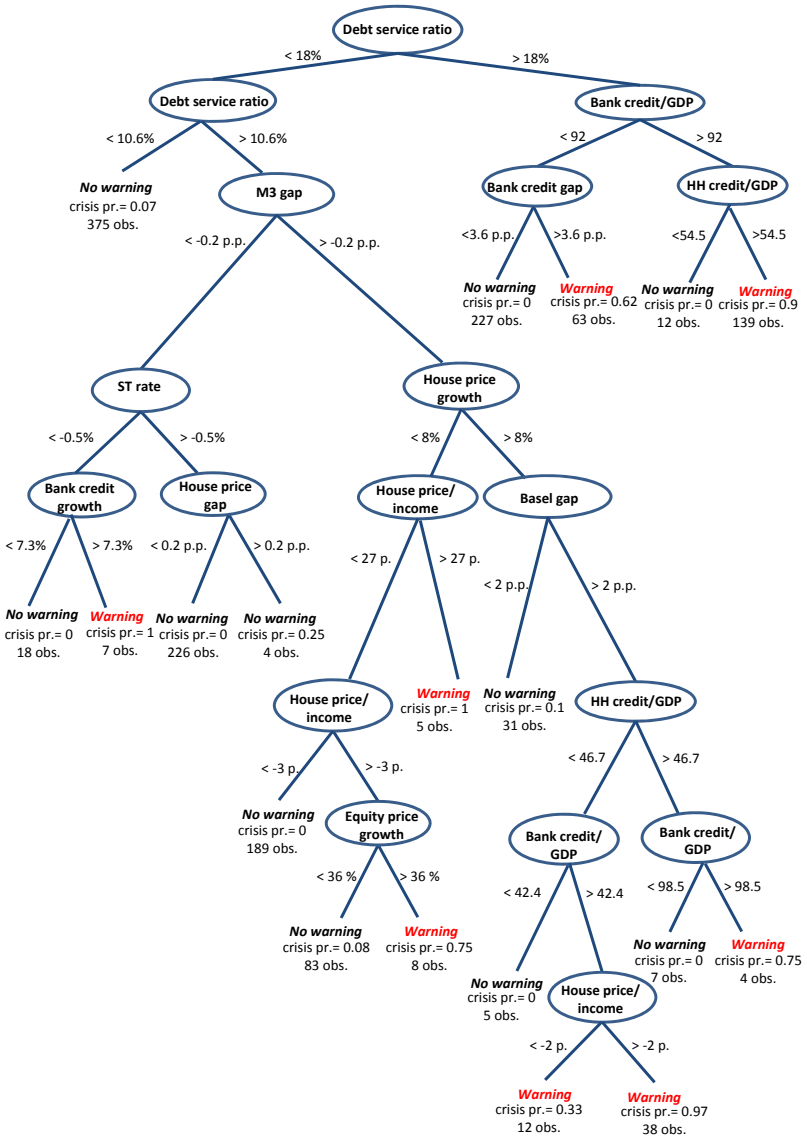


Random Forest ranking

Key indicators



Early warning tree



Evaluation metrics

	Crisis	No Crisis
Signal	A	B
No signal	C	D

		$\theta = 2/3$
TPR	$\frac{A}{A+C}$	85%
FPR (Type II error)	$\frac{B}{B+D}$	4%
Type I error	$\frac{C}{A+C}$	15%
N2S	$\frac{B}{B+D)} / \frac{A}{A+C}$	5%
Loss	$\theta \frac{C}{A+C} + (1-\theta)\frac{B}{B+D}$	0.12
Usefulness	$\min[\theta; 1-\theta] - Loss$	0.22
Rel. Usefulness	$\frac{Usefulness}{\min[\theta;1-\theta]}$	0.65

Out-of-sample exercise

Imagine you were in mid-2006

	Crisis	No crisis
Warning	FR, IE, ES, SE, DK, UK	FI, IT
No warning	GR, PT, LV, SI, NL	AU, BE, LU, DE, EE, SK, MT, CY*

*Crisis started beyond prediction horizon

Conclusion

- The Random Forest/Early Warning methodology can become a useful quantitative tool to:
  - spur discussion on country risks
  - provide information on the most appropriate policy instrument to address identified vulnerabilities
- Additional relevant (potentially country specific) information can be included