

# Identify Sustainable Credit Gap

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# Introduction

## Introduction

- ▶ Motivation
- ▶ Contribution

## Methodology

- ▶ Data
- ▶ Empirical Model
- ▶ Results

## Motivation

- ▶ To overcome model uncertainty in using credit gap as an early warning indicator (EWI) of systemic financial crises, we propose using model averaging of different credit gap measurements. The method is based on Bayesian Model Average - Raftery (1995)

## Motivation

- ▶ Area under the curve of operating characteristic (AUROC or AUC) has been widely used as a criterion to determine the performance of a EWI. But it has received some criticism

# Model

## Credit gap creation

$$100 * \frac{Credit}{GDP} = y_t = \tau_{yt} + c_{yt} \quad (1)$$

We created 90 candidate one-sided credit gap measurements based on the literature.

logit regression:

$$pre.crisis_{it} \sim credit.gap_{itj} \quad (2)$$

- ▶ where  $pre.crisis_{it} = 1$  or  $0$
- ▶  $i$  is country indicator.  $j$  is credit gap filter type
- ▶ The pre-crisis indicator is set to 1 when  $t$  is between 5-12 quarters before a systemic crisis.
- ▶ We discard measurements between 1-4 quarters before a crisis, periods during a crisis and post-crisis periods identified in Lo

```
options(kableExtra.latex.load_packages = FALSE)
```

```
options(knitr.table.format = "pandoc")
```

```
library('kableExtra')
```

```
library(dplyr)
```



```
library(knitr)
```

```
library(rstudioapi)
```

```
setwd(dirname(getActiveDocumentContext())$path))
```

getwd()



```
filepath='../Data/Output/052219_Thu_BIC_unrestricted/Mc
```

```
df<-read.csv(filepath, sep = ",", header=TRUE)
```





```
rownames(df) <- df[,1]
```

```
df<-df[,-1]
```

```
df<-df[-c(31:nrow(df)),-c(8:ncol(df))]
```

```
#colnames(df) <- c("Median", "10pct", "90pct",  
"Median", "10pct", "90pct", "Median", "10pct", "90pct")
```



```
#options(knitr.kable.NA = '')
```



```
#df = df %>% mutate_if(is.numeric, format, digits=4)
```





```
#kbl(data.frame(x=rnorm(10), y=rnorm(10), x=
rnorm(10)), digits = c(1, 4, 4))
```



```
kbl(df, "latex", booktabs = T, digits = c(4, 4, 4, 4, 4, 4, 4, 4),  
caption = 'Variable selection', escape=FALSE,  
linesep=c(" ", " ", " ", " ", " ", "\addlinespace")) %>%
```

```
kable_paper("striped") %>%
```

```
#add_header_above(c("Parameters" = 1, "VAR2" = 3,  
"VAR2 1-cross lag" = 3, "VAR2 2-cross lags" = 3)) %>%
```

```
#footnote(general="UK Bayesian regression results")  
%>%
```

```
kable_styling(latex_options="scale_down") %>%
```



```
column_spec(4, bold =  
TRUE)#c(0,0,1,0,0,0,1,0,0,0,0,0,0,0,0))
```

# Model averaging

## Model posterior probability

### Bayesian Model Averging

The Bayesian Model Average method is formalized in Raftery (1995).

equation (33): Model posterior probability:

$$P(M_k|D) = \frac{P(D|M_k)P(M_k)}{\sum_{l=1}^K P(D|M_l)P(M_l)} \approx \frac{\exp(-\frac{1}{2}BIC_k)}{\sum_{l=1}^K \exp(-\frac{1}{2}BIC_l)} \quad (3)$$

- ▶ Where  $P(M_k)$  is model prior probability and can be ignored if all models are assumed equal prior weights.
- ▶  $P(D|M_k)$  is marginal likelihood. And  $P(D|M_k) \propto \exp(-\frac{1}{2}BIC_k)$
- ▶ In which  $BIC_k = 2\log(\text{Bayesfactor}_{sk}) = \chi_{sk}^2 - df_k \log(n)$ .  $s$  indicates saturated model.

### Model posterior probability

- ▶  $BIC_k = 2\log(\text{Bayesfactor}_{sk}) = \chi_{sk}^2 - df_k \log(n)$
- ▶  $\chi_{sk}^2$  is the deviance of model K from the the saturated model

# Weighted credit gap creation

## Weighted credit gap motivation

GLM binomial estimation:

$$\widehat{pre.crisis}_{ti} = \widehat{response}_{ti} = \frac{1}{1 - \exp(a + \sum_j \hat{\beta}_j c_{tij})}$$

► With  $\hat{\beta}_j = E[\beta_j | D, B_j \neq 0] = \sum_{A_j} \hat{\beta}_j(k) p'(M_k | D)$

We propose a single weighted credit gap  $\hat{c}_{ti}$  that satisfy:

$$\frac{1}{1 - \exp(a + \hat{\beta} \hat{c}_{ti})} = \frac{1}{1 - \exp(a + \sum_j \hat{\beta}_j c_{tij})}$$

OR

$$\sum_j \hat{\beta}_j c_{tij} = \hat{\beta} \hat{c}_{ti} \tag{7}$$

## Weighted gap creation

# Empirical Results

Comparing pAUC of weighted gap

Plot weighted gap against BIS gap