Early Warning Models for Systemic Banking Crises in Montenegro

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INTRODUCTION

- ✓ Considering high costs of resolving systemic banking crises and their significant negative effects on the economy and therefore on the standard of living, it is necessary to dedicate a lot of attention to research on how and why crises happen in order to try to predict them.

- ✓ The main idea of early warning models is that if factors triggering crises can be identified, then also the occurrence of crises can be predicted.

- ✓ Economic slowdown and sudden stop of credit activity supported by the global economic crisis has led to much more deepening of the crisis, and to an intensive growth of sovereign debt.

- ✓ In order to prevent a scenario like this to happen again, it is necessary to create and implement early warning models for systemic banking crises.

METHODOLOGY AND AVAILABILITY OF DATA (I)

- ✓ Extensive empirical literature indicates that, in general, there are two approaches for designing early warning systems that are most commonly used.

- ✓ Selection of potential indicators is mostly based on the economic reasoning that takes into account theoretical assumptions and indicators already used in previous researches.

- ✓ The choice of indicators depends largely on the availability of data.

- ✓ The criterion commonly used for determining the starting date of systemic banking crises is a 10% share of nonperforming loans in total loans at the level of a banking system.

- ✓ The signal horizon is defined 24 months prior to the crisis.

METHODOLOGY AND AVAILABILITY OF DATA (II)

| Variable	Definition
ASSETS	Total assets at the aggregate level of the banking system
LOANS	Total gross loans at the aggregate level of the banking system
LLP	Total loan loss provisions at the aggregate level of the banking system
NET_LOANS	Total net loans at the aggregate level of the banking system, calculated as gross loans minus loan loss provisions
DEPOSITS	Total deposits at the aggregate level of the banking system
BORROWINGS	Borrowings from central banks, banks and other credit and financial institutions, and borrowings from the Government at the aggregate level of the banking system
CAPITAL	Total capital at the aggregate level of the banking system
LOANS_DEPOSITS	Loans-to-deposits coefficient at the aggregate level of the banking system
INT_INCOME	Total interest income at the aggregate level of the banking system
RESERVE_REQ	Total amount of reserve requirements at the level of the banking system
MONEX20	Index value that consists of twenty the most liquid companies on the Montenegrin stock exchange
PRICES	Annual growth rate of consumer prices in Montenegro
PRICES_M	Monthly growth rate of consumer prices in Montenegro
EURIBOR_1M	1-month EURIBOR
EURIBOR_3M	3-month EURIBOR
INDPR_SERBIA	Index of industrial production in Serbia
EUR_USD	Exchange rate EUR to USD

LOGIT APPROACH (I)

✓ Coefficients in the logit model show only the direction of change in probability, thus it is necessary to calculate marginal effects.

✓ Results of the estimated dynamic logit model suggest that loans have the highest marginal effect on the dependent variable.

Variable	Marginal effects
C	-0.206890
LOANS	3.096187
DEPOSITS	-2.144623
EURIBOR_1M	0.350085
INDPR_SERBIA	-0.004979
LLP	1.495731
EUR_USD	-1.094894
CAPITAL	1.259757
LOANS_DEPOSITS_1	0.018119
PRICES_3	0.056112

LOGIT APPROACH (II)

✓ The model has correctly predicted 88.76% observations, therefore it has proved to be unsuccessful in 11.24% cases.

✓ Furthermore, the model has precisely predicted the crisis in 79.17% cases (i.e. months), and the normal period in 92.31% cases.
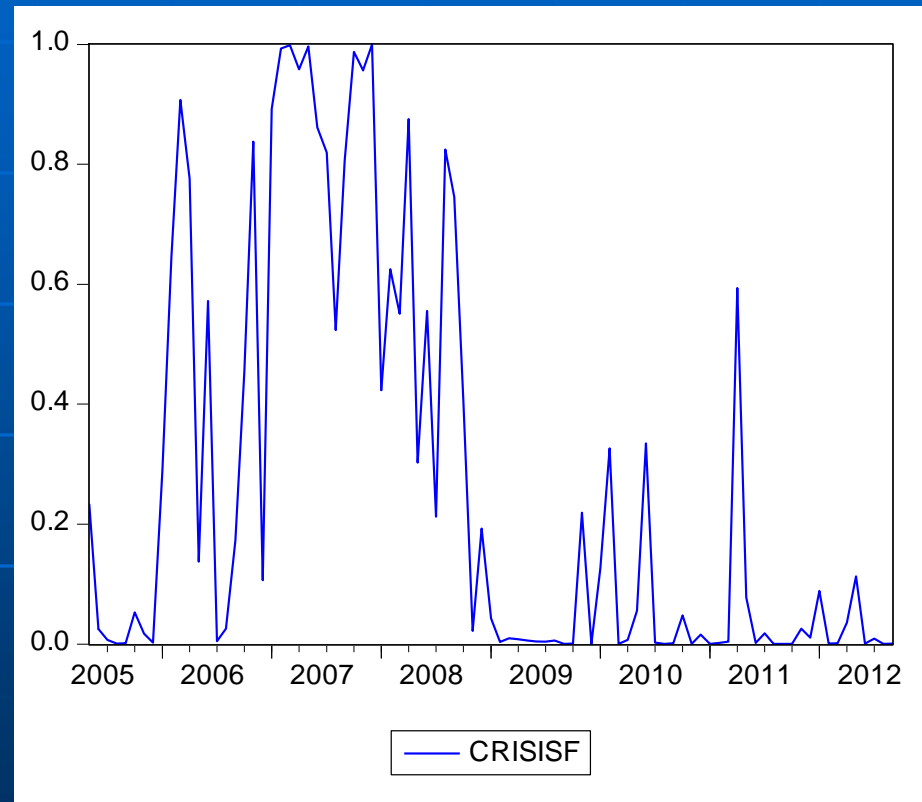
BAYESIAN MODEL AVERAGING (I)

✓ There are at least two problems with simple regression when there are many potential explanatory variables.

✓ First, putting all potential variables in one regression might significantly increase standard errors if irrelevant variables are included.

✓ Second, the use of sequential testing in order to exclude unimportant variables might lead to misleading results taking into consideration the fact that there is a probability that a relevant variable is excluded every time when the test is done.

✓ Bayesian model averaging considers model uncertainty by taking into account combinations of models and assigning them weights in accordance with their performance.

BAYESIAN MODEL AVERAGING (II)

Model	Variable	Coefficient	Statistic significance	Weight (0-1)
	ASSETS	106.23	0.0001	
Model 1	DEPOSITS	-69.62	0.0010	0.14370
	CAPITAL	13.42	0.0153	
Model 2	BORROWINGS	19.33	0.0003	0.13973
	LOANS	50.23	0.0000	
Model 3	RESERVE_REQ	-11.66	0.0205	0.15971
	EURIBOR_1M	5.35	0.0043	
Model 4	LLP	16.08	0.0024	0.13106
	LOANS_DEPOSITS	37.15	0.0010	
Model 5	INT_INCOME	7.60	0.0226	0.13266
	EURIBOR_3M	6.06	0.0138	
Model 6	PRICES_M	1.44	0.0113	0.12907
	MONEX20	-9.46	0.0011	
Model 7	NET_LOANS	47.32	0.0000	0.16408

BAYESIAN MODEL AVERAGING (III)

✓ These results largely coincide with results of the previously estimated logit model.

✓ The accelerated economic growth influenced the banks to initiate the exaggerated lending activity that led to credit expansion with three-digit yearly credit growth rates, and that in turn even additionally encouraged overheating of the economy.

Variable	Marginal effects
ASSETS	16.28
DEPOSITS	-10.67
CAPITAL	2.22
BORROWINGS	3.19
LOANS	7.46
RESERVE_REQ	-1.73
EURIBOR_1M	0.80
LLP	2.41
LOANS_DEPOSITS	5.87
INT_INCOME	1.20
EURIBOR_3M	0.98
PRICES_M	0.23
MONEX20	-1.25
NET_LOANS	6.24

CONCLUDING REMARKS

✓ Although many economists, especially critics of economics as science, consider that early warning models have proved to be unsuccessful because they failed to predict occurrence of the present global crisis, the economic policy can not be conducted in an appropriate and efficient manner without reliable quantitative information.

✓ These models might have an important complementary role as an objective measure of the banking system vulnerability.

✓ Results of the estimated models have shown that the systemic banking crisis in Montenegro has its roots in the domestic economy.

✓ Causes of crisis originate from the period of unsustainable credit expansion. Also, there is a significant impact of international trends on the Montenegrin banking system and overall economy.