

Information About Currency Crisis Given By KLR Approach

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Abstract: - During 1990s many currency crisis all over the world countries have occurred, since a number of studies have done to predict systematically which countries are more likely to suffer currency crisis. Perhaps, the indicators approach of Kaminsky et. al. (1998) is the most prominent model. This model is based on observation of various indicators that show unexpected behaviours before the crisis. If an indicator exceeds the certain threshold, it is appraised as a warning signal such as there will be currency crisis in this country within 24 months. In this study, a contribution over indicators approach of KLR is given in sense of entropy and information theory. So, this contribution gives opportunities to select the economical indicators more easily. Moreover, the interpretations can be made more clearly.

Key-Words; Entropy, Information theory, Currency crisis, Economical indicator, KLR approach.

1 Introduction

1.1 The Situation of problem

Many currency crisis all over the world countries have occurred since 1990. Especially, interests on analysis of financial crisis are increased after East Asia Crisis that caused world countries to perceive its effects. In order to prevent these currency crisis, the reasons of the crisis and the factors that cause the crisis spread are investigated. However, many theoretical models, i.e. first generation models, second generation models etc., were suggested. Many studies about the currency crisis were made. Some of them provides only a qualitative discussion of the causes and developments leading to the currency crises. These papers often stressed the evolution of one or more indicators, but no formal test were conducted to evaluate the usefulness of the various indicators in predicting crises (Kaminsky, 1998). For instance, Dornbusch, Goldfajn and Valdes (1995), Goldstein (1996), Krugman (1996) and Ferretti, Maria and Razin (1996). Kaminsky and Reinhart (1996) presented a nonparametric approach to evaluating the usefulness of several variables in signaling an impending crisis. Kaminsky, Lizondo and Reinhart (KLR) (1998) proposed a specific early warning system involves monitoring the evolution of several indicators that tend to exhibit an unusual behavior in the periods preceding a crisis. The main

discussion of these papers is the selection of the economical indicators.

In this study, a contribution over indicators approach of KLR model is given. Economical indicators can be selected more easily by this contribution.

1.2 An overview

Economical indicators used to predict crisis is nearly related with the belief about which factor will mostly cause a crisis. One of the first studies about predictability of the currency crisis belongs to Kamin (1988). Kamin represents real exchange rate, terms of trade, increasing of difference between domestic exchange rate and world exchange rate as economical indicators. In another study, Velasco (1987) suggested the failure of bank system as indicator of crisis associated with balance of payments.

In this study, we will take "indicators approach" suggested by Kaminsky, Reinhart and Lizondo into account.

1.3 A contribution over KLR model

Indicators approach of Kaminsky, Lizondo and Reinhart is based on observation of various indicators that show unexpected behaviours before

the crisis. If an indicator exceeds the certain threshold, it is appraised as a warning signal such as there will be a currency crisis in this country within 24 months (Kaminsky et.al., 1998). The authors published the probabilities of the indicators that give crisis signals in their study.

In this paper, we propose such a contribution over KLR model that using entropy and information measures of these indicators instead of probability is more meaningful. Hence, interpretations can be made not only according to probabilistic means but also according to informational means. So, it can be easily obtained how much bits information can be achieved from these indicators about the system of crisis. So, in this study, entropy and information measures of the KLR indicators are given. Additionally related economical interpretations are made.

2 Indicators Approach of KLR Model

While improving KLR models; seventy-six crisis occurred between 1970-1995, various economical indicators and twenty countries (Argentina, Bolivia, Brazil, Chile, Colombia, Endonesia, Israel, Malaysia, Mexico, Peru, Philippines, Thailand, Turkey, Uruguay, Venezuela, Denmark, Finland, Norway, Spain and Sweden) were taken into account by the Kaminsky et. al. (1998).

The variation of the indicators were calculated according to their values in previous year, and were appraised as percentage. If the variation of the one of the indicators exceeded threshold value, this was taken as crisis signal. If it exceeds threshold value and give a crisis signal before 24 months, it is called good signal. But if no crisis occurred in spite of crisis signal, the signal is called bad signal. Kaminsky et. al. (1998) published the Table 1 under that application.

Table 1. Efficiency of the indicators.

	Crisis (within 24 months)	No crisis (within 24 months)
Signal was issued	A	B
No signal was issued	C	D

In table 1;

A: the number of months that indicators give good signal

B: the number of months that indicators give bad signal

C: the number of months that good indicators give no signal

D: the number of months that bad indicator give no signal

Under the knowledge from Table 1, percentage of the signals issued by the indicator that were followed by at least one crisis within the subsequent 24 months were published the performance of the indicators as Table 2.

Table 2. The percentage of the signals issued by the indicator that were followed by at least one crisis within the subsequent 24 months

In terms of the matrix in the text	P(crisis/signal)
	A/(A+B)
Real exchange rate	67
Banking crises	46
Export	49
Stock prices	49
M2/international reserves	46
Output	49
“Excess”M1 balances	43
International reserves	41
M2 multiplier	40
Domestic credit/GDP	39
Real interest rate	34
Terms of trade	36
Real interest differential	29
Imports	26
Bank deposits	25
Lending rate/deposit rate	18

Indeed, due to Table 2, all indicators sent the first signal anywhere between a year and a year and a half before the crisis erupts, with banking sector problems. So this approach can be useful as the basis for early warning system of currency crisis.

3 The Concept of Entropy and Information Theory

The basic concept of entropy in information theory has to do with how much randomness there is in a signal or random event. An alternative way to look at this is to talk about how much information is carried by the signal.

The entropy formula expresses the expected information content or uncertainty of a probability

distribution. Let E_i stand for an event (e.g., one technology adoption of technology i) and p_i for the probability of event E_i to occur. Let there be n events E_1, \dots, E_n with probabilities p_1, \dots, p_n adding up to 1. Since the occurrence of events with smaller probability yields more information (since these are least expected), a measure of information h should be a decreasing function of p_i . Shannon (1948) proposed a logarithmic function to express information $h(p_i)$:

$$h(p_i) = \log_2 \left(\frac{1}{p_i} \right) \quad (1)$$

which decreases from infinity to 0 for p_i ranging from 0 to 1. The function reflects the idea that the lower the probability of an event to occur, the higher the amount of information of a message stating that the event occurred. Information is here expressed in bits using 2 as a base of the logarithm.

From the n number of information values $h(p_i)$, the expected information content of a probability distribution, called entropy, is derived by weighing the information values $h(p_i)$ by their respective probabilities:

$$H = \sum_{i=1}^n p_i \log_2 \left(\frac{1}{p_i} \right) \quad (2)$$

where H stands for entropy in bits.

4 Statistical Properties of Indicators Approach Based On Entropy and Information Theory

Entropy measure of KLR indicators are calculated according to their probability distribution given in Table 2 and results are given in Table 3.

Obviously, it is seen from Table 3 entropy measure of the indicators such as Export, Stock prices, Output carry 1.03 bits information and that means these indicators give the same information about the currency crisis. Also, Banking crises and M2/international reserves give the same information about the currency crisis. So, the indicators that give same information can be used interchangeably.

Table 3. Entropy measures of signals issued by the indicator that were followed by at least one crisis within the subsequent 24 months

	$h(p_i)$
Real exchange rate	0.58
Banking crises	1.12
Export	1.03
Stock prices	1.03
M2/international reserves	1.12
Output	1.03
“Excess”M1 balances	1.22
International reserves	1.29
M2 multiplier	1.32
Domestic credit/GDP	1.36
Real interest rate	1.56
Terms of trade	1.47
Real interest differential	1.79
Imports	1.94
Bank deposits	2
Lending rate/deposit rate	2.47

Moreover, due to Table 3, while Lending rate/deposit rate is the most random indicator besides the others, this indicator give 2.47 bits information which is more than the others. Additionally, Real exchange rate is less random indicator but give less information than the other indicators.

Consequently, while KLR approach can be useful as the basis for early warning system of currency crisis, we propose in this paper that if entropy and information of these indicators are examined, more useful information can be obtained for early warning system of currency crisis.

5 Conclusion

Accurately forecasting the time that currency crisis can arise is the main goal of many academics and policymakers alike. Since, policymakers wish to avoid the crisis, a warning system is required. In this sense, KLR approach is one of the best track record.

Furthermore, in this study we propose that not only the probabilistic measure of KLR indicators but also the entropic and informational measures can be used for early warning system of currency crisis. The fact is the entropy and information measure of these indicators give additional information about the crisis. Moreover, since the amount of information that indicators give

can be easily obtained, researchers can choose the indicators for their data set more easily.

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