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Does asymmetric information play a role in explaining the Asian crisis? Application to Indonesian and Malaysian cases using a two-state Markov Switching model

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Abstract

This paper aims at establishing a relationship between disparity of information and the probability of speculative attack in explaining the Asian crisis. We apply the general framework of Markov-Switching models to the differential of interest rates (DIR), subsequently in Indonesia and Malaysia. We allow dependency of the transition probabilities over the asymmetric information indicators.

The Maximum Likelihood estimators results (MLE) are twofold: (1) an increase of information dispersion among speculators leads to a higher probability of a currency crisis (2) there is a significant asymmetric impact of information disparity as measured by difference between fund price and Net Asset Value (NAV) on the transition probability in the case of Indonesia, while the hypothesis is rejected for Malaysia's case.

JEL Codes: F31, D82

Keywords: Speculative attack, Global Games, Asymmetric information, Markov-Switching Models

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1 Introduction

Whether asymmetric information plays a role in currency crisis is an issue that has important implications for both the theoretical and empirical literature in international finance. The matter is critical. If for example, asymmetric information increases the probability of a speculative attack, the exchange rate regimes will be more vulnerable in periods of higher disparity of information and policymakers should adjust their policies accordingly, as underlined by Prati and Sbracia (2002, p.1)

The Asian crisis has caused severe economic turbulence in the economies of South East Asia since July 1997, and has spread beyond the region to reach Russia and Brazil. The explanation of the Asian crisis has been the subject of much argument. There is no easy consensus to be reached on what they lay behind it. According to first generation models (Krugman (1979), Flood and Garber (1984)), currency crises are caused by insufficient foreign exchange reserves due to a persistent deficit in balance of payment and bad fundamentals. However, the second generation characterizes the currency crises as self-fulfilling speculative attacks and they result in multiple equilbria. Ratti and Seo (2003)[1] provide some evidence of Korea being in zone of multiple equilibria and there having been self-fulfilling speculation at times during 1997 and 1999 using a non linear model. A new generation of currency crisis emphasizes financial sector weakness and investor behaviour. These models are called inter-generation models because they combine sequences of first and second generations. Krugman (1998) and Corsetti et al. (1998) explain the Asian crisis using a moral hazard model. As a response to the Asian crisis, international policy makers suggest that increased transparency could help to avoid specultative crashes. To date, there has been little empirical work on the role of asymmetric information in explaining currency crises, with the notable exception of three papers, namely Prati and Sbracia (2002), Metz (2003) and Tillmann (2004). While the two first papers study the impact of uncertainty about fundamentals on currency crisis, the third one uses a different approach. He analyses the impact of uncertainty that originates from private information among foreign exchange investors. He finds that information disparity raises the probability of speculative attack for the French Franc and Italian Lira in the EMS crisis of 1992.

This paper focuses on the cases of Indonesia and Malaysia, and tries to separate the contributions of economic fundamentals from asymmetric information in explaining the speculative events.

The paper is organized as follows; section 2 introduces the theoretical foundations related to the role of asymmetric information in a global game framework. Section 3 derives the testable implications of the latter inspired from Tillmann's technical methodology and discusses the results of our estimates. Section 4 concludes.

2 Theoretical basis

This paper also related to the growing literature on global games and information aggregation in equilibrium outcomes such as Morris and Shin (1998).

This section builds on the pioneering work of Morris and Shin (1998) and Heinemann and Illing (2002) who build up a reduced game to model currency attack under noisy private information. The authors suggest that changes in information structure of speculators can be explained by sudden movements in the probability of devaluation. Assuming that the information structure determines a unique $\theta*$. When the precision of private information increases, the threshold below which a crisis occurs increases.

[1] Their results are supportive for the role played of both fundamentals and self-fulfilling beliefs in explaining currency crisis.

An empirical evidence of this central result that applies the higher order beliefs concept must include the information disparity as inducing change in the probability of speculative attack. However, linking global games framework to empirical finance seems not to be an easy task. That's why adopting a methodology analogous to that of Tillmann, seems to be the most suitable approach for our purpose.

3 Econometric modelling

Market participants' strategic behaviour has the potential to fuel and magnify market turmoil and even trigger financial crises. To capture and understand such pathologies, we propose to adapt the same empirical framework suggested by Tillmann (2004), to the Asian crisis context. Our specific empirical focus is on Indonesia and Malaysia.

3.1 Data and model description

In models of regime change, the regression parameters depend on an unobservable discrete variable whose realization is a Markov chain of first order. Iterative algorithms are used to estimate model parameters, which are based on Bayesian procedures. The Markov-switching models are very useful for modelling changes in the economic linkages and their interaction with economic fundamentals. They are particularly useful for identifying episodes of crisis and non crisis. Jeanne (1997) and Jeanne and Masson (2000), among others, use this framework to see if the attack incurred in the case of the EMS crisis was caused by a phenomenon of "sunspots".

The DIR of a country displays different behaviour during periods of "pressure" and "stable" periods. In order to capture this asymmetry, we apply a two-state Markov-switching model with time varying transition probabilities. Hamilton (1989, 1990) considered a simple version of Markov-switching with transition probabilities that are fixed (PTF). Later, Diebold et al. (1994) developed a Markov-switching with time-varying transition probabilities (PTV) in order to capture the systematic changes in the transition probabilities. The use of Markov-switching models has the advantage that it can yield more accurate estimates of the process. The regime switching model combines two ore more sets of model parameters into one system. According to Moore and Wang (2009, p. 3), "it is argued that a discrete measure of crisis in probit models, which are frequently employed for the analysis of currency crises, leads to a loss of information on the scale of speculative pressure." So, we don't refer to those models in explaining the role of asymmetric information. In our case, there are two possible states of nature: "tranquil" (s_t=0) versus "crisis" (s_t=1) regime. The behaviour of our dependent variable DIR_t is dependent on s_t whose density is given by:

$$f\left(DIR_t / s_t\right) = \frac{1}{2\sqrt{\pi}\sigma} \exp\left(-\frac{(DIR_t - m_{s_t} - \sum_{i=1}^{3} \theta_i F_{it})^2}{2\sigma^2} \right) \tag{1}$$

Where F_{it} is the fundamental i at time t, i=1, 2, 3.

In equation (2), the interest rate differential between Indonesia or Malaysia, respectively, and United States is regressed on three macroeconomic fundamentals[2] (see Table1 for details) whose effects are represented by the coefficients θ_1, θ_2 , and θ_3:

[2] The author acknowledges Wajih Khallouli for providing dataset on Asian fundamentals.

$$
\begin{aligned}
DIR_t^{ind} &= m_{s_t} + \theta_1 cagdp_t + \theta_2 rgdpg_t + \theta_3 treer_t + \varepsilon_t \\
&\text{with} \quad \varepsilon_t \to iid\left(0, \sigma^2\right) \\
DIR_t^{mal} &= m_{s_t} + \theta_1 dcrg_t + \theta_2 rgdpg + \theta_3 treer_t + \varepsilon_t \\
&\text{with} \quad \varepsilon_t \to iid\left(0, \sigma^2\right)
\end{aligned} \tag{2}
$$

Where m_{s_t} is a regime-specific intercept. The discrete variable s_t can shift between two realizations:

$$s_t = j, \quad j = 0{,}1 \tag{3}$$

$$prob(s_t = j / s_{t-1} = i) = p_{ij} \tag{4}$$

All the transition variables are collected in the (2x2) transition matrix:

$$\mathrm{P} = \begin{bmatrix} p_{00} & p_{10} = 1 - p_{11} \\ p_{01} = 1 - p_{00} & p_{11} \end{bmatrix} \tag{5}$$

The transition probabilities are assumed to be time-varying by considering a logistical function:

$$
\begin{aligned}
p_{oo} &= \frac{\exp\left(q_0 + q_1 \phi_{t-1}^i\right)}{1 + \exp\left(q_0 + q_1 \phi_{t-1}^i\right)} \\
p_{11} &= \frac{\exp\left(p_0 + p_1 \phi_{t-1}^i\right)}{1 + \exp\left(p_0 + p_1 \phi_{t-1}^i\right)}
\end{aligned} \tag{6}
$$

Where p_{ii} : is the probability of remaining in regime i at time t, p_{ij} is the probability of switching from regime i to j. The coefficient q_1 (p_1) represents the impact of the proxy on the probability of jumping from regime 0 (1) to regime 1 (0). We expect q_1 to be negative, which means that more disparate information is, the more likely the probability of speculative attack is. Finally, ω^i, is a proxy of information disparity among speculators. Following Tillmann (2004), we consider the same three measures of asymmetric information:

$$
\begin{aligned}
\omega_t^1 &= (fund\ \ price - NAV)_t \\
\omega_t^2 &= \left| fund\ \ price - NAV \right|_t \\
\omega_t^3 &= \left(fund\ \ price - NAV\right)^2{}_t
\end{aligned} \tag{7}
$$

The difference between fund price and NAV is called premium or discount. This latter reflects the informational advantage of local investors over foreign ones. The evidence of privileged information by local investors has been enhanced by Frankel and Schmuckler (1996, 2000) who have examined the dynamics of premia for the case of the Mexican crisis in 1994 and the Asian crisis in 1997. In fact, Indonesia and Malaysia followed Thailand by free floating their exchange rates on August 14 and July 14, respectively.

Finally, the estimator of maximum likelihood is given by the expression:

$$\hat{\theta}_{ML} = \arg\max_{\theta} \ln L(\theta) = \sum_{t=2}^{T} f\left(DIR_t / \Omega_{t-1}\right)$$

$$f\left(DIR_t / \Omega_{t-1}\right) = \sum_{j=0,1}\sum_{i=0,1} f\left(DIR_t, s_t = j, s_{t-1} = i / \Omega_{t-1}\right) \quad (8)$$

$$= \sum_{j=0,1}\sum_{i=0,1} f\left(DIR_t / s_t = j, s_{t-1} = i, \Omega_{t-1}\right) prob\left(s_t = j / s_{t-1} = i : \phi_{t-1}\right) prob\left(s_{t-1} = i / \Omega_{t-1}\right)$$

3.2 Results and discussion

This study uses monthly data for Indonesia and Malaysia over the period 1990: 3 through 2001: 3 and 1987: 5 through 2001: 3, respectively. The choice of the period is restricted by the Dataset on fundamentals provided and the availability of country funds data. These latter were gathered from http://www.etfconnect.com/ web site.
The EM-algorithm was performed using R2.6.0 software[3]. In this subsection, we discuss the estimating results of the MS model with fixed transition probabilities and of the MS with time varying transition probabilities.

Markov switching with fixed transition probabilities

From these results, we can draw the following observations:
First, in order to identify which regime is more persistent, we need to interpret the probability estimates. The estimates of transition probabilities p_{oo} and p_{11} are both highly significant in the two East Asian countries. The probabilities of staying in regime 0 (the values are about 0.98) are bigger than the probabilities of staying in regime 1 (the values are about 0.94 and 0.97, respectively).

Markov switching with time varying transition probabilities

Results from estimating the non-linear maximum likelihood model are given in Tables 1.1 and 2.1. As can be seen, the coefficients of the three macroeconomic fundamentals are statistically significant for the case of Indonesia, and a little bit for Malaysia. They have also the expected signs. The regime-switching intercepts are highly significant. It is clear that the linear approach is strongly rejected in both cases against the Markov-switching model as shown in table 1.2 and table 2.2 which report the results of Wald specifications tests for equality for the regime dependent coefficients. The null hypothesis of equal intercept terms across regimes is rejected at high levels of significance for both countries, mirrored by the value of likelihood ratio (LR[4]). In most cases, the impact of ω^i is negative as measured by the coefficient q_1 which means that disparate information raises the probability of a currency crisis. However, only the first disparity of information measure seems to have a significant asymmetric impact on the transition probability (Indonesia). The same test fails to detect any significant asymmetric impact for the other measures.

[3] The author is grateful to Atsushi Matsumoto for providing R program on Markov-switching available on his webpage: http://www.geocities.jp/atsmatsumoto/index.html. Some modifications were done in order to fit our model specification.
[4] LR=-2(L_c-L_{nc}) where L_c and L_{nc} are Max L. for constraint and non constraint models, respectively.

Other empirical works that studied PTV models for the exchange market pressure, namely Cerra and Saxena (2002) tried to test the contagion effect on the Indonesia's currency crisis from the neighbouring countries (Thailand, Korea). Similarly, Abiad (2003) used PTV models for the Asian crisis but he hardly found any significant impact of fundamentals on the exchange market pressure. All these papers analysed the impact on the exchange market pressure, in our knowledge this paper is the first to study the combined effect of fundamentals and asymmetric information on the differential of interest rates but applied to the context of Asian crisis.

4 Concluding Remarks

In this paper, we have investigated the role of information disparities in the case of Asian crisis. We particularly focused on two East Asian countries, namely, Indonesia and Malaysia. Our framework imitates Tillmann (2004). Country funds premia are used to approximate the dispersion of information among investors. We find that disparate information raises the probability of a currency crisis, with a significant asymmetric impact on the probability of transition, hardly depicted only for the case of Indonesia. This paper relates to the role that transparency plays in currency crisis models. It will be more interesting to investigate the impact of disparate information on the probability of speculative attack in other East Asian countries (i.e. Thailand, Singapore, Korea, Hong Kong, Taiwan, Philippines). On step in this direction might be modelling DIR as a Markov- switching process for panel data. This will depend upon availability data on country funds. There may be also scope for an empirical verification of multiple factors crisis as in Cerra and Saxena (2002). Future research may be, then, seeing which of the following factors, namely, fundamentals, contagion or asymmetric information that the most determines the Asian currency crisis.

References

Cerra, V. and S.C. Saxena (2002), "Contagion, monsoons, and domestic turmoil in Indonesia's currency crisis", *Review of International Economics*, 10(1), p. 36-44.

Corsetti, G., P., Pesenti and N. Roubini (1998), "Paper Tiger? A model of Asian crisis", Mimeo, NYU.

Flood R.P., and P.M. Garber (1984), "Collapsing Exchange Rate Regimes: Some Linear Examples", *Journal of International Economics*, August, 17(1-2), p. 1-13.

Frankel, Jeffrey A., and Sergio L. Schmukler (1996), "Country Fund Discounts, Asymmetric Information and the Mexican Crisis of 1994: Did Local Residents Turn Pessimistic Before International Investors?", NBER Working Paper, No. 5714, National Bureau of Economic Research.

Frankel, Jeffrey A., and Sergio L. Schmukler (2000), "Country funds and Asymmetric Information", *International Journal of Finance and Economics*, 5, p. 177-195.

Hamilton, James A. (1989), "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle", *Econometrica*, 57, p. 357-384.

Hamilton, James A. (1990), “Analysis of Time Series Subject to Changes in Regimes”, *Journal of Econometrics*, 45, p. 39-70.

Heinemann, F., and G. Illing (2002), “Speculative Attacks: Unique equilibrium and Transparency”, *Journal of International Economics*, 58, p. 429-450.

Jeanne, O. (1996), « Les modèles de crise de change : un essai de synthèse en relation avec le franc de 1992-1993 », Economie & Prévision, n°123-124.

Jeanne, O. (2000), “Currency Crises: A perspective on Recent Theoretical Developments”, Special papers in International Economics n°20, International Finance Section, Princeton University.

Krugman, P.R. (1979), “A Model of Balance-of-payments Crises”, *Journal of Money, Credit and Banking*, 11, p. 311-325.

Krugman, P.R. (1998), “What happened to Asia?”, Mimeo, MIT.

Matsumoto, A. (2008), “Estimation of Markov Switching Model using a statistical Software R”, User’s Manual. http://www.geocities.jp/atsmatsumoto/index.html

Metz, Christina E. (2003), “The role of Information Disparity in 1994/1995 Mexican Peso Crisis: Empirical Evidence”, Mimeo.

Moore, T, and P. Wang (2009), “Can the persistence of a currency crisis be explained by fundamentals? Markov switching models for exchange market pressure”, Working Paper n° 09-36.

Morris S., Shin H.S. (1998), “Unique Equilibrium in a Model of Self-fulfilling Currency Attacks”, *American Economic Review*, 88(3), June, p. 587-597.

Prati A., and M. Sbracia (2002), “Currency crisis and Uncertainty about Fundamentals”, IMF Working Paper WP/02/3.

Ratti, R.A., and J. Seo (2003), “Multiple equilibria and currency crisis: evidence for Korea”, *Journal of International Money and Finance*, 22, p. 681-696.

Tillmann, P. (2004), “Information Disparities and the Probability of Currency Crises: Empirical Evidence”, *Economics Letters*, 84, p. 61-68.

A. Tables

Table 1- Fundamentals per country and expected signs

	Notation	Indonesia	Malaysia	Expected sign
Current account as a percentage of GDP	**cagdp**	**yes**		**-**
Domestic Credit Growth	**dcrg**	**yes**	**yes**	**+**
Real gross domestic product growth	**rgdpg**		**yes**	**-**
Temporary component of real exchange rate	**treer**	**yes**	**yes**	**?**

Note: treer=actual real exchange rate-Hodrick Prescott filter

Table 1.1- Linear and Markov switching results: Indonesian case

	Linear	*Markov-switching*			
		PTV			PTF
		ω_t^1	ω_t^2	ω_t^3	
m	20,31157*** (0,59865)				
$m(s_t=0)$		26,004*** (0,65424)	20,312*** (0,58914)	22,239*** (0,50596)	26,043*** (0,655664)
$m(s_t=1)$		17,1529*** (0,49114)	5,0106*** (350,043)	-0,822881 (2,2381)	17,083*** (0,48246)
θ_1	-81,25916*** (17,60637)	-57,326*** (12,337)	-81,2777**** (17,339)	-113,33*** (13,638)	-59,353*** (12,125)
θ_2	-150,22697*** (10,53189)	-126,61*** (7,7468)	-150,23*** (10,348)	-180,78*** (8,6133)	-124,68*** (7,8168)
θ_3	0,20654*** (0,05067)	0,19548*** (0,041097)	0,2056*** (0,055164)	0,05658 (0,048457)	0,18461*** (0,040191)
σ	5,091	3,3789*** (0,21172)	5,0137*** (0,30749)	3,8198*** (0,2374)	3,2721 (0,21112)
p_{00}					0,981357
p_{11}					0,9350268
p_0		3,5714*** (0,83953)	3,1482 (77,355)	-3,4055 (3,6863)	3,9623*** (0,72759)
q_0		5,5632 (3,9388)	11,595 (35,157)	5,3357*** (1,6983)	2,6666*** (0,67565)
p_1		0,25121 (0,54468)	4,9846 (596,58)	461,25 (371,1)	
q_1		-2,0861 (2,3847)	4,9921 (582,45)	27,61 (62,098)	
Sample	1990 : 3 - 2001 : 3				
Max L	-410,7232	-362,7761	-403,14054	-374,1851	-363,55635

Note: Asterisks refer to significance level: * 10%, ** 5%, *** 1%

Table 1.2- Wald test Results: Indonesia

$H_0(\chi^2(1))$	ω_t^1	ω_t^2	ω_t^3	PTF
$m(s_t=0)=m(s_t=1)$	95,89425***	15,16532***	73,07619***	94,3337***
$p_1=q_1$ [5]	23,95169***	-2,617626 e^{-06}	1,491540	

Note: Asterisks refer to significance level: * 10%, ** 5%, *** 1%

[5] H_0 : the impact is symmetric

Table 2. 1- Linear and Markov switching results: Malaysian case

	Linear	*Markov-switching*			
		PTV			PTF
		ϕ_t^1	ϕ_t^2	ϕ_t^3	
m	-0,12012 (0,41517)				
$m(s_t = 0)$		-1,3572*** (0,25823)	-1,3432*** (0,24897)	-1,3492*** (0,25616)	-2,7836*** (0,28589)
$m(s_t = 1)$		3,7318**** (0,33013)	3,7533*** (0,31715)	3,7227*** (0,32941)	1,9063*** (0,26772)
θ_1	16,221*** (2,32648)	13,756*** (1,5001)	13,61*** (1,4746)	13,579*** (1,4756)	20,003*** (1,5693)
θ_2	-5,41371 (4,57014)	-5,0382* (2,7821)	-5,2924** (2,6566)	-5,2646* (2,7517)	2,3917 (2,9212)
θ_3	-0,04849 (0,04810)	0,050862* (0,030734)	0,054317* (0,02999)	0,054568* (0,030043)	0,052789* (0,031127)
σ	2,693	1,5358*** (0,084927)	1,5286*** (0,083822)	1,536*** (0,08498)	1,5551*** (0,085734)
p_{00}					0,9827272
p_{11}					0,967428
p_0		3,1965*** (0,84463)	4,4528*** (1,4316)	2,9302*** (0,724)	3,39119*** (0,63930)
q_0		4,2394*** (0,7316)	5,1718*** (1,1198)	4,739*** (1,0726)	4,0412*** (0,74114)
p_1		-0,45105 (0,4739)	-2,5056* (1,6796)	3,2268 (9,8805)	
q_1		-0,16666 (0,31772)	-3,8572** (1,6058)	-8,3788 (7,509)	
Sample	1987 : 5 – 2001 : 6				
Max *L*	-407,62044	-326,61923	-323,54842	-326,42895	-330,48011

Note: Asterisks refer to significance level: * 10%, ** 5%, *** 1%

Table 2. 2- Wald test results: Malaysia

$H_0(\chi^2(1))$	ω_t^1	ω_t^2	ω_t^3	PTF
$m(s_t = 0) = m(s_t = 1)$	162,0024***	168,1440***	162,3830***	154,2807***
$p_1 = q_1$	0,2584267	0,2059565	1,022133	

Note: Asterisks refer to significance level: * 10%, ** 5%, *** 1%