Thai's Country Risk Assessment

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***Abstract*—There are major public concerns about economics fragility due to country risks in the recent years. It is caused by both internal and external factors. The internal factors are the debt related problems and the political instability while the external problems results from the global financial dynamics through capital mobility. As a results, this paper attempts to identify,measure, and estimate country risk in Thailand from both probability and impacts for socioeconomics policy consideration. The logit and country beta model are applied to Thai's quarterly data and the evidence indicates strong political risks as well as internal private debt weakening the economy.**

***Index Terms*—Country risk, logit, forecasting.**

I. Introduction

Economists assess country risk using a wide range of techniques. Selecting appropriate method is crucial for practical applications; however, the use of statistical model is common in the academic literature to avoid judgmental bias. This study attempts to assess the probabilities of occurrence of uncertain events in Thailand. During a recent years, the politicians, economists, academics, investors as well as the general public concerns about the country instabilities in Thailand. These concerns of the unfortunate events may occur due to the global dynamic instability and various types of instabilities inside the country. Nonetheless, there are few academics studies provide the evidence to support such claims. Bunn and Wright (1991) mention that expert opinions may subject to judgmental bias [1]. The rest of this paper is concerned with liquidity risk from capital flow, credit risk from both internal and external debts, political risk, and its impact on real GDP. Section II of this paper summarizes the methodology and describes the dependent variables. Section III includes the literature reviews and outline the techniques of country risk assessment. Section IV provide the sources of data used in this paper. The empirical evidences are illustrated in Section V. Finally, in Section VI the conclusions are drawn with some suggesting policy implications.

II. Methodology and the Dependent Variables

A. Methodology

The non-linear multivariate statistical model such logit model are used to estimate the probability. The logit model is a qualitative binary response that take the value of 1 and 0, representing risk or without risk. The probability model are written in the likelihood function and estimated by using maximum likelihood estimator via iterative algorithm.

Somerville and Taffler (1995) conclude that statistical models can outperform judgmentally based methods of country-risk assessment [2]. Hamer (1983), Saini and Bates (1984), Lo (1986), and Morgan (1986) compare the effectiveness of discriminant analysis (DA) with that of logit analysis and they conclude that there is no clear superiority of one method over the other, but Schmidt (1984) conclude that the logit model is superior to DA and cluster analysis [3]-[7]. Calverley (1990) conclude that Multivariate techniques such as logit and discriminant analysis out-perform econometrics models in assessing country risk [8]. As a result, the commonly used logit model is applied. The impact on macroeconomics variables are estimated by using the Beta Model of Country Risk with regression analysis.

B. Dependent Variables

Assessing the liquidity risk from capital flow are considered from both capital inflow and capital outflow. The credit risk from both internal and external private debts, as well as public debt. The political risks are represented by the legitimacy of the state index and the group grievance index. The impact of country risk are measured on the growth rate of real GDP.

III. Risk Assessment Techniques

There are wide ranges of methods assessing country risk both quantitative and qualitative models. The qualitative method such as numerical rating and scoring system are popular, but this method depends on the experience assessors to score the proper weights for each criterion in order to be credible. This scoring method is normally used for country credit rating, a country ranking in relative to the other countries. Moreover, the assessors may be influenced by market sentiment in particular countries rather than by economics and political fundamentals. When panic is driven, the rating agencies tend to over-react to the problem. Haque *et al.* (1997) mention that there are some regional bias in favor of certain regions such as Asian and European countries [9]. Hammer, Kogan and Lejeune (2006) mention that the lack of comprehensibility known as black boxes since rating agencies specify neither the factors which are taken into consideration in determining their ratings, nor the rule of aggregation of multiple factors into a single rating [10]. Reinhart (2002) and Levich *et al.* (2002) criticize about the failure in predicting crises [11], [12].

Monfort and Mulder (2000) uses econometrics tool to estimate country risk ratings while the model uses information

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derived from past ratings. One of the limitation, is the impossibility to apply such model to not-yet-rated countries [13]. Erb *et al.* [14], [15], Gangemi *et al.* [16] explores the relevance of the country beta approach which is allowed macroeconomic variables to influence country beta.

McAleer *et al*. (2010) use the value at risk (VaR) approach for country risk ratings in three major components risk, namely economic, financial and political risk. VaR is a technique that helps quantify the potential size of losses, given a certain confidence level, and it is widely used in the banking industry to determine appropriate capital requirements that can be set aside to protect banks from adverse movements in the value of their trading portfolios. The evidence indicates that the country risk returns may follow an asymmetric distribution [17].

Several studies attempt to test and evaluate country risk models using three popular standard statistical techniques such as DA, logit or probit models and cluster analysis. Saini and Bates (1978) compared logit models and discriminant analysis and find that the results from both models are very similar, but Schmidt (1984) compare discriminant analysis, logit models and cluster analysis and conclude that the logit model is superior to discriminant analysis and cluster analysis [18]. The logit model can be written as

$$Y_{it} = \ln(Odd) = \ln(\frac{P_{Yit}}{Q_{Yit}}) = \ln(\frac{P_{Yit}}{1-P_{Yit}})$$

$$= \beta_{0i} + \beta_{1i}X_{1t} + \beta_{2i}X_{2t} + \ \ldots \ + \beta_{ki}X_{kt} + u_t$$

where

$$\text{Odd Ratio} = \frac{\Pr ob(Event)}{\Pr ob(NoEvent)} = \frac{P_{Yit}}{Q_{Yit}} = \frac{P_{Yit}}{1-P_{Yit}}$$

Given F(·) be the cumulative densityof logistic function. The likelihood function, L(·) and log likelihood function, *l*(·) can be written as

$$L(\beta_i) = \prod_{t=1}^{N}[F(\boldsymbol{\beta}'\mathbf{x})]^{y_{it}}[1-F(\boldsymbol{\beta}'\mathbf{x})]^{(1-y_{it})}$$

$$l(\beta_i) = \log L(\beta_i) = \sum_{t=1}^{N} y_{it}.\log[F(\boldsymbol{\beta}'\mathbf{x})] + (1-y_{it}).\log[1-F(\boldsymbol{\beta}'\mathbf{x})]$$

Maximize the likelihood function and solve the first order condition using Newton-Raphson Scoring Algorithm to obtain

$$\boldsymbol{\beta}^{(j)} = \boldsymbol{\beta}^{(j-1)} - \left[\frac{\partial^2 \log L}{\partial\beta.\partial\beta'}\right]^{-1}_{\boldsymbol{\beta}=\boldsymbol{\beta}^{(j-1)}}$$

$$f(\boldsymbol{\beta}'\mathbf{x}+\mathbf{u}) = \frac{e^{-\boldsymbol{\beta}'\mathbf{x}+\mathbf{u}}}{(1+e^{-\boldsymbol{\beta}'\mathbf{x}+\mathbf{u}})^2}$$

$$F(\boldsymbol{\beta}'\mathbf{x}) = \frac{e^{\boldsymbol{\beta}'\mathbf{x}}}{(1+e^{\boldsymbol{\beta}'\mathbf{x}})}$$

The probability can be computed using delta method of linear approximation. If the heteroskedasticity problem persists, the weighted least squares calculation is applied. This estimator becomes the best unbiased estimator which can be demonstrated by using the Cramer-Rao inequality. (For further information look at D. N. Gujarati (1995), M. Intriligator *et al.* (1996), W. H. Green (1997), Judge *et al.* (1982)).

The impacts of country risk on the real GDP are examined using the standard country risk beta model, with the model being of the form.

$$Y_{it} = \beta_{0i} + \beta_{1i}X_{1t} + \beta_{2i}X_{2t} + \ \ldots \ + \beta_{ki}X_{kt} + u_t$$

where t = 1, 2, 3, …, T and k is the number of independent variables, which is optimally determined by using backward stepwise selection method. The beta are unknown parameters, and Y_{it} represents real GDP and X_{it} represent macroeconomics variables, the liquidity risk, the credit risk, and the political risk, respectively. The error term (u_t) is assumed to be white noise. The multicollinearity, serial correlation, and heteroskedasticity are tested and fixed, if such problems persist.

IV. Data

Most macroeconomics quarterly data is collected from the International Financial Statistics. There are 15 important macroeconomics variables used in this model. These variables consist of the growth rate of real GDP for Thailand ($GRGDP_t$), the growth rate of real GDP for the United States ($GRGDPUS_t$), the interest rate differential from short term government bonds between Thailand and the United States (ID_t), lending rate (LR_t), inflation rate (INF_t), the degree of openness ($OPEN_t$), trade balance (TB_t), total debt ($TDEBT_t$), unemployment rate (UNP_t), nominal spot exchange rate between Thai Baht and the US. Dollar (S_t), the capital (K_t), the price of diesel fuel in Thailand (OIL_t), producer price index (PPI_t), the business confidence index ($CONF_t$), and the corruption index ($Corrupt_t$).

The liquidity risk from capital flow is a binary variable. It can be explained by sudden surge, sudden stop, or capital reversal. When one of these situation occur, it will take the value of 1; otherwise becomes 0. The criteria used to identify this type of risk look at Sula (2008) [23]. Such liquidity risks include the risk of total capital inflow or capital surge ($RISKTIF_t$), the risk of public loan outflow ($RISKPLOF_t$), and the risk from total capital outflow ($RISKTOF_t$). The credit risk from both internal and external debts is considered from the credit worthiness and it takes the value of 1 when there is an increase in such debts; otherwise becomes 0. These credit risks include the risk from private debt ($RISKPRD_t$) and the risk from public debt ($RISKPD_t$). The political risk is proxy by the legitimacy of the state ($RISKLS_t$) and the group grievance ($RISKGG_t$). It will take the value of 1 when there are political instability and 0 otherwise.

The analysis of liquidity risk from capital flow include the data started from the first quarter of the year 1999. The credit risk is analysed using the data started from the first quarter of the year 2003. The analysis of political risk and the impact measurement on real GDP use the data started from the first quarter of the year 2005. All data series are up to the last quarter of the year 2013. Such studies use all available data to obtain the best possible outcomes.

V. Results

A. Liquidity Risks and Capital Flow

There are 3 types of liquidity risks focused in this paper: (1)

the risk of total capital inflow or capital surge ($RISKTIF_t$), (2) the risk of public loan outflow ($RISKPLOF_t$), and (3) the risk from total capital outflow ($RISKTOF_t$).

The results from capital surge analysis at 95 percent confident interval reveal that the interest rate differential from short term government bonds between Thailand and the United States (ID_t), the exchange rate and the corruption index ($Corrupt_t$) can affect the total capital inflow such that

$$RISKTIF_t = -27.09 + 1.12ID_t + 0.19S_t + 4.89CORRUPT_t + u_{1t}$$

where z-Statistic (ID_t) = 2.0021 (Prob = 0.0453); z-Statistic (S_t) = 1.8068 (Prob = 0.0708); z-Statistic ($Corrupt_t$) = 2.5513 (Prob = 0.0107); Akaike info criterion = 0.7543; and the Hosmer-Lemeshow Goodness-of-Fit Tests = 8.5967 (Prob HL= 0.3775). The probabilities of capital surge are shown in Fig. 1.

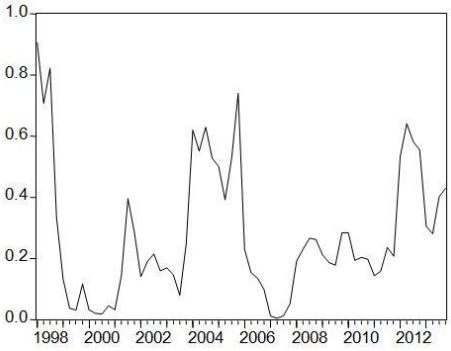

Fig. 1. Risk of total capital inflow or capital surge: $RISKTIF_t$.

Fig. 2 represents the risk associated with public loan outflow. The empirical evidences reveal that the unemployment rate (UNP_t), and the corruption index ($Corrupt_t$) can affect the public loan outflow at 95 percent confident interval while the exchange rate affects public loan outflow at 90 percent confident interval. The equation represent the risk associated with public loan outflow can be written as

$$RISKPLOF_t = -24.67 - 4.17UNP_t + 0.35S_t + 4.63CORRUPT_t + u_{2t}$$

where z-Statistic (UNP_t) = -2.3525 (Prob = 0.0186); z-Statistic (S_t) = 1.6835 (Prob = 0.0923); z-Statistic ($Corrupt_t$) = 2.1350 (Prob = 0.0328); Akaike info criterion = 0.7543; and the Hosmer-Lemeshow Goodness-of-Fit Tests = 8.5967 (Prob HL= 0.3775)

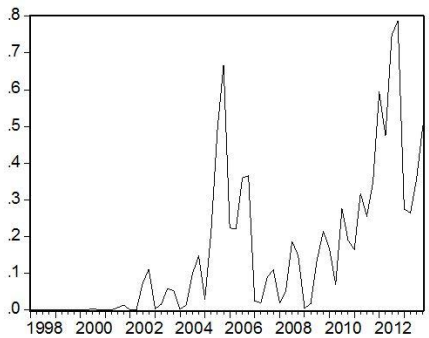

Fig. 2. Risk of public loan outflow: $RISKPLOF_t$.

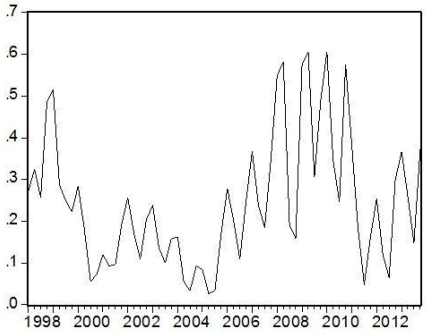

Fig. 3. Risk from total capital outflow: $RISKTOF_t$.

Fig. 3 illustrates the risk associated with total capital outflow. The evidences show that the degree of openness ($OPEN_t$), producer price index (PPI_t), and the price of diesel fuel in Thailand (OIL_t) can affect the total capital outflow at 95 percent confident interval while the equation can be written as

$$RISKTOF_t = -0.06OPEN_t + 0.07PPI_t + 0.17OIL_t + u_{3t}$$

where z-Statistic ($OPEN_t$) = -2.5273 (Prob = 0.0115); z-Statistic (PPI_t) = 1.6615 (Prob = 0.0966); z-Statistic (OIL_t) = 1.9014 (Prob = 0.0572); Akaike info criterion = 1.0622; and Hosmer-Lemeshow Goodness-of-Fit Tests = 12.2856 (Prob HL= 0.1389)

B. Credit Risks

There are 2 types of credit risks examined in this paper: (1) the risk from private debt ($RISKPRD_t$), and (2) the risk from public debt: ($RISKPD_t$).

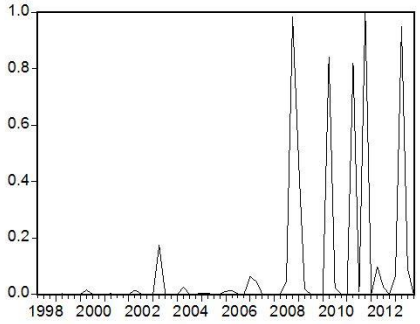

Fig. 4. Risk from private debt: $RISKPRD_t$.

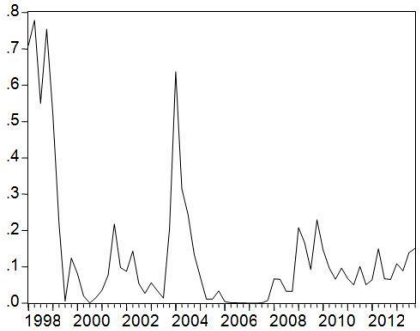

Fig. 5. Risk from Public Debt: $RISKPD_t$.

The results from private debt analysis at 95 percent confident interval reveal that the growth rate of real GDP ($GRGDP_t$), inflation rate (INF_t), and unemployment rate (UNP_t) can affect the private debt such that

$$RISKPRD_t = -1.36GRGDP_t - 2.44INF_t - 2.66UNP_t + u_{4t}$$

where z-Statistic ($GRGDP_t$) = -3.6214 (Prob = 0.0003); z-Statistic (INF_t) = -3.0571 (Prob = 0.0022); z-Statistic (UNP_t) = -3.8185 (Prob = 0.0001); Akaike info criterion = 0.3508; and Hosmer-Lemeshow Goodness-of-Fit Tests = 4.5785 (Prob HL= 0.8015). The probabilities of private debt are shown in Fig. 4.

Fig. 5 illustrates the risk associated with public debt. The evidences show that unemployment rate (UNP_t), the interest rate differential from short term government bonds between Thailand and the United States (ID_t), and lending rate (LR_t) can affect the public debt at 95 percent confident interval while the equation can be written as

$$RISKPD_t = -3.88 + 1.49UNP_t + 2.09ID_t - 0.89LR_t + u_{5t}$$

where z-Statistic (UNP_t) = 2.4470 (Prob = 0.0144); z-Statistic (ID_t) = 2.4035 (Prob = 0.0162); z-Statistic (LR_t) = -1.8198 (Prob = 0.0688); Akaike info criterion = 0.6816; and the Hosmer-Lemeshow Goodness-of-Fit Tests = 2.9237 (Prob HL= 0.9391)

C. Political Risks

There are 2 types of political risks examined in this paper: (i) the risk associated with legitimacy of the state ($RISKLS_t$), and (ii) the risk from group grievance: ($RISKGG_t$).

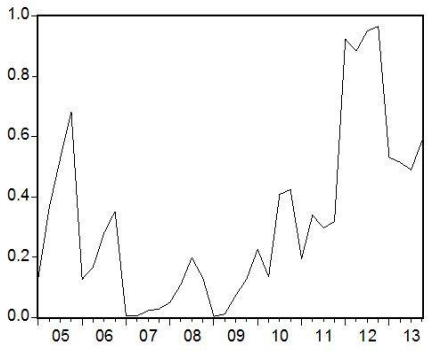

Fig. 6. Legitimacy of the state: $RISKLS_t$.

Fig. 6 represents the risk associated with legitimacy of the state. The empirical evidences reveal that the unemployment rate (UNP_t), and the corruption index ($Corrupt_t$) can affect the risk associated with legitimacy of the state at 95 percent confident interval. The risk equation can be written as

$$RISKLS_t = -38.89 - 3.30UNP_t + 11.82CORRUPT_t + u_{6t}$$

where z-Statistic (UNP_t) = -2.4580 (Prob = 0.0140); z-Statistic ($Corrupt_t$) = 2.6010 (Prob = 0.0093); Akaike info criterion = 1.0069; and the Hosmer-Lemeshow Goodness-of-Fit Tests = 3.9742 (Prob HL= 0.8594)

Fig. 7 reveals the risk associated with group grievance. The evidences show that unemployment rate (UNP_t), trade balance (TB_t), and the price of diesel fuel in Thailand (OIL_t), can affect the risk at 95 percent confident interval. The equation can be written as

$$RISKGG_t = 19.43 - 7.77UNP_t + 0.00002TB_t - 0.31\mathrm{OIL}_t + u_{7t}$$

where z-Statistic (UNP_t) = -3.3360 (Prob = 0.0008); z-Statistic (TB_t) = 2.4640 (Prob = 0.0137); z-Statistic (OIL_t) = -2.7637 (Prob = 0.0057); Akaike info criterion = 0.6410; and the Hosmer-Lemeshow Goodness-of-Fit Tests = 6.9677 (Prob HL= 0.5401)

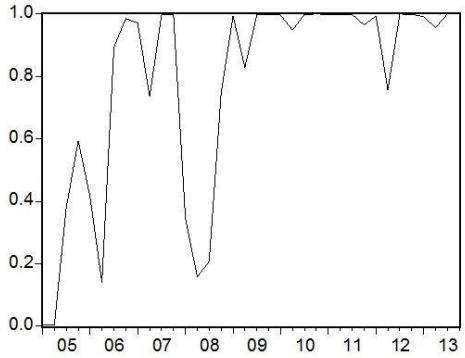

Fig. 7. Group grievance: $RISKGG_t$.

D. Impact on Real GDP

The impact of country risk on real GDP in Thailand is one of the crutial questions which is currently debated. When we treat the risk factors as dummy variables the impact equation can be shown as following

$$\begin{aligned} RDPG_t = {} & 1598.31 + 0.00001M2_t^* - 11.71INF_t^* - 52.28UNP_t^* \\ & + 0.00017\mathrm{TB}_t^* + 12.08\mathrm{CONF}_t^* - 303.71\mathrm{CORRUPT}_t^* \\ & + 79.94\mathrm{RISKLS}_t^* - 126.98\mathrm{RISKGG}_t^* \\ & + 43.81\mathrm{RISKPD}_t^{**} + u_t \end{aligned}$$

where *R-squared* = 0.9207, *Adjusted R-squared* = 0.8922, *AIC* = 9.9663, White Heteroskedasticity Test = 8.6860 (Prob = 0.893354), Breusch-Godfrey Serial Correlation LM Test = 0.0503 (Prob = 0.8226), and the * and ** are represented at the 95 percent confidence interval and 90 percent confidence interval, respectively.

Given all other variable constant with risk from public debt, risk from the legitimacy of the state and the group grievance risk, if the broad money increase by 1 million baths, the real GDP will increase by 0.00127 million baths. If the inflation rate increases by 1 percents, it would reduce the real GDP by 11,710 million baths and when the unemployment rate increases by 1 percents, it would decrease the real GDP by 52,280 million baths. If the trade balance increases by 1 million baths, the real GDP will rise by 0.174 million baths. When the business confidence index rise by 1 point, the real GDP would increase by 12,080 million baths, but when the corruption index increase by 1 point, it would reduce the real GDP by 303,710 million baths. Moreover, the political risk factor causing by the group grievance reduce the real GDP by 126,980 million baths.

VI. Conclusions and Policy Implications

Country risk measure is important for developing countries because these countries seek foreign investment and sell government bonds on international financial markets. Logit and country beta models are proven to be objective

self-contained methodology for estimating country risk in Thailand. Integated these methodologies helps to understand the probability and the magnitude of uncertain events. One of the advantage of such techniques used in this study is that it is not complicated,but these methods may have a hidden problem that should be aware. Since these techniques are parametric estimation assuming the normal distribution, when the data do not satisfy such assumption, it may deviate from optimal solutions.

The empirical evidences provide some interesting policy implication. At 50 percent cut off probability, two political risk factors in Thailand, the legitimacy of the state and the group grievance, are significantly needed to be in socioeconomics policy consideration. The probability of political risk occurance are higher than that of other economics risks. The risk associated with the private debt is also higher than the risk from capital flow. In short, Thai's social planner need to watch out the internal weakness more than external causes.

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