BANK FRAGILITY IN THE CARIBBEAN

by

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I. INTRODUCTION

Within the last decade a few Caribbean countries have been experiencing difficulties within their financial sectors. Experience has warned that fragility of the financial system can have severe negative macroeconomic implications. A sound banking sector is crucial to economic growth in the Caribbean where capital markets are fragmented and relatively underdeveloped. Thus, the banking sector must be given considerable attention, in an effort to maintain a stable and solvent banking environment. Effective monitoring of the financial system must therefore include gauging the factors which contribute to bank fragility.

This paper attempts to test the significance of bank specific variables, macroeconomic variables and aggregate banking sector variables as determinants of bank fragility. Much research has been conducted in an effort to determine the factors which contribute to failure of financial institutions and fragility of a financial system. Gonzalez Hermosillo et al in an application to the Mexico financial crises propose an empirical methodology to gauge the factors determining the fragility of banks and the banking sector[1]. This paper applies their methodology to panel data from the banking sector of CARICOM countries. An attempt is made to gauge the relative contribution of bank specific variables, banking sector variables and macroeconomic variables to bank fragility.

The paper proceeds as follows: Section II presents justification for the study and describes the methodology of logit and probit models. Section III discusses the data used in the study, describes the proxy measures which were used for specific factors and details the expected signs for different variables. Section IV presents an analysis of the results from the

[1]Hermosillo et al. Banking System Fragility: Likelihood versus Timing of Failure- An Application to the Mexican Financial Crises. IMF Working Paper, 1996.

estimation process and section V concludes with a summary of the results and suggestions for future research.

II. THEORY AND METHODOLOGY

Theoretical Issues

Although the legal definition and activities of banks vary across countries, most banks share similar characteristics. Banks create liquid liabilities by accepting deposits from the the public and acquire assets which are illiquid and of longer maturity than their liabilities.

Banks dominate the financial system of most Caribbean countries. A sound banking system is important because of the key role it plays in such economies. They assist in the financial intermediation and credit allocation processes, facilitate payment flows and help maintain financial discipline among borrowers. In the Caribbean, banks produce the necessary information for intermediation, provide portfolio diversification for maturity transformation and risk reduction , allocate resources and also provide liquidity for payments of services.

A banking system which is fragile can be defined as one where the banks accounting for most of the system's assets and liabilities are insolvent or likely to remain to become insolvent. Solvency is reflected in the positive net worth of the bank. The probability of a bank maintaining solvency depends to a large measure on the banks' profitability, quality of management, efficiency and capitalization.

The existence of asymmetric information increases the risk of market failure in banks. On the asset side, banks risk funding borrowers whose ability to repay is uncertain. On the liabilities side, the confidence of depositors who are faced with imperfect information is crucial to any bank's ability to provide deposit services. The exposure of banks to market failure should be addressed because of the negative externalities associated with bank failure. Bank failures may spillover to affect other banks and the wider economy.

A few writers have examined banking sector crises in various countries in an effort to determine the contributing factors. Miskin (1994) outlines that declines in stock prices, increases in interest rates and corporate indebtedness and unanticipated declines in inflation are a few signals of financial crises. Gavin (1995) argues that loan delinquencies are lagging indicators and focuses on the role of credit booms and macroeconomic shocks to asset quality and bank funding as determinants of bank fragility. Hermosillo et al (1996) contend that bank fragility is determined by a combination of bank specific variables, banking sector variables and macroeconomic variables. Fischer and Gueyie (1995) use a combination of bank balance sheet, macroeconomic and policy variables to determine the probability of bank failure.

The work of Hermosillo et al is used as a reference point for this study. This is due to the fact that they examined a financial crises in a developing countries. We therefore contend that bank fragility is determined by a combination of factors. Banks may fail because of factors which are specific to the individual banks, contagion effects in the banking system and macroeconomic shocks. Some of the variables used by Hermosillo were not used in this study because it was felt that they would not be appropriate in the Caribbean context or due to data limitations.

Hemosillo et al examined profitability, the quality of management and market risk as bank

specific determinants of bank failure. In this paper we also focus on profitability, the quality of management and market risk as microeconomic indicators of bank fragility in the Caribbean. We examine profitability because it is felt that sustained losses incurred by a bank may lead to failure. On the other hand increases in profitability are sometimes associated with allocation of funds to high risk projects. A high proportion of loans to a vulnerable sector may contribute to bank failure. Considerable lending to sectors where revenue flows are volatile, such as agriculture may increase the probability of bank failure as borrowers may fail to honor their debt during difficult periods. The quality of management impacts on the profitability, credit risk and market risk of any bank and is therefore examined. When depositors lose confidence in a particular bank, it is likely that they will withdraw their funds, thus increasing the probability of failure. A proxy measure for deposit runs is therefore examined.

Credit risk and the growth of credit are examined as banking sector variables. Considerable exposure to bad credit increases the probability of bank failure. Thus we examine credit risk as a determinant of bank fragility. Rapid increases in credit relative to growth of the economy could pose serious problems for the banking sector.... In an environment of increasing credit and slow economic activity, business people may not be able to generate enough revenue to meet obligations to the banking sector. Hermosillo et al examine the ratio of nonperforming loans to total loans as a proxy for credit risk. This proxy is also used in this paper. We also adopt their proxy for growth of credit in the banking sector. This variable is measured by the ratio of total bank loans to gross domestic product. The level of interbank borrowing could be positively related to bank failure as troubled banks may be able to access the interbank market. However this variable was not examined in the study because of data limitations.

Lindgren et al (1996) contend that banks are derivative institutions in that the solvency of banks reflects the health of customers and the economy as a whole. Thus it should therefore be possible to establish relationships between macroeconomic variables and microeconomic and contagion indicators of fragility. A number of macroeconomic variables are expected to impact on the health of the banking system. Gross domestic product and sectoral growth rates, current and capital account balances are indicators of macroeconomic conditions, while consumer credit, interest rates, asset price indices and consumer price indices are indicators of financial fragility. Unexpected inflation and recessionary conditions are expected to impact negatively on banks' performance. Foreign borrowing may be an indicator of the fragility of the exchange rate. Indeed a high share of foreign liabilities may indicate exposure to the variations of the exchange rate vis-a vis other countries. This study examines the role of the consumer price index, real gross domestic product (1990 prices), the treasury bill rate and the nominal exchange rate in determining bank fragility. Foreign borrowing is not used in this model due to insufficient number of observations.

The discussion presented above indicates that a large number of factors contribute to bank fragility. The preferred model would therefore include a combination of most of the above mentioned factors. Due to data limitation, such a model cannot be estimated.

Preferred Model

$$\text{Intervention} = \beta_1 DEP + \beta_2 CPI + \beta_3 NEXR + \beta_4 CONS + \beta_5 ROA + \beta_6 OEX + \beta_7 TBR + \beta_8 FB + \beta_9 IBF + \beta_{10} CAR + \beta_{11} NPL + \beta_{12} GDP + \beta_{13} AGR$$

Model Specification

The pith of the empirical exercise is to determine the factors which contribute to the probability of bank failure and the timing of bank failure. The paper sets out to test the following hypothesis:

- Bank fragility is caused by some factors specific to the bank and more generally to the banking sector and the economy.

For the purposes of this paper bank failure is defined as; intervention by government or central bank in the operation of the bank or termination of a bank's operations. The dependent variable (intervention) is a discrete qualitative variable which takes on the value of zero when a bank was intervened and one when there was no intervention.

Two models were estimated. Model II includes the ratio of non performing loans total loans; a variable for which there was limited number of observations. Thus the number of observations included in model II is considerably small.

MODEL I

Intervention = $\beta_1 DEP + \beta_2 CPI + \beta_3 NEXR + \beta_4 CONS + \beta_5 ROA + \beta_6 OEX + \beta_7 TBR$

MODEL II

Intervention = $\beta_1 NPL + \beta_2 DEP + \beta_3 OEX + \beta_4 CPI + \beta_5 NEXR + \beta_6 GDP + \beta_7 ROA + \beta_8 LNI$

Statistical Technique

Logit/ Probit models are used in this study to determine the relationship between bank failure, bank specific variables, banking sector variables and macroeconomic variables. Survival analysis is also conducted to determine the factors which explain the duration of a given state, which in this case is the state of non failure of a bank. We will first discuss the method used to determine the probability of failure and then turn to a discussion of the survival analysis.

Probability of failure

Logit/Probit models belong to a class of models called Qualitative Response models or Limited Dependent Variable models. Qualitative response models are regression models where the dependent variable assumes discrete values. In this paper, we use a univariate qualitative response model which is defined below.

$P(Y=1) = F(\beta' x)$

$P(Y=0) = 1 - F(\beta' x)$

The parameter Y represents a set of dependent binary random variables which assume a value of 1 where there was no intervention within a bank and 0 when there was some form of intervention. β is a set of unknown parameters which will be estimated and they reflect the impact of changes in the explanatory variables on the probability of bank failure. The parameter x represents our set of explanatory variables. The probability that any given bank was intervened is modeled as a linear combination of the explanatory variables (x_i) with weights given by the β coefficients. The estimation exercise seeks to find the the optimal

values for the β coefficients. In our case we have the problem of choosing a functional form for F which is most appropriate. The Linear probability model; $F(x)=x$ cannot be used as it is not a proper distribution function since $\beta'x$ cannot be constrained to lie between the zero-one interval. In light of the shortcomings of the linear probability model we use the functional form of the Logit/Probit models. These are indicated below.

Probit Model

$F(x) = \Phi(x) = \int^{x}_{-} (2\Pi)^{-½} \exp(-t/2)dt$

Logit Model

$F(x) = \Lambda(x) = (\exp(x))/(1+\exp(x))$

The estimation procedure in the Logit model is based on the assumption that the cumulative distribution of the stochastic disturbance is logistic while that of the Probit model assumes that it is normal. The cumulative normal distribution and the logistic distribution are very similar and therefore estimated logit and probit models, in many instances tend to be similar. This study utilizes the logit model to test the probability of bank failure. Estimation in this model is based on the method of maximum likelihood. Each observation is treated as a single draw from a Bernoulli distribution. The model with success probability $F(\beta'x)$ and independent observations leads to the joint probability or likelihood function:

$L = \prod [F(\beta'x)]^{y_i}[1- F(\beta'x)]^{1-y_i}$

Maximum likelihood estimation is consistent with the idea of finding values for β estimates which maximize the probability of obtaining the observed sample.

Survival analysis

Survival models focus on conditional probabilities, whereas the specification for the probability of failure focus on the unconditional probability an event taking place. In our context therefore, we focus on the probability that a bank will fail in period $t+1$ given that it has survived until period t. Survival analysis provides information about the period leading up to intervention of the bank. This includes an estimate of the probability that any bank will survive to operate in the period under consideration, the probability that the bank will fail after it has reached that period and the expected time before a bank fails.

Survival analysis involves the use of data which measures the time to achieve a particular state or complete an action such as failure, death, response or divorce. Such times are subject to random variations and form a distribution which is characterized by three equivalent functions. These functions are the survival function, the hazard function and the probability density function and are mathematically equivalent. For the purposes of this study, the survival function $S(t)$ is defined as the probability that a bank survives longer than time t. The probability density function of survival time is defined as the probability of failure with a small time interval. The survival time has a hazard function which is defined as the probability that a bank fails in avery short interval, given that it has survived until the beginning of the interval.

The likelihood function for the survival model can be written as:

$L = \prod^{N} [\prod^{T} [P_{i,t} f(t_i)]^{Q_{i,t}} [(1-P_{i,t}) + P_{i,t} S(t_i)]^{1-Q_{i,t}}$

where P is the probability of failure, f(t)is the density function of the time to failure and S(t) is the survival function. Q is a variable which assumes the value of one when the bank

survived the sample period and zero otherwise. Q is a censored observation and is included as one of our dependent variables. N represents the number of banks in the sample.

Estimation of the hazard and survivor functions could be done by parametric, non-parametric and semi parametric methods. The survival analysis presented in this paper focus on the use a parametric method for estimation. A logistic specification is used for estimation purposes. The logistic functional form allows for a hazard which first increases, reaches a peak and then declines. The logistic specification is given by :

$$S(t) = 1/1+\lambda t^{\pi}$$

$$f(t) = \lambda\pi (\lambda t)^{\pi-1} / [1+ (\lambda t)^{\pi}]^2$$

$$\lambda = e^{-\mu' x}$$

The parameters λ and govern the shape of the survival curve, while the coefficient μ indicates the relationship between the (time varying) characteristics and the survival time. The dependent variables for the survival model are the (log) time to failure for the bank (number of years before intervention) and a truncation vector which shows whether or not the bank survived over the sample period.

III. DATA

The bank specific data used was sourced from the Central Banks of the various countries. The sample which contains 68 banks, includes all commercial banks operating in Barbados and the OECS and a sample of the banks operating in Belize, Guyana and Jamaica. Banking sector and macroeconomic data were collected from various publications of the World Bank , the International Monetary Fund and Central Banks' reviews. Since a sample was drawn from some of the countries, the model does not capture all the banks which failed in the region during the period under consideration. The model was built using panel data from the various countries for the years 1990 to 1996.

Microeconomic data

The study proposes that certain bank specific factors contribute to bank fragility. Thus, a few variables related to individual banks were examined in the model.

The ratio of classified loans to total loans is used as a proxy for credit risk. Banks which hold a significant amount of nonperforming assets must provide for losses on some of these assets and this impacts negatively on net profits and capital. A high ratio of non performing loans to total loans is therefore expected to be positively related to the likelihood of failure and negatively related to survival time.

Market risk is proxied by the concentration of banks' asset portfolio. Usually, considerable exposure to susceptible sectors would be positively related to the probability of failure. The agricultural sector is one of the more vulnerable sectors in the region. The intervened banks are therefore expected to have a larger share of agricultural loans (AGR) in their loans portfolio. Consumer loans (CONS) are expected to dominate the loans portfolio of non intervened banks. However, one cannot be sure about the nature of the relationship between these variables and the probability of failure.

High levels of bank profitability normally assist in the improvement of economic viability of a bank and is therefore negatively related to the probability of bank failure. However, increased profitability could also be related to the financing of risky projects and may be positively related to the probability of failure. The ratio of net profits (before taxes) to total assets (ROA) is used as a proxy for profitability.

Deposit runs from the public or from banks would be positively related to the probability of failure and negatively related to survival time. The share of private deposits to total deposits should be significantly higher for non intervened banks.

The relative efficiency of banks is measured by the ratio of operating expenses to total assets. This ratio is often used as proxy for the quality of management. Higher costs are expected to be positively related to the probability of failure and negatively related to survival time.

Banking sector data

The experience of certain countries indicates that banking crises are often associated with a rapid increase in loans relative to gross domestic produce (GDP). The ratio of total loans to GDP is used as a proxy for the growth of the extended banking sector. The fragility of the banking system is proxied by the ratio of non-performing loans to total loans. The ratio of total loans is expected to be positively related to bank failure and negatively related to survival time.

Macroeconomic variables

Bank soundness can be evaluated mainly at the micro level. However in cases where macroeconomic conditions impact significantly on bank soundness, it becomes a systemic issue because all banks will be exposed to these conditions. The state of the banking system therefore reflects in a large measure the health of the overall economy. In a weakening economy, there may be a reduction in new bankable projects. This may impact negatively on consumer and business activity. Beyond the general difficulties of operating in a weak economy bank unsoundness may often be compounded by macroeconomic shocks.

In light of the foregoing, a few macroeconomic variables were examined in the model. The exchange rate will affect banks profitability through the performance of borrowers. We examine the role of the nominal foreign exchange rate and the treasury bill rate. The role of real GDP and the level of the CPI is also examined. The consumer price index and treasury bill rate are both expected to be positively related to the probability of failure and negatively related to survival time. It is expected that real GDP will be negatively related to the probability of failure and positively related to survival time. Table I overleaf lists the explanatory variables and the expected signs for their coefficients.

Table I: Explanatory Variables

Variable	Expected Sign Failure	Expected Sign Survival Time
Bank Specific Variables		
Consumer loans to total loans (CONS)	+/-	+/-
Net income to total assets (ROA)	+/-	+/-
Expenditure to total assets (OEX)	+	-
Private deposits to total loans (DEP)	+	-
Non-performing loans to total loans (NPL)	+	-
Banking Sector Variables		
Total loans to GDP (LNI)	+	-
Macroeconomic Variables		
Consumer price index (CPI)	+	-
Real GDP (GDP)	-	+
Nominal exchange rate (NEXR)	+	-
Treasury bill rate (TBR)	+	-

Survival Bias

The reliability of the estimates from this model may be affected by two factors; data limitation and the definition of the dependent variable.

Data constraints faced during the data collection process may render some of the results of the estimation process biased. There were insufficient observations for a few variables which we thought would significantly increase the probability of bank failure. The level of non-performing loans, risk adjusted capital adequacy ratio, residential mortgages, foreign borrowing, interbank funds and central bank borrowing were not available for a large number of the observations. As a result of this data limitation only non-performing loans was used in the estimation process. Due to this problem two models were estimated; the first was estimated using the more consistent series and the second using the series with many missing observations.

In this paper a bank is considered to be intervened when ; the bank ceases operation, the central bank or government agency assumes operation or when the government agency or central bank injects funds into the bank.

An element of bias may be introduced in the model due to the fact that intervention as defined above is not necessarily synonymous with failure of the bank in question. In one of the countries examined there was intervention in two banks. Government intervened to prevent the failure of Bank F in 1993. In 1991 the Central Bank sold the assets of the second bank ; Bank G. Bank G can be divided into two banks; Bank G_1 and Bank G_2. This intervention however was not due to the financial situation of bank G or the economic and financial environment, but to problems met by the head office. In 1993 the activities of Bank G_1 were suspended and it's assets sold to Bank G_2.

The results may also be biased because intervention does always occur at the time a bank fails. A bank may become insolvent long before there is any decision to intervene in it's operations.

IV. RESULTS

This section presents the findings from the estimation of model I and model II. The results are presented in tables II and III below.

Table II

LOGIT MODEL

Results from estimation of Model I

Dependent Variable: Intervention				
Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Probability**
TBR	1.005	0.292	3.439	0.006
DEP	0.110	0.443	0.250	0.802
CPI	-0.057	0.016	-3.613	0.000
NEXR	-0.163	0.042	-3.868	0.000
CONS	7.874	4.783	1.646	0.101
ROA	36.589	14.682	2.491	0.013
OEX	33.232	13.806	2.407	0.017

In model I seven variables were examined. Among these variables five of them were found to have a significant influence on the probability of bank failure. It must be noted that banking sector variables were not examined in model I. From the results it is evident that bank fragility is determined by a combination of microeconomic and macroeconomic factors.

The proxy measure for profitability of banks; return on assets ratio (ROA) is significant and positively related to the probability of bank failure. This implies that as the net profits of a bank increases the probability that it will fail also increases. This result may seem unusual as sustained high level of profitability may enable a bank to boost it's economic position. However it must be noted that higher levels of profitability may be associated with risky and mega projects which could increase the probability of failure.

The quality of management (OEX), as proxied by the ratio of operating expenses to total assets is significant and also positively related to the probability of failure. It is not unreasonable to assume that continuous increases in operating expenses without the mitigating effects of increases in profitability or boost in capital will increase the probability of bank failure.

Market risk represented by the ratio of consumer loans to total loans (CONS) is significant at the 10% level. This indicates that as the level of consumer loans increases, the level of loan default and hence the probability of bank failure increases. This result suggests that there is a high level of risk associated with increased consumer borrowing from the banking system.

The nominal exchange rate shares a significant negative relationship with the probability of failure. As the domestic currency depreciates the probability of failure increases. Currency depreciation is usually accompanied by increases in domestic and foreign prices. This inflationary effect may reduce businesses' overall profitability and the level of loan default. Thus, this negative relationship is consistent with our expectations.

The treasury bill rate is positively related to the probability of failure. This is consistent with the view that persistent increases of interest rates increases the likelihood of failure.

The Consumer price index (CONS)is negatively related to the probability of failure. This result is contradictory to apriori expectations that increases in prices will increase the probability of bank failure. The business community (banks' customers) in the region rely on foreign suppliers and buyers for their supplies and revenue flows. Although domestic prices do reflect foreign prices to a certain extent, it is felt that foreign prices would exert a greater influence on the banking system.

In some cases where there is a move towards domestic production and import substituting industrialization foreign prices and local prices may be showing different trends.

The ratio of private deposits to total loans (DEP) is insignificant. Experience has indicated the banks have failed in the Caribbean mainly because of credit and market risk. The fact that the deposit run proxy is insignificant is therefore not a surprising result.

Table III

Results from estimation of model II

Dependent Variable :Intervention				
Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Probability**
NPL	-32.726	32.233	-1.015	0.313
DEP	-9.587	6.422	-1.493	0.139
OEX	-200.66	112.025	- 1.791	0.077
CPI	-0.551	0.341	-1.618	0.109
ROA	-346.77	187.37	-1.850	0.068
NEXR	19.832	9.567	2.072	0.041
LNI	0.477	0.286	1.668	0.092
GDP	0.024	0.019	1.245	0.216

Model II included two new variables. The ratio of non-performing loans to total loans and the ratio of total loans to gross domestic product (banking sector variables). Gross domestic product was included while, the ratio of consumer loans to total loans and the treasury bill rate were dropped from the model. More banking sector variables could not be included in the model as there would not be sufficient degrees of freedom to facilitate estimation.

The results from model II show that most of the variables which were significant in model I remained significant. However the signs of all these variables expect the consumer price index changed. The change in sign may be due to the small number of observations included in the model.

The ratio total loans to gross domestic product (LNI) is significant at the 10% confidence level and is positively related to bank fragility. This result is in keeping with the experience of countries which have experienced financial crisis. Banking crises are often associated with a rapid rise in loans relative to GDP. Sustained increases in LNI would therefore imply a higher probability of bank failure.

Profitability (ROA) in this model is negatively related to the probability of failure. In general, increases in the level of profitability enables a bank to improve it's economic viability, thus being negatively related to bank fragility.

The quality of management (OEX) is also negatively related to the probability of failure. This suggests that as operating expenses increase the probability of failure is reduced. In the Caribbean increases in operating expenses during the period under consideration, could be explained by an increase in process innovation and modernization costs. Financial innovation and modernization are often associated with an increase in efficiency. Thus increases in operating expenses may be compensated for by increased profits.

The nominal exchange rate is positively related to the probability of failure. This could be explained by the fact that as a currency appreciates it's exports become less competitive. As a consequence, domestic producers find it difficult to maintain their market share and therefore loan default may increase.

The ratio of private deposits to total loans is negatively related to bank failure, suggesting that as the share of private deposits in a bank's loans portfolio becomes smaller the probability of failure increases.

Non-performing loans do exert any significant influence on bank fragility in this model. This is a surprising result but this may due to the small number of observations. The level of real Gross Domestic Product is also insignificant.

The consumer price index is again inconsistent with our expectations. The coefficient is negative and significant.

V. CONCLUSION

This paper argues that bank fragility in the Caribbean is determined by bank-specific factors as well as macroeconomic conditions. Due to data limitations, we were unable to adequately assess the effect that overall fragility of the banking system in the presence of systemic risk, would have on the probability of failure of individual banks.

The results suggest that profitability (ROA), the quality of management (OEX) and the ratio of consumer loans to total loans (CONS) are the most important microeconomic variables in terms of determining the probability of bank failure. Thus, market risk, profitability and management and growth of the banking sector relative to the economy seem to be crucial indicators of fragility.

The performance of the macroeconomic variables suggest that adverse macroeconomic shocks may put tremendous pressure on the banking system and increase the likelihood of bank failure. The exchange rate is an important tool for economic adjustment and the results suggest that there should be many considerations when a country is contemplating devaluation.

Future research should include examining the contribution of more banking sector variables and microeconomic variables to the probability of bank failure. It may be useful to use an alternative method to determine which factors contribute to the probability of bank failure and time to bank survival. This paper serves as a point of departure in examining the problems of the banking sector of the region. It is hoped that the paper demonstrates the importance of such an exercise and that data may be made more readily available for future research.

REFERENCES

Central Bank of Barbados. *Annual Statistical Digest.* 1996.

_____ *Aremos Data Bank.* Central Bank of Barbados, Barbados, 1997.

Craigwell, Roland and Nathaniel Samuel. *Administrative Tax Reform and the Duration of Tax Returns in the OECS.* Review Seminar, Central Bank of Barbados. August, 1997.

Garcia, Gillian, Lindgren Carl-Johan and Matthew Saal. *Bank Soundness and Macroeconomic Policy,* International Monetary Fund, Washington, D.C. 1996

Greene, W. H. *Econometric Analysis.* Prentice-Hall International. London. 1997.

Gonsalez-Hermosillo, Brenda at al. *Banking System Fragility: Likelihood versus Timing of Failure - An Application to the Mexican Financial Crisis.* International Monetary Fund Working Papers. Monetary and Exchange Affairs Department, 1996.

International Monetary Fund. *International Financial Statistics.* July, 1997

Judge, G. Et al. *The Theory and Practice of Econometrics.* John Wiley and Sons Inc. Canada. 1985.