THE FRAGILITY OF FINANCIAL INSTITUTIONS IN THE CARIBBEAN

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by

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I Introduction

For the past fifteen years, 133 of the 181 current members of the international monetary fund have experienced significant financial problems[5] at some stage. Through their experience, it has been highlighted that chronic weakness and crisis in financial institutions can affect the overall economy. In particular, the Mexico Crisis is the most (striking) example and has released an abundance of literature on financial crisis, their causes and consequences. Much research have been led among which we can find those of Gonzales Hermosillo. Indeed, Gonzalez Hermosillo et al have carried out a survey on deposit-taking institutions in the Caribbean. This paper applies his methodology, providing an analysis of the relationship between some characteristics specific to the firm, and more generally to the financial sector and economy, indicating a risk of financial institution failure, the probability of financial failure. These indices are microeconomic indices as the Cooke ratio, the size of the banks in term of assets, the classified debt to total loans, indices of the banking sector as a whole as the treasury bill rate, the foreign borrowing, the borrowing from the Central Bank and macroeconomic indices as the real GDP and the inflation rate.
The survey assesses the impact of firms specific indicator ratios, banking system ratios and macroeconomic factors on the financial sector and also tests, through the probit / logit specifications, the proposition that a financial institution's fragility is determined by those microeconomic and macroeconomic factors.
The survey studies the case of Barbados, using quarterly data.

[5]Carl-Johan Lindgren, Gillian Garcia, Matthew I. Saal, Bank Soundness and Macroeconomic Policy, International Monetary Fund, Washington, D.C., 1996, 214 p.

II Data

We will examine both indicators of individual bank fragility and of the whole system fragility. Indeed, the purpose of this paper is to test the significance of bank-specific factors, macroeconomic conditions and, when externalities or potential contagion effects exist in the system, aggregate banking sector variables as determinants of bank fragility.
The bank-specific data used in this survey is derived from AREMOS and the bank supervision department of the Central Banks. The sample excludes foreign banks. Banking sector data macroeconomic data are collected from the various Central Banks' reviews and the International Financial Statistics. The survey is based upon quarterly data from 1990:Q1 to 1996:Q4 for Barbados and annual data for the other countries of the Caribbean Community.

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II.1 Microeconomic data

We examine several bank specific indicators.

The capital adequacy ratio serves as a cushion to absorb shocks. It is expected to be negatively linked to the probability of failure and positively linked to the expected survival time. The mean CA is expected to be significantly lower for intervened banks than for non-intervened banks.

Credit risk is proxied by the ratio of classified debt to total loans. This ratio includes the loans classified as substandard, the loans classified as doubtful and the loans classified as a loss. Holding of large troubled asset reduces net earning and ultimately capital. A high ratio would then be positively linked to the likelihood of failure and to the time of failure. In the cases which have been examined, the mean ratio is about three times higher for the banks which have suffered an intervention than those which have not.

Market risk is has as a proxy the riskiness and concentration of a bank's portfolio. Usually, a large share of vulnerable sector loans would be positively related to the probability of failure and negatively to the survival time. On average, the intervened banks are expected to have many more agricultural loans (AGR) and residential mortgages (HOUS) in their loan portfolio. In opposite, non-intervened banks are expected to have a larger share of consumer loans in their loan portfolio.

Normally, sustained high levels of profitability are negatively related to the probability of failure. But a high level of profitability may be positively linked to the probability of failure because high rates of return are gotten by high risk taking. As a proxy of profitability, we examine the ratio of net profit (before taxes) to total assets.

Deposit-runs from the public would be positively related to the likelihood of failure and to the expected time of failure. On average, the share of private deposit to total loans (DEP) should be significantly higher for the non-intervened banks.
Likewise, low value of deposit to loan ratio suggests a banking system that may be overreaching its resources in more ways than merely financial (on the other hand, high values of deposit to loan ratio may indicate a banking system whose managers choose, or are constrained, not to exploit their franchise).

To measure the quality of management, we examine the ratio of operating expenses to total assets, representative of relative efficiency. Higher costs are expected to be positively related to the probability of failure and negatively related to the survival time. For the cases already studied, the mean value for EXPA is approximately the same for both intervened and non-intervened banks.

Finally, the size of the banks, in term of assets, relative to banking sector (SIZE) measure the ability of relatively large banks to survive because, if, for instance, they are better able to diversify risk. Even though they may be intervened, their survival time may be extended by an easier access to short-term financing and also by "too big to fail" policies for the larger banks. Nevertheless, in the case of Mexico the banks which have been intervened have a significantly higher average size than those which have not been intervened.

II.2 Banking sector data

In this section, we examine the impact of banking sector variables.

Experience shows that banking crisis are often associated with a rapid rise in loans relative to GDP,
often in connection with a financial reform policies. Thus, as a banking sector variable, we focus on the share of total bank loans to GDP as a proxy of how extended the banking sector may be.

We also focus on the banking sector's non-performing loans to total loans as a proxy of the fragility of the whole system.

As the deposit-to-loan ratio, a banking system in which foreign borrowing has a high value may also indicate that the resources are not overreached by the only financial ways. Foreign borrowing may also be an indicator of the fragility of the exchange rate. Indeed, a high share of foreign liabilities may indicate a high exposure to the variations of the exchange rate vis-a-vis the other countries involving foreign exchange risk for the system.

We examine the borrowing of the banking system from the Central Bank. As a matter of a fact, borrowing from the Central Bank often entails some degree of official control over the banks' use of the credit.

II.3 Macroeconomic variables

A number of macroeconomic variables should be expected the banking system or reflect its condition.

Macroeconomic shocks affect a bank's balance sheet and banking system's ** health, particularly in the monetary area. Thus, we have to analyze linkages between the traditional areas of policy and the soundness of the banking system.

Economic conditions are key determinants of the soundness of the banking system. Banks' failure may involve unsoundness of the banking system for many reasons :

- poor or negligent management
- excessive risk taking
- poor operating environment
- fraud
- non-anticipated sharp deterioration of the economic environment.

Bank soundness is first an issue of individual banks. But when unsoundness is due to macroeconomic conditions, it becomes a systemic issue because all banks will be exposed to these conditions.
Banking soundness reflects in a large measure the health of the economy. In a weakening economy, new bankable projects may get reduced and thus involve difficulties for business and householder borrowers and even for the government in servicing their loans. So, fluctuations in real sector conditions have an immediate impact on banking system soundness.
Beyond the general difficulties of operating in a weak economy, bank unsoundness is often compound of macroeconomic shocks.

Sharp changes in relative prices can contribute to enterprise insolvencies and bank unsoundness. The rise in oil prices in the seventies and in the eighties damaged oil import dependent business and countries, and their banks. In 1986, the collapse in oil prices contributed to recession and bank failures in oil exporting countries.

Shifts in the terms of trade have been one of the component of banking difficulties in many countries in the eighties in, for instance, Chile, Malaysia, and in the early nineties in the countries of Eastern and Central Europe, the Baltic, and the former Soviet Union. ... . .

Non economic shocks such as war, earthquake, or severe weather can have an adverse economic impact.

Banking system may be affected by the monetary policy instrument.
Indeed, a smooth functioning of the payment system needs a property functioning lender-of-

last-resort which absence can drive a liquid bank to insolvency through a massive sale of assets. Financing of budget deficits at below-market interest rates through imposition of high liquidity ratios can constitute a tax on the banking system and can result in a widening of interest rate spreads, increased bank lending rates and disintermediation. The frequent use of banks, by governments, as a source of finance through reserve requirements or holding of government securities, may make bank earnings suffer if those assets do not pay market rates.

The exchange rate policy has varied effects across sectors.
A prolonged over-evaluated exchange rate will be detrimental to export sectors, while a prolonged under-evaluation will disadvantage import sectors. The level of exchange rate will affect the bank profitability through the performance of borrowers although there may be some impact on banks' foreign exchange services or trading. Shifts in exchange rate also have diverse effects through sectors. The impact of a significant change in the exchange rate will generally worsen the financial condition of some borrowers and increase the number of non-performing loans. The impact on banks may be compounded if their direct or indirect foreign exchange risk exposure has not been regulated. Exchange rate instability and uncertainty have negative effects on banks operations. Uncertainty linked to the Mexican financial crisis of 1995 in turn triggered financial problem in several Latin-American countries and placed stress on banking system in other emerging markets far removed from the crisis. Unstable or deteriorating conditions are often accompanied by net increases in real interest rates reflecting growing risk premium. Exchange rate policies, often coupled with political concerns, may induce capital flight and bank runs. When devaluations are expected, disintermediation can occur as depositors shift to foreign currency.

Shifts in foreign exchange rate can lead to inflation. Banks can usually mitigate the impact of high inflation on their own profitability by indexing lending rate and shifting into assets whose prices lead to inflation (such as foreign exchange). However, bank earnings which are derived from the float on payments, from the inflation tax collected on non-remunerated demand deposits (net of reserve requirements) and from foreign exchange dealings may be unsustainable when inflation decreases. Moreover, bank portfolio risk is likely to increase.
High inflation or/and exchange rate volatility induces interest rate and good prices informational bias. High interest rates during inflation may exacerbate opportunistic behavior problems in bank lending as moral hazard and adverse selection. Uncertainties caused by inflation also erode the information base for business planning and credit rating.
The exchange rate fragility is proxied by the ratio of import over international reserves when the exchange rate is fixed.

Prolonged macroeconomic instability and inflationary policies will distort bank operations and the real value of bank capital. Nevertheless, the transition forward a more stable environment may not be easy for the banking system. Among other countries, Chile, Finland and Malaysia have undergone episodes of unsoundness owing to stabilization. Where previously expected inflation has been incorporated to investment decisions, a rapid reduction in inflation will leave those forecasts unmet and borrowers unable to service their loans. Moreover, after banks have adjusted their operations to inflationary conditions, macroeconomic stabilization may have a relevant impact on bank profitability. A decline in inflation deprives banks of inflation-linked sources of earnings. Instead, banks must rely increasingly on traditional intermediation, focusing on loan and client assessment.

III Methodology

III.1 Research issues

In this paper, the empirical analysis focuses on the determinants of bank failure (intervention). The major hypothesis is that bank fragility is determined by some characteristics specific to firm and more generally to the financial sector and the economy.

The model determines the probability of failure (intervention) and the factors affecting the probability of failure. Our dependant variable is the decision to intervene a bank in case of bank intervention. This dependant variable is a discrete qualitative variable which can take the value of one (intervention) or zero (no intervention).
The probability of failure is estimated as a function of a set of explanatory variables using a maximum likelihood logit model.
The major issue is what factors determine the fragility of banks and the overall sector. This question is analyzed via the Cross-section/ Time Series model:

$$\log[\text{prob} / 1\text{- prob}] = P[GDP_{t-1}, OEXP_{t-1}, HOUS_{t-1}, SIZ_{t-1}, TBR_{t-1}, ITBR_{t-1}, DEP_{t-1}, AGR_{t-1}, CONS_{t-1}, BCB_{t-1}, FB_{t-1}, GBGT_{t-1}, INFL_{t-1}, COV_{t-1}]$$

Where

GDP -	Gross Domestic Product
OEXP -	Operating Expenses / Total Assets
HOUS	Residential Mortgages / Total Loans
SIZ	Size of bank in terms of assets relative to the banking sector
TBR	Treasury Bill rate
ITBR	Interbank rate
DEP	Deposits / Total loans
CONS	Consumer loans / Total loans
AGR	Agricultural loans / Total loans
BCB	Borrowing from the Central Bank
FB	Foreign borrowing
GBGT	Government Budget (Deficit / Surplus) / GDP
INFL	Inflation rate
COV	Imports / International reserves

Intervention is considered to occur when either

1. The bank ceases operations.

or

2. The Central bank or government agency assumes operation.

or

3. The government or the central bank or a government agency injects funds into the bank.

The specification is based on evidence established by the bankruptcy prediction model of Gonzales Hermosillo for deposit taking institutions in the Caribbean.

While the basic model analyses only bank-specific variables as explanatory variables, this methodology explores an extended form analyzing the role that macroeconomic factors affecting all banks, can play in determining the soundness of an individual bank. It also analyses the role of banking sector variables in determining the probability of failure.

The model is structured in the form:

$$\text{INTERVENTION}_t = \beta_1 GDP_{t-1} + \beta_2 SIZ_{t-1} + \beta_3 OEXP_{t-1} + \beta_4 HOUS_{t-1} + \beta_5 TBR_{t-1} + \beta_6 ITBR_{t-1} + \beta_7 DEP_{t-1} + \beta_8 CONS_{t-1} + \beta_9 AGR_{t-1} + \beta_{10} BCB_{t-1} + \beta_{11} GBGT_{t-1} + \beta_{12} INFL_{t-1} + \beta 13 COV_{t-1}$$

The specification is based on evidence established by the bankruptcy prediction model of Gonzales-Hermosillo for deposit-taking institutions in the Caribbean. The methodology assumes that some characteristic specific to the firm and more generally to the banking sector and the economy indicate a risk of financial institution failure.
The major hypothesis to be explored in this study is to what extent bank institution fragility is related to those determinants.
This model allows for the possibility that the factors influencing the probability of failure may differ from those determining of the time of failure.
In the next section is exposed the statistical method used to predict bank fragility.

III.2 Statistical Method

The statistical method used to test the impact of firm specific, banking sector and macroeconomic indicators on the financial institution is the probit and logit models.

Qualitative response models are regression models in which dependant (or endogenous) variable take discrete values. Economists have to deal with such as models in which a single dependant variable takes more than two discrete values (multinomial models) or models that involves more than one discrete dependant variable (multi variate models), as well as considering a larger number of independent variables. In our context, we uses an univariate binary model.
An univariate binary QR model is defined by

$$P(y_i = 1) = F(x'_i \beta_0) \qquad I = 1,2,\ldots, n,$$

Where $\{y_i\}$ is a sequence of independent binary random variables taking the value 1 or 0, x_i is a K-vector of known constants, β_0 is a K-vector of unknown parameters to be estimated, and F is a certain known function.
The functional forms of F most frequently used in application are the following:

Linear Probability Model

$$F(x) = x$$

Probit Model

$$F(x) = \Phi(x) \equiv \int_{-\infty}^{x} (2\Pi)^{-1/2} \exp\left[-(t^2/2)\right] dt$$

Logit Model

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

The linear probability model has an obvious defect in that F for this model is not a proper distribution function as it is not constrained to lie between 0 and 1. This defect can be corrected if $F(x'_i\beta_0)>1$ and $F = 0$ if $F(x'_i\beta_0)$, but the procedure produces unrealistic kinks at truncation point. Indeed, econometrics textbook typically point out that if the dependant variable in an equation is a dichotomous dummy variable, and if an equation is estimated by OLS (Ordinary Least Square) in which this dependant variable is related linearly to an intercept term, a number of regressors, and a stochastic error term, then the resulting equation (often called linear probability model) suffers, from at least, as said above, two defects[6] :
- the fitted values are not confined in the zero-one interval thus their interpretation as probabilities is inappropriate
- the residuals from such an equation are heteroskedatic.

In this survey, INTERVENTION is such a dichotomous dependant variable.
When the dependant variable is dichotomous, one more appropriate estimation procedure is based on the assumption that the cumulative distribution of the stochastic disturbance is logistic. The resulting maximum likelihood estimator is usually called Logit.
We can also use another common estimation procedure based upon the assumption that the cumulative distribution of disturbance is normal. This is usually called Probit model.
Because of the very propinquity of the cumulative normal distribution to the logistic distribution, the logit and probit estimated models will be, in most cases, quite similar.
Thus, the probit and logit specifications are applied to analyze binary discreet qualitative variables. Indeed, two alternatives are possible. Suppose Yt is the dependant variable, in a probit or logit model, Yt is a dummy variable that is a variable which always take a value of zero or one. Yt is usually assigned the value of one if the event occurs or zero if not. In this survey, the dependant variable is the regulators' decision to intervene a bank. If the intervention occurs, the dependant variable can take the value of one or zero if not. The logit or probit model imposes the restriction that the probability always lies between zero using the functional form based upon the cumulative distribution function for a logistic random variable. $\Phi(.)$ is the standard cumulative normal distribution function so that $\Phi(z)$ is the probability that normally distributed random variable with zero mean and unit variance does not exceed z.
Both specifications model the probability of the event as depending on a linear combination of the observed variables, xi with weights given by the coefficient β. The task of the estimation is to find the best values for these coefficients.
Differentiating with respect to *j-th* explanatory variable x_{ij} yields

$$[\partial E(y_i|x_i)/\partial(x_i)] = [\exp(x_i\beta)/(1+\exp(x_i\beta))^2]\beta_j$$

for the logit model, and

$$[\partial E(y_i|x_i)]/\partial x_{ij} = \phi(x_i\beta)\beta_j$$

for the probit model. When weighted by the appropriate nonlinear factors, the β_j coefficient measure the change in the expected value (probability) in response to changes in x_{ij}. Positive values for β_j imply that increasing x_{ij} will increase the probability of the response; negative values imply the opposite.
In this study we will use logit model to test the probability of failure .

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[6]Ernst e. Berndt, The Practice of Econometrics, Classic and Contemporary, Addison-Wesley Publishing Company, U.S.A.,1991,702 p

III.3 Survival Basis

In this study a point must be highlighted. We must point out that the results may be biased. Indeed, in the paper we considered that the bank institution there has occurred two interventions. The first intervention was in October 1993 when the government intervened to prevent a failure of "Bank B". The second bank, "Bank F" is a case subject to discussion. As a matter of fact, "Bank F" has been intervened by the Central Bank in 1991: The Central Bank decided to sell (and sold) its assets. "Bank F" can be divided into two banks, that is "Bank F_1" and "Bank F_2".The assets of "Bank F_1" have been sold to "Bank F_2" by The Central Bank, but this intervention was due neither to the financial situation of "Bank F_1" nor to the financial and economic environment, but to the problems met by the head office. The activity of "Bank F_1" has been suspended and its assets sold to "Bank F_2" in 1993, year of settlement of "Bank F_2" in the financial place of Barbados. So a flat must be introduced in the interpretation of the results.

IV Results

We test the hypothesis with a logit probit model. Regression results are presented in the table 1 for the entire sample. Of the fourteen (14) variables eight (8) are significant.

In the case of Barbados, among the macroeconomic variables, the only significant variable is the Gross Domestic Product (GDP). This variable is negatively related to the probability of failure. As a matter of fact, it is expected that the macroeconomic environment affects the financial system. Therefore, economic recession conditions will increase the probability of failure. The results show that the GDP decreased constantly from 1992, Q until 1993, Q. An intervention has occurred in October 1993 until 1996 Q2. As we can see, 1994 Q1 is just 'except rise' for the decrease of the GDP restarted in 1994 Q2 until December 1995, that is 1995 Q4. The intervention ended in February 1996, thus, we can say that the real GDP is a factor explaining the probability of failure.

The higher the private deposit relative to total loan, the lower the probability of failure. Indeed, this ratio is a proxy of the deposit runs and the liquidity. An increase in the liquidity of the banks could only strengthen them, thus, the more liquid they are the more, the sounder they are, likewise, deposit runs occur before several financial crash. This points out the distrust of the depositors to the bank. If this bank is a large one the domino effect can occur and the overall system may suffer a deposit run which leads to the financial institutions failure, hence we can conclude that this result is reasonable.

Furthermore, it appears that the larger a bank is in terms of assets relative to the banking sector, the more able it is to survive than to fail. Consequently the sentence "To big to fail" is corroborated by the negative relation between the size ratio and the likelihood of failure. Nevertheless this result should be flattened, as a matter of fact, in the case of Barbados we only have one case of intervention. In numerous cases in the world, the large size did not prevent the bank from failing. For instance, in France The Credit Lyonnais, one of the largest banks in the country, has been intervened in order to hinder a 88 effect. In Colombia, where that country underwent significant problems with banks between 1982 and 1985, six (6) major banks have been intervened by the authorities. In St. Vincent and the Grenadines, the only domestic bank which is a state-owned bank accounts for thirty percent (30) of the deposits. About ten (10) percent of its assets are non performing. Since 1994 this country sustained significant problems . Guyana's major bank has also been intervened. All these banks have been intervened because they have been unable to diversify risk.

A choice has to be made between this indicator and the treasury bill rate. In fact when we take into account the only significant variables, one or both become insignificant depending on the variable that was first entered. If they are entered separately in two different models, they become significant. Based upon the various studies of determinants of credit, it has been carried out that the interest rate has insignificant effects on the demand for credit [Hinds, 1995] or long-term as well as short-term savings [Craigwell and Wood, 1993]. Thus the results chosen will be those including the only SIZ variable. Even though Barbados has sustained several checks for the last twenty five (25) years ending at a decrease in the GDP, growth rate, high inflation rate and a weak external balance. Therefore sustained growth, low inflation and high unemployment policies have been implemented

through a fixed exchange rate regime.

The relation linking the ratio or mortgage loan to total loan is negative, yet this ratio was expected to be positive. We can justify the relation by the fact that mortgages in a portfolio among the risky assets are the less risky.

Being given that operating expenses are a proxy of quality of management and being given the environment of innovation in which have evolved the banks since two (2) decades, we can assume that these expenses are due to the fact that Barbados banking system has followed the trend an increase in the operating expenses could be owed to "Process Innovation" with, for example the advent of telematics and vulgarization of the flea-card and the overall computer system.
So we can deduce that the negative relation is explained by costs of modernization of the system, which can only improve the quality of management. This cost may be operating expenses for the human resources and then due to the best qualification of the staff or to marketing management strategy.

CBB is negatively related to the probability of failure. Borrowing of the banking system from the central bank often entails some degree of official control over the bank's use of credit.

This point is subject to discussion. About the control of credit two (2) schools of thought set each other face against the doctrine of "Financial Repression" initiated by Mac Kinnon [1973] and Shaw [1973] for whom credit rationing implies some distortion in the financial institution. According to them, financial liberalization is a simple an effective means to increase the economic growth of developing countries. They extol the removal of credit control, postulating that it involves a reallocation of the resource away from the efficiency sector , and a recourse to the informal market to obtain the funds required to finance their investment. Rationing of credit and administration of interest rates
- reduce savings (decrease of deposits)
- Set the investment under its optimum value.
- Deteriorates investment quality because banks are forced by government to finance unproductive projects (agricultural production ...)
In this context, liberalization of the financial sector will stimulate accumulation of savings and thus allow increased investment. It should also allow banking intermediation inducing a curtailment of intermediation expenses thanks to economies of scale, a best diversification of risk and east access of borrowers to lendable funds.
In recent years, most developing countries have undergone a decline in the external financing thus inducing an increased role in the financial sector in the economic activity. That decrease in external source of funds got their investment rate reduced and their growth performance disappointing. It was the case in Barbados where the investment rate fell from twenty seven percent (27%) in the period of 1970 - 1979, to twenty two percent (22%) during the years 1980 - 1987 and the growth rate collapsed from 2 -3 % to less than one percent (1%). For the corresponding periods during the years 1980 - 1987, while the sinking fund payments on portfolio investments outreached inflows of direct foreign investment, net private foreign capital has been negative.
The financial market of Barbados enclosed the characteristics of a repressed one consisting of, among others, control on interest rate, selective credit control and direct lending but although in the financial liberalization theory real interest rates have significant impact on the level of savings, empirical works indicate a negative impact on savings [Craigwell and Wood, 1993] and that moreover real interest rates are not relevant determinant of savings [Wood, 1990; Ferreira, 1993].
Furthermore the market studies of Barbados is distinguished by its oligopolistic nature. Lessons can be learnt from the experience of Chile whose financial system was oligopolistic. The removal of financial repression suffered a real defeat.
The banking systems are based on credit (credits make deposits). However as said by Bagehot: A banking failure may mean that " instead of credit there is discredit". While the liabilities of banks are short term, their assets are longer term and have no ready market. Thus there exists an increased potential of failure and domino effects with the evolution of the financial system.
Stiglitz and Weiss (1981) have showed that there could exist a rationing of credit even on competitive credit markets. This implies that financial liberalization (removal of control) may be ineffective given the credit market imperfection. Credit Markets are not structurally ordinary markets as the exchanged goods are not contemporary goods but funds to which are attached promises of prospective returns. Therefore a default-risk exists which varies from one loan to another. This default risk variableness raises the problem of information and its collecting for the lender. If he cannot determine with precision the risk attached to each borrower or if he cannot perfectly behave in function of acquaintance of these risks, then the information imperfection may lead to anti-selection process. The banks may sanction all their debtors considering them as imperfectly safe because the bank would not have been able to perceive exactly the risk attached to each one.

LOGIT // Dependent Variable is INTERVENTION
Date: 06/16/97 Time: 10:20
Sample: 1 196
Included observations: 196
Convergence achieved after 10 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.97167	6.978675	3.148401	0.0019
GDP	-0.089999	0.031511	-2.856117	0.0048
OEXP	-321.0099	90.90246	-3.531367	0.0005
HOUS	-148.5616	68.52004	-2.168149	0.0314
SIZ	-5.767277	3.581682	-1.610214	0.1090
CBB	-0.009753	0.021338	-0.457067	0.6481

Log likelihood	-35.38462
Obs with Dep=1	16
Obs with Dep=0	180

Variable	Mean All	Mean D=1	Mean D=0
C	1.000000	1.000000	1.000000
GDP	210.8577	205.0248	211.3762
OEXP	0.011662	0.007572	0.012025
HOUS	0.050336	0.006612	0.054223
SIZ	0.146356	0.133190	0.147526
CBB	29.71739	29.73281	29.71602

INTERVENTION

Last updated: 05/22/97 - 08:34

1	0.000000	0.000000	0.000000	0.000000	0.000000
6	0.000000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000	0.000000
21	0.000000	0.000000	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000	0.000000	0.000000
31	0.000000	0.000000	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000	0.000000	0.000000
41	0.000000	0.000000	1.000000	1.000000	1.000000
46	1.000000	1.000000	1.000000	1.000000	1.000000
51	1.000000	0.000000	0.000000	0.000000	0.000000
56	0.000000	0.000000	0.000000	0.000000	0.000000
61	0.000000	0.000000	0.000000	0.000000	0.000000
66	0.000000	0.000000	0.000000	0.000000	0.000000
71	0.000000	0.000000	0.000000	0.000000	0.000000
76	0.000000	0.000000	0.000000	0.000000	0.000000
81	0.000000	0.000000	0.000000	0.000000	0.000000
86	0.000000	0.000000	0.000000	0.000000	0.000000
91	0.000000	0.000000	0.000000	0.000000	0.000000
96	0.000000	0.000000	0.000000	0.000000	0.000000
101	0.000000	0.000000	0.000000	0.000000	0.000000
106	0.000000	0.000000	0.000000	0.000000	0.000000
111	0.000000	0.000000	0.000000	0.000000	0.000000
116	0.000000	0.000000	0.000000	0.000000	0.000000
121	0.000000	0.000000	0.000000	0.000000	0.000000
126	0.000000	0.000000	0.000000	0.000000	0.000000
131	0.000000	0.000000	0.000000	0.000000	0.000000
136	0.000000	0.000000	0.000000	0.000000	0.000000
141	0.000000	0.000000	0.000000	0.000000	0.000000
146	1.000000	1.000000	1.000000	1.000000	1.000000
151	1.000000	1.000000	0.000000	0.000000	0.000000
156	0.000000	0.000000	0.000000	0.000000	0.000000
161	0.000000	0.000000	0.000000	0.000000	0.000000
166	0.000000	0.000000	0.000000	0.000000	0.000000
171	0.000000	0.000000	0.000000	0.000000	0.000000
176	0.000000	0.000000	0.000000	0.000000	0.000000
181	0.000000	0.000000	0.000000	0.000000	0.000000
186	0.000000	0.000000	0.000000	0.000000	0.000000
191	0.000000	0.000000	0.000000	0.000000	0.000000
196	0.000000				

V Conclusion and discussion

The paper argues that the degree of soundness of the bank is determined by bank specific variables, which are conditioned by micro prudential guideline applicable to banks, banking sector when the eventuality of systematic crisis exists and macroeconomic variables which define the macro prudential environment in which banks evolve. The maintenance of transparent, predictable and stable policies reduce the macro prudential risk while minimizing micro prudential risk is obtained through an appropriate legal framework and adequate banking supervision.

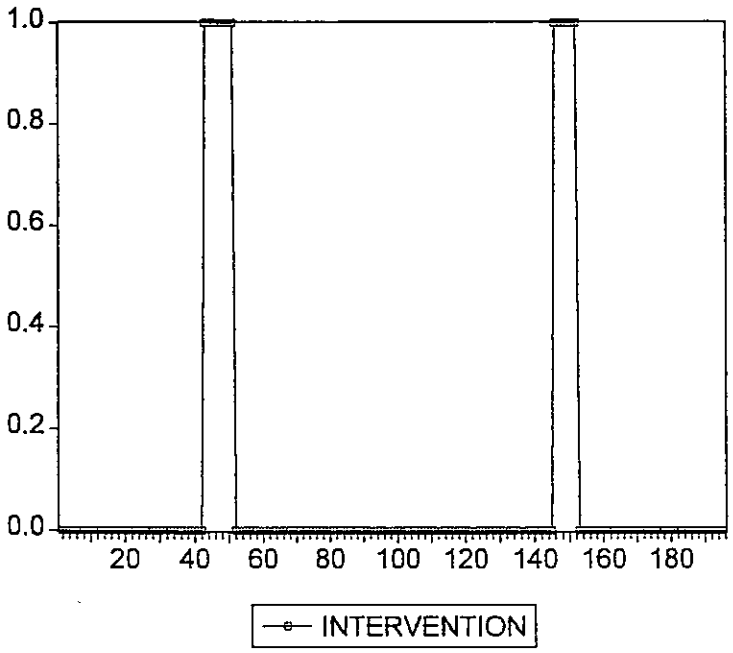
In this context of economic and financial globalization of technologic and financial innovation, the environment in which the economic agents operate and in our particular case, the financial ones, is riskier and riskier. The role of the monetary authorities, in this circumstance, the Central Bank is "to provide a regime in which the users of financial services can benefit from robust competition among financial firms". This can only happen if each individual firm takes on some risk. Now the Central Bank has to ensure the confidence of the public in the monetary system as a whole. This can be achieved in two ways. First, through supervision, trying to prevent a connection with financial regulators, the emergence of general financial pressures. The second way is by direct intervention of the Central Bank whenever such pressures do arise and try to restrain them, going so far as to act as the "Lender-of-last-resort". The prevention can take different forms which can complement each other.

Risk can be reduced through a structural shifts in the payment and settlement system. Improvement in the technology of the payment delivery system may greatly reduce the risk involuntarily taken by banks with each other in the payment system. The nature of the supervisory activity is to essentially reduce systematic risk and to pressure the stability of the financial system as a whole. Through setting and monitoring minimum standards for capital adequacy, liquidity and the concentration of risk, The Central Bank can ensure that banks have a cushion against developing pressures, which gives them time to respond.

The Central Bank can draw the attention to the individual banks to pressure and encourage them to prepare themselves for these pressures before they hit them, by strengthening their liquidity or scaling down their business to the level of liquidity likely to be available to them. However prophylactic supervision is sometimes inadequate. The role of the lender of last resort intervenes at this point. This does not mean that the Central has intervened in each and every failing bank because as for all economic activity, the contingency of failure is necessary for the efficiency of the financial system but the eventuality of an intervention has to be at least considered. Nevertheless the decision of intervention has to be unpredictable so that intervention is not expected as a matter of course.

In order to prevent an intervention, the regulator has to provide to the bank's supervisor indicators of fragility, early enough to enable them to respond to possible turbulence in the economic and financial system.

In this paper we have tested the probability of failure of the banking system and the factors affecting



the probability of failure. Nevertheless an extension to the study of the factors determining the timing of failure should be done for a more complete investigation and more pertinent results estimating the survival rate through survival analysis, revealing, in this way, information about the period leading to intervention, comprising an estimate of the probability that a given bank would survive long enough to operate in any period under study, the probability that it would fail after reaching that period and the expected time before a bank would fail. More precisely, what would be tested is the probability of failure during the next period, being given the duration of the survival state until time t. Survival times are data which assess the time to some events such as failure, death, response, the development of a certain disease, or divorce. These times are prone to random variations and they form a distribution which is generally characterized by three mathematically equivalent functions: the survival function, the probability density function and the hazard function. This can be studied in more details in a nearest investigation also including the other countries of the CARICOM.

Indeed, Barbados is not a country which has suffered major financial crisis, in contrast to Trinidad & Tobago and Jamaica which have undergone severe financial institution problems. Therefore the sample should be expanded to the other countries of the Caribbean for a best approach of the regulators in predicting the financial institutions fragility in the CARICOM.

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Correlation Matrix

	SIZ	OEXP	INTERVENTIO	GDP	FB	DEP
SIZ	1.000000	-0.176135	-0.049878	0.002505	-0.008593	-0.134368
OEXP	-0.176135	1.000000	-0.122711	-0.112387	-0.016420	-0.088386
NTERVENTIO	-0.049878	-0.122711	1.000000	-0.158042	0.043053	-0.048863
GDP	0.002505	-0.112387	-0.158042	1.000000	-0.197891	0.122537
FB	-0.008593	-0.016420	0.043053	-0.197891	1.000000	-0.001327
DEP	-0.134368	-0.088386	-0.048863	0.122537	-0.001327	1.000000
CBB	-0.004476	-0.020659	0.000314	-0.075235	-0.257080	-0.145174

	CBB
SIZ	-0.004476
OEXP	-0.020659
INTERVENTIO	0.000314
GDP	-0.075235
FB	-0.257080
DEP	-0.145174
CBB	1.000000

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OEXP

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1	0.007003	0.007484	0.007464	0.006186	0.006240
6	0.005574	0.007785	0.006286	0.007037	0.007547
11	0.007652	0.006510	0.006153	0.006335	0.007433
16	0.006443	0.005613	0.006937	0.006465	0.006226
21	0.005825	0.006564	0.007992	0.005954	0.005888
26	0.007246	0.008044	0.000000	0.007624	0.009295
31	0.009142	0.010588	0.008454	0.010803	0.011414
36	0.010122	0.008859	0.010426	0.010297	0.008153
41	0.008302	0.009890	0.001408	0.008995	0.009054
46	0.007647	0.020100	0.006970	0.010156	0.001954
51	0.011942	0.008605	0.008165	0.008526	0.004256
56	0.000000	0.017449	0.013944	0.018525	0.014159
61	0.016317	0.016670	0.018097	0.015591	0.017849
66	0.015976	0.017886	0.018189	0.014053	0.016574
71	0.021696	0.013118	0.019735	0.013203	0.017643
76	0.014316	0.013561	0.015070	0.018816	0.014131
81	0.016869	0.015456	0.017498	0.015449	0.012522
86	0.012550	0.011712	0.012244	0.011472	0.113686
91	0.012609	0.014258	0.013768	0.001407	0.013986
96	0.014716	0.014279	0.015508	0.015800	0.016164
101	0.016291	0.014209	0.015869	0.015559	0.014262
106	0.015188	0.017382	0.017895	0.015186	0.014673
111	0.014612	0.020670	0.010376	0.011897	0.009654
116	0.011327	0.010344	0.010759	0.010759	0.010368
121	0.010861	0.011946	0.011201	0.011018	0.011137
126	0.012696	0.030754	0.013941	0.013089	0.013211
131	0.017047	0.014717	0.013834	0.014947	0.012086
136	0.009121	0.013806	0.012066	0.022702	0.000000
141	0.005856	0.005857	0.006107	0.006095	0.006133
146	0.006133	0.006133	0.006133	0.006133	0.006133
151	0.006133	0.006133	0.004620	0.011791	0.013957
156	0.007329	0.008064	0.010539	0.007778	0.009426
161	0.009738	0.010876	0.012968	0.015600	0.001566
166	0.001689	0.001865	0.001290	0.008235	0.010540
171	0.011608	0.009107	0.007189	0.008692	0.014333
176	0.009818	0.009339	0.011323	0.017238	0.009292
181	0.008889	0.008548	0.017158	0.008626	0.008549
186	0.077212	0.019674	0.008551	0.014150	0.009411
191	- 0.006800	0.008152	0.006672	0.007606	0.005945
196	0.005945				

SIZ

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1	0.201968	0.207380	0.204749	0.205066	0.203511
6	0.225313	0.216675	0.223676	0.215825	0.216337
11	0.220183	0.215042	0.211164	0.209395	0.080773
16	0.219635	0.221991	0.256411	0.213840	0.212930
21	0.214114	0.218096	0.197645	0.198615	0.205206
26	0.199320	0.197721	0.186467	0.158906	0.157638
31	0.156884	0.155662	0.149962	0.162181	0.135200
36	0.135208	0.139731	0.138393	0.138245	0.156239
41	0.143272	0.155570	0.663731	0.133103	0.139129
46	0.178557	0.155148	0.147996	0.151199	0.155415
51	0.146525	0.145441	0.153576	0.146856	0.150187
56	0.135618	0.201968	0.207380	0.204749	0.205066
61	0.203511	0.225313	0.216675	0.223676	0.215825
66	0.216337	0.220183	0.215042	0.211164	0.209395
71	0.080773	0.219635	0.221991	0.256411	0.213840
76	0.212931	0.214114	0.218096	0.197645	0.198615
81	0.205206	0.199320	0.197721	0.186467	0.080302
86	0.080329	0.079458	0.078422	0.076212	0.008920
91	0.079338	0.076818	0.072691	0.066968	0.065913
96	0.063033	0.060077	0.056531	0.022304	0.058932
101	0.055322	0.063366	0.053627	0.050939	0.051515
106	0.051733	0.048914	0.047850	0.045778	0.047159
111	0.047737	0.043409	0.158210	0.155070	0.160044
116	0.154952	0.157831	0.185603	0.178667	0.177915
121	0.189646	0.194856	0.180809	0.181153	0.170051
126	0.154213	0.070148	0.149833	0.146984	0.164770
131	0.146423	0.148827	0.143466	0.151172	0.151005
136	0.173129	0.150056	0.167084	0.159128	0.165650
141	0.039461	0.038167	0.037112	0.035448	0.037177
146	0.037177	0.037177	0.037177	0.037177	0.037177
151	0.037177	0.037177	0.042643	0.043744	0.018079
156	0.047651	0.048008	0.060514	0.056871	0.053209
161	0.052877	0.051574	0.472780	0.046783	0.045624
166	0.052493	0.047601	0.047361	0.159184	0.154036
171	0.157005	0.165383	0.171794	0.192669	0.173444
176	0.162707	0.166282	0.167108	0.174668	0.169491
181	0.161630	0.171151	0.064194	0.171212	0.166576
186	0.019970	0.160251	0.173168	0.172715	0.153913
191	0.210989	0.189566	0.194554	0.187769	0.199904
196	0.235029				

HOUS

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1	1.073797	1.203892	1.121006	1.059039	0.114753
6	0.115195	0.108250	0.106967	0.110808	0.110504
11	0.111075	0.109816	0.107585	0.104559	0.097752
16	0.097413	0.097224	0.102227	0.102406	0.098314
21	0.091788	0.088508	0.143084	0.131457	0.082037
26	0.081023	0.122862	0.081795	0.004817	0.004328
31	0.003813	0.003970	0.003521	0.003335	0.003361
36	0.002704	0.002692	0.002734	0.002625	0.002482
41	0.002425	0.001848	0.001481	0.003955	0.002138
46	0.003381	0.003375	0.002962	0.007122	0.000703
51	0.005365	0.004869	0.004365	0.003670	0.002891
56	0.002665	0.000381	0.000384	0.000350	0.000326
61	0.000441	0.000262	0.000243	0.000242	0.000237
66	0.000228	0.000206	0.000206	0.000206	0.000206
71	0.000206	0.000206	0.000206	0.000206	0.000206
76	0.000206	0.000206	0.000206	0.000206	0.000206
81	0.000206	0.000206	0.000206	0.000206	0.074880
86	0.072708	0.067723	0.064327	0.061233	0.059481
91	0.059275	0.059125	0.057810	0.068303	0.070907
96	0.066383	0.066283	0.061588	0.057240	0.055850
101	0.052008	0.054455	0.050475	0.049017	0.045924
106	0.043859	0.045704	0.045656	0.047368	0.046328
111	0.040356	0.036884	0.018140	0.020022	0.020107
116	0.019401	0.019047	0.018981	0.019865	0.022606
121	0.023342	0.020344	0.021127	0.021736	0.021026
126	0.021469	0.021414	0.022295	0.021634	0.022482
131	0.020865	0.018080	0.018029	0.016284	0.014674
136	0.013954	0.014005	0.013535	0.011810	0.010758
141	0.010758	0.010758	0.010758	0.010758	0.010758
146	0.010758	0.010758	0.010758	0.010758	0.010758
151	0.010758	0.010758	0.010758	0.010758	0.007916
156	0.008076	0.018256	0.014013	0.012643	0.015623
161	0.019092	0.019376	0.022798	0.023828	0.026949
166	0.027990	0.021720	0.029335	0.011341	0.011338
171	0.011386	0.010960	0.010731	0.010245	0.010638
176	0.010464	0.010490	0.010552	0.010548	0.010269
181	0.010391	0.010104	0.009957	0.009198	0.009205
186	0.009134	0.008976	0.008712	0.008510	0.008664
191	0.007790	0.007321	0.007305	0.007235	0.006742
196	0.005781				

CBB

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1	35.88400	34.88100	40.87900	42.88900	45.56800
6	51.12300	52.84300	54.05600	52.09800	47.53400
11	43.77500	38.25100	33.46700	16.38800	20.93800
16	19.71400	17.13300	10.92600	10.51100	10.11400
21	16.86200	14.00600	15.84100	24.70400	18.90000
26	17.34300	16.75600	28.70300	35.88400	34.88100
31	40.87900	42.88900	45.56800	51.12300	52.84300
36	54.05600	52.09800	47.53400	43.77500	38.25100
41	33.46700	16.38800	20.93800	19.71400	17.13300
46	10.92600	10.51100	10.11400	16.86200	14.00600
51	15.84100	24.70400	18.90000	17.34300	16.75600
56	28.70300	35.88400	34.88100	40.87900	42.88900
61	45.56800	51.12300	52.84300	54.05600	52.09800
66	47.53400	43.77500	38.25100	33.46700	16.38800
71	20.93800	19.71400	17.13300	10.92600	10.51100
76	10.11400	16.86200	14.00600	15.84100	24.70400
81	18.90000	17.34300	16.75600	28.70300	35.88400
86	34.88100	40.87900	42.88900	45.56800	51.12300
91	52.84300	54.05600	52.09800	47.53400	43.77500
96	38.25100	33.46700	16.38800	20.93800	19.71400
101	17.13300	10.92600	10.51100	10.11400	16.86200
106	14.00600	15.84100	24.70400	18.90000	17.34300
111	16.75600	28.70300	35.88400	34.88100	40.87900
116	42.88900	45.56800	51.12300	52.84300	54.05600
121	52.09800	47.53400	43.77500	38.25100	33.46700
126	16.38800	20.93800	19.71400	17.13300	10.92600
131	10.51100	10.11400	16.86200	14.00600	15.84100
136	24.70400	18.90000	17.34300	16.75600	28.70300
141	35.88400	34.88100	40.87900	42.88900	45.56800
146	51.12300	52.84300	54.05600	52.09800	47.53400
151	43.77500	38.25100	33.46700	16.38800	20.93800
156	19.71400	17.13300	10.92600	10.51100	10.11400
161	16.86200	14.00600	15.84100	24.70400	18.90000
166	17.34300	16.75600	28.70300	35.88400	34.88100
171	40.87900	42.88900	45.56800	51.12300	52.84300
176	54.05600	52.09800	47.53400	43.77500	38.25100
181	33.46700	16.38800	20.93800	19.71400	17.13300
186	10.92600	10.51100	10.11400	16.86200	14.00600
191	15.84100	24.70400	18.90000	17.34300	16.75600
196	28.70300				

GDP

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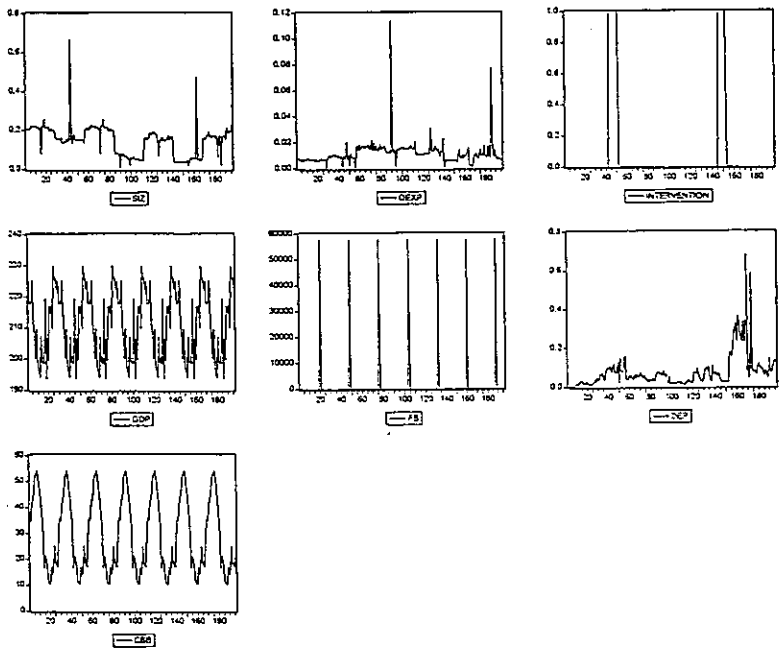
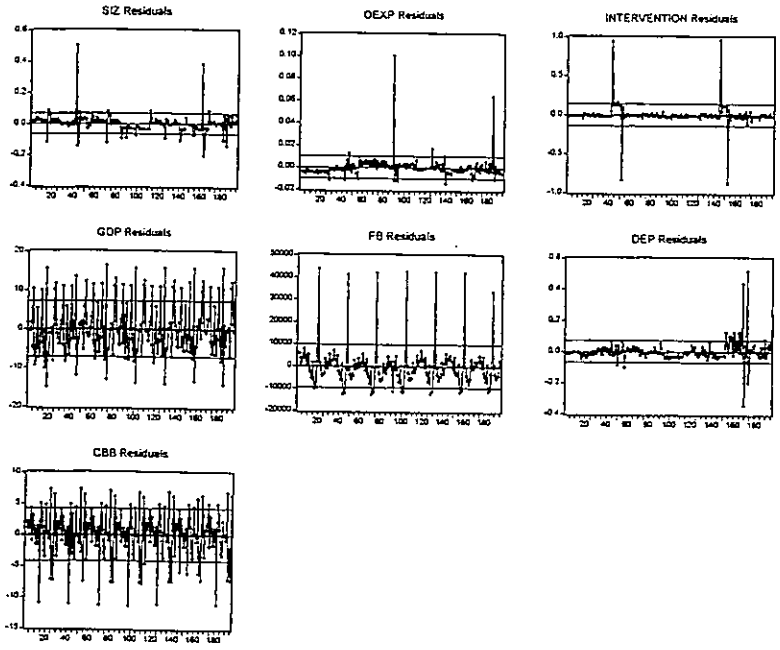
1	224.8855	217.8452	217.5454	218.4630	225.1838
6	211.5478	207.7916	200.0768	209.4988	197.4558
11	195.4857	194.0040	206.9942	199.1261	198.5288
16	198.3230	219.2528	193.5243	206.4944	199.5545
21	217.0659	214.6808	217.1119	209.8757	229.8000
26	225.7000	225.9000	222.3000	224.8855	217.8452
31	217.5454	218.4630	225.1838	211.5478	207.7916
36	200.0768	209.4988	197.4558	195.4857	194.0040
41	206.9942	199.1261	198.5288	198.3230	219.2528
46	193.5243	206.4944	199.5545	217.0659	214.6808
51	217.1119	209.8757	229.8000	225.7000	225.9000
56	222.3000	224.8855	217.8452	217.5454	218.4630
61	225.1838	211.5478	207.7916	200.0768	209.4988
66	197.4558	195.4857	194.0040	206.9942	199.1261
71	198.5288	198.3230	219.2528	193.5243	206.4944
76	199.5545	217.0659	214.6808	217.1119	209.8757
81	229.8000	225.7000	225.9000	222.3000	224.8855
86	217.8452	217.5454	218.4630	225.1838	211.5478
91	207.7916	200.0768	209.4988	197.4558	195.4857
96	194.0040	206.9942	199.1261	198.5288	198.3230
101	219.2528	193.5243	206.4944	199.5545	217.0659
106	214.6808	217.1119	209.8757	229.8000	225.7000
111	225.9000	222.3000	224.8855	217.8452	217.5454
116	218.4630	225.1838	211.5478	207.7916	200.0768
121	209.4988	197.4558	195.4857	194.0040	206.9942
126	199.1261	198.5288	198.3230	219.2528	193.5243
131	206.4944	199.5545	217.0659	214.6808	217.1119
136	209.8757	229.8000	225.7000	225.9000	222.3000
141	224.8855	217.8452	217.5454	218.4630	225.1838
146	211.5478	207.7916	200.0768	209.4988	197.4558
151	195.4857	194.0040	206.9942	199.1261	198.5288
156	198.3230	219.2528	193.5243	206.4944	199.5545
161	217.0659	214.6808	217.1119	209.8757	229.8000
166	225.7000	225.9000	222.3000	224.8855	217.8452
171	217.5454	218.4630	225.1838	211.5478	207.7916
176	200.0768	209.4988	197.4558	195.4857	194.0040
181	206.9942	199.1261	198.5288	198.3230	219.2528
186	193.5243	206.4944	199.5545	217.0659	214.6808
191	217.1119	209.8757	229.8000	225.7000	225.9000
196	222.3000				




SIZ Residuals
OEXP Residuals
INTERVENTION Residuals
GDP Residuals
FB Residuals
DEP Residuals
CBB Residuals

Vector Autoregression Estimates

CBB(-1)	-0.000473	-0.000149	-0.002727	0.279722	184.6272
	(0.00096)	(0.00015)	(0.00209)	(0.10599)	(141.598)
	(-0.49320)	(-1.00188)	(-1.30443)	(2.63909)	(1.30388)
CBB(-2)	0.000514	0.000154	0.003303	-0.471649	-432.3963
	(0.00101)	(0.00016)	(0.00221)	(0.11178)	(149.337)
	(0.50868)	(0.98659)	(1.49793)	(-4.21925)	(-2.89543)
C	0.026186	0.001674	-0.186210	77.82810	83530.12
	(0.12692)	(0.01964)	(0.27693)	(14.0389)	(18755.0)
	(0.20631)	(0.08521)	(-0.67241)	(5.54376)	(4.45375)
R-squared	0.368976	0.055287	0.753023	0.603219	0.258813
Adj. R-squared	0.319622	-0.018601	0.733706	0.572186	0.200843
Sum sq. resids	0.761631	0.018242	3.625730	9317.964	1.66E+10
S.E. equation	0.065230	0.010095	0.142322	7.214961	9638.711
Log likelihood	262.1212	624.1014	110.7674	-650.8420	-2047.135
Akaike AIC	-5.385512	-9.117266	-3.825163	4.026480	18.42125
Schwarz SC	-5.132842	-8.864596	-3.572494	4.279150	18.67392
Mean dependent	0.145755	0.011707	0.082474	210.7494	2162.738
S.D. dependent	0.079081	0.010002	0.275798	11.03079	10782.09

Determinant Residual Covariance	1.607850
Log Likelihood	-1293.984
Akaike Information Criteria	0.629537
Schwarz Criteria	0.882206

Forecast Evaluation

Actual: INTERVENTION Forecast: INTERVE
Sample: 8 196
Include observations: 147

Root Mean Squared Error	0.206160
Mean Absolute Error	0.088563
Mean Absolute Percentage Error	4.428162
Theil Inequality Coefficient	0.388714
Bias Proportion	0.000000
Variance Proportion	0.204710
Covariance Proportion	0.795290