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Exploring the Relationship between Real Estate Activity and Financial Markets: Evidence from Jamaica

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Abstract

This paper utilizes a structural vector a utoregression (VAR) along with a Logit and Probit framework to investigate the relationship between real estate activity and vulnerability in financial markets in the Jamaican economy. Descriptive analysis suggests that changes in the macroeconomic environment influenced volatility in real estate prices, which adversely impacted the health and stability of the financial system. This was collaborated by numerous country studies as well as the Jamaican experience. The relevance of real estate activity on the probability of financial distress was confirmed by the results of the Logit and Probit model. As such asymmetrical real estate price developments often contribute to financial sector distress. The results from the structural VAR indicate that shocks to real estate prices are consistent with a priori expectations. Shocks to real GDP and private sector credit invoke positive responses in real estate prices as increases in purchasing power and credit provision increases the effective demand for real estate. Additionally, given the close association between real estate and stock market activity, this should be closely monitored and factored into determining informed financial sector risk assessments.

JEL Classification Numbers: C52; E51; G11; E44; R2

Keywords: Financial Markets; Real Estate activity; Structural VAR; LOGIT; PROBIT

[1] The views expressed are those of the author and do not necessarily reflect those of the Bank of Jamaica

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1. Introduction

It has long been recognized that a myriad of market activities generating the business cycle are interrelated. As such, disturbances to market fundamentals in the given market, generates movement of capital into and out of the affected market, signaling varying levels of asset substitution. Recent literatures have attempted to examine the level of substitution between money and bond markets, real estate and other financial markets (Kiyotaki and Moore (1995)).[2] The findings imply that non-synchronized movements in the price of real estate are directly related to an unstable macroeconomic environment and can generate instability in the financial sector. Of equal significance however is the use of real estate as collateral. This use also implies that fluctuations in prices of real estate can lead to fluctuations in the value of an institutions' asset base through its loan portfolio, which can translate into financial sector instability.

This paper seeks to examine the effect of developments in real estate markets and its impact on financial markets in the Jamaican context. The paper is organized as follows: Section 2 presents an overview of the literature. Sections 3 and 4 outline the functioning of real estate markets and its implications for financial market activity. In Section 5 and 6, the methodology is discussed as well as the results of the empirical analysis. Section 7 provides concluding remarks and policy recommendations.

2. Literature Review

Various studies have been widely used in an effort to understand the impact of the real estate activity on financial markets. The role of banks and other financial institutions in the functioning of real estate markets has rested primarily on understanding the main determinants of real estate price mechanism, the causes of cycles and bubbles in the real estate market and the risk of over-exposure of financial institutions. DiPasquale and Wheaton (1996) published a model for analyzing real estate markets while Herring and

[2] See DiPasquale and Wheaton (1996)

Wachter (1999) discussed a number of theories on real estate cycles with a focus of banks and collateralized assets. In 1998, MIT professor P. Krugman developed a model specific to the Asian crisis. This model deals with the implications of moral hazard in the inherent risks of institutions overexposure to real estate activity. Kiyotaki and Moore(1995), Kennedy and Andersen(1994), Samiei and Schinasi(1994) and Icoviello (2000) worked on studies which estimated the effect of macroeconomic shocks on the real estate market and its impact on financial markets in the United States, the United Kingdom and Japan. This paper will also incorporate as evidence, a joint study done by Kaminsky and Reinhart (1999), Lindgren, Garcia and Saal (1996), Enoch and Green(1997) which found evidence in eleven (11) selected countries that a boom in the real estate cycle precedes an era of financial distress. These studies found that on average real estate prices corrected for inflation rose by more than 20 per cent from two to seven years before the beginning of financial distress and fell by more than 15 per cent prior to the beginning of financial distress. After the onset of the banking crisis, real estate prices often continued to fall at least until the peak of the crisis. This also suggests that financial sector distress may further exacerbate the fall in real estate prices.

3. Functioning of Real Estate Markets

3.1 Characteristics of Real Estate Markets

Throughout world economies, real estate markets share similar characteristics. Firstly, real estate markets are predominantly heterogeneous in both housing stock and market structure. A real estate market typically consists of a series of geographical and sectoral submarkets lacking a central trading market.

No two properties are identical and information concerning market transactions is available in limited amounts. Secondly, trading in real estate markets is infrequent, closing costs are large and the final price of the asset is based on negotiation. As a result, real estate markets possess no clear market price making an equilibrium price difficult to assess. This is in clear contrast to other financial markets for example stock markets where a clear trading price exists. Thirdly, real estate markets largely possess a rigid supply as the time lag between construction and effective demand for housing units. Finally, real estate markets distort business cycles where collateralized lending is prominent. The presence of a credit boom with widespread collateralized lending causes the value of loans extended which are collateralized by real estate fluctuate with the real estate market cycle.

3.2 Causes of Real Estate Bubbles

In many cases, boom and busts in real estate cycles originate from non financial peculiarities as well as the lending policies of the financial institutions. Some reasons however have to do with both external and internal macroeconomic developments. Work done by Carey (1990), argued that real estate cycles is largely influenced by a combination of a rigid supply of housing stock due to construction lags along with investors' speculative behavior. In the context of housing shortage due to a fixed supply, investors hold to a fundamental price above the market clearing price. At this fundamental price, instead of selling short as in other efficient markets, investors remain in the market hedging against inflation or using their assets as collateral for loans. This high price signal results in an increase in supply. The increase in supply causes the vacancy rates to increase precipitating a fall in house prices. Experiencing significant

financial distress, the investor will leave the house market resulting in a further decline in the price of housing. As a result, it is clear to see that the combination of these actions result in a more exaggerated fluctuation in the real estate cycle.

The second major cause of real estate bubbles has to do with the intermediation practices of institutions. Herring and Wachter (1999) outlined that a booming real estate market will attract financial institutions to re-adjust their portfolio towards investing in real estate. Also, loans collateralized by real estate will cause the value of their loan portfolio and subsequently, their asset base to increase. On the reverse side, over-exposure to real estate assets does however have debilitating effects to an institutions value of asset and liquidity position when the real estate market is in decline. In this situation, many institutions may experience difficulty disposing of assets without realizing capital losses. This translates negatively to the rest of the financial sector if this overexposure is large. Seminal work done by Renaud (1999), found that in many countries, liberalization and deregulation often precede the formation of new financial markets and institutions.

The plethora of institutions erodes the supernormal profits previously held by the existing market. As such, intense competition force institutions seeking higher yields to move to new categories of riskier real estate assets further exaggerating the boom in real estate prices. Conversely, a downturn in the real estate market would translate to recession in these financial markets. Researchers Kiyotaki and Moore (1995), found a link between boom and busts in real estate cycles and the used of real estate as loan collateral. Rising real estate prices raises the market value of loans collateralized by real estate. As the credit risk to lenders decline, the willingness to finance more real estate projects increases. A prevailing credit boom allows more resources to be available for

funding real estate projects. As a result, an increased demand will translate to higher real estate prices.

3.3 Implications of Real Estate Market Overexposure

Numerous studies suggest that the greater a financial institutions' exposure to real estate, the larger the oscillations in the real estate cycle. Despite this fact however, risk managers tend to underestimate the dangers associated with being overexposed to the real estate market. Hilbers and Zacho (2001) posited three main reasons for the high level of apathy to institutions portfolio risks associated with real estate market. Firstly, the inadequate data availability on real estate which is vital to monitoring risks associated with holding these asset types. Banks extending loans collateralized by real estate may leave their institutions' investment portfolio exposed to risks from the real estate market. Without the commensurate information which would facilitate a proactive response. Declining values of real estate assets below the value of the loans it is used to collaterize create an incentive for borrowers to default. This creates a high level of non-performing loans to total loans and subsequently liquidity problems for the institution.

Secondly, studies on the real estate market have found that changes in real estate cycle may outlive an entire generation. The low frequency in changes in the value of real estate may encourage institutions to overlook the probability of negative shocks and its implications for the value of the asset portfolio. Finally, the asymmetric information set along with a highly leveraged position lead institutions to choose to finance real estate projects through their liquid funds rather than equity. The situation

can become potentially catastrophic when developers attempt to shift their downside risk to banks. In this case, banks surrender their liquid position for the more imperfectly marketable real estate assets. Having more real estate assets on their balance sheet makes banks very vulnerable to liquidity problems in the eventuality of a decline in the real estate asset prices.

4.0 Impact of Real Estate Activity on Financial Markets: Descriptive Analysis

4.1 *Selected Country Experiences*

In many countries, a complete oscillation in the real estate cycle typically precedes a financial sector crisis. In this context, financial institutions' overexposure to real estate assets could translate to greater vulnerability as their portfolio becomes more exposed to shocks in the real estate market. This study seeks to highlight this by examining some examples from selected countries.

4.1.1 The Nordic Experience

Seminal work done by Jaffe (1994) and Kokko (1999) examined the Nordic Banking crisis of the 1980s. Both studies found that following deregulation and liberalization of the financial sector, a buoyant capital market developed. This buoyancy was facilitated by new types of less regulated non-bank financial institutions engaged in real estate lending. Further, banks attracted to the booming property market, extended credit to finance projects on the basis of collateral rather than cash flow evaluations.

The beginning of the worldwide economic recession of the 1990s resulted in a rise in both interest and vacancy rates. As a result, property prices began to fall causing real estate companies and by extension banks to experience significant liquidity problems. Consequently, this overexposure to real estate market precipitated a systemic financial crisis.

4.1.2 The Japanese Experience

Direct lending to the construction sub-sector represents another avenue of financial institutions' increased risk through overexposure to the real estate market. Researchers Nagashima (1997) and Kanaya and Woo (2000), posited that a major contributor to the financial crisis in Japan is explained in the excessive lending to the construction sub-sector. Between 1985 and 1991, construction loans as a proportion of total loans averaged 18 per cent per year. The slowdown of the Japanese economy in the early 1990s fueled a sharp contraction in the growth of credit. As a result real estate prices fell as institutions sought to relieve their liquidity problems. Concurrent with these developments was the rise in non-performing loans on financial institutions balance sheet. The large stock of construction loans meant a significant decline in the value of the institutions' loan portfolio significantly weakening the financial sector.

4.1.3 The Asian Experience

Several studies outline a variety of reasons for the south East Asian financial crisis of the 1990s. Chief among these include poor risk assessment and excessive lending particularly to real estate interests. Thailand and Malaysia in particular recorded

significant exposure to the real estate market. At the end of 1996, construction loans as a percentage of total loans for both countries averaged about 30 per cent[3].

The currency crisis in 1997 resulted in several problems for the financial sector. Firstly, liquidity problems resulted in several institutions being unable to honour their short term loans. This problem was exacerbated as institutions invested short term deposits in the long ended real estate market, As a result, the number of non-performing loans increased, setting the background for systemic financial instability.

TABLE 1
Length and Magnitude of Real Estate Price Falls

	PriceFall		Length of Bust Period		Lag from Peak to Distress+	
	Residential	**Commercial**	**Residential**	**Commercial**	**Residential**	**Commercial**
Canada	-21	-30	3	5	2	3
Finland	-47	-53	4	4	2	2
Ireland	-28	n.a.	7	n.a.	5	n.a.
Japan	-33	-72	8	8	2	2
Malaysia	-15	-5	2(ongoing)	1(ongoing)	2	1
Mexico(1)	-81	n.a.	6	n.a.	1	n.a.
Mexico(11)	-10	n.a.	1	n.a.	1.5	n.a.
Netherlands	-48	n.a.	7	n.a.	5	n.a.
Spain	-32	n.a.	4	n.a.	1	n.a.
Sweden	-26	-42	3	3	2	2
Thailand	-45	-69	6	8	4	6
Average	-35	-45	4.6	4.8	2.5	2.7

Source
Explanation: n.a. = not available
`+ Lag from peak of Real estae Prices to beginning of Financial Distress

A study conducted by Kaminsky and Reinhart (1999) et al, found that on average real estate prices corrected for inflation, rose by more than 20 per cent from two to seven years before the beginning of financial distress and fell by more than 15 per cent prior to the beginning of financial distress (see Table 1). Further, in most cases, real estate prices continued to fall at least until the peak of the respective crisis. As a result, several countries with significant participation of the financial sector in real

[3] See Miller and Luangaram (1998)

estate activity experience magnified negative shocks in both financial and real estate markets with a high degree of hysteresis.

It is important to note however that not all countries experience a financial crisis after a real estate boom and bust. Studies conducted by Hilbers (2001), found evidence that the Hong Kong SAR and Singapore were able to manage the implications of sharp booms and busts in their real estate markets. In both cases the soundness of their banking system along with a moratorium on land sales in the case of Hong Kong SAR was the contributing factor.

5. The Jamaican Experience 1990-2000

5.1 The Macroeconomic Context:

1990-1994: Economic Liberalization

The early 1990s saw the introduction of liberalization which included the removal of exchange controls. This resulted in the Jamaican economy experiencing episodes of exchange rate depreciation which translated into higher domestic price levels[4]. Consequently, this led to excess liquidity propelling the domestic price levels created the need for the Bank to employ tight liquidity management in an attempt to arrest inflationary pressures in the system. This approach was augmented by employing indirect market instruments, which was fostered through the development of the domestic money market.

The process of financial sector liberalization and deregulation at the start of the 1990s resulted in an easing of many barriers to entry for potential participants. As a result, a

[4] For April 1992, inflation reached a record high of 108.0 per cent

plethora of new institutions offering a wide array of investment options emerged. Alongside the development of fund managers, was the rise of other securities dealers whose portfolios consisted mainly of government securities which earned interest income from government paper. The portfolios of these type of institutions was also dominated by real estate assets aimed at taking advantage of the rapid appreciation of real estate and stock prices.

The bubble in both the real estate and the stock markets was further exacerbated by the lending boom of the early 1990s. This increase in credit was facilitated by the expansion in the money supply. In addition, the inflationary environment in this period represented the catalyst for growth in the banking sector. Additionally, the strong growth in the loan portfolio of these banking institutions was accommodated by the significant appreciation in property values.

1995-2000: Price Stability through Base Money Management

A policy shift in 1995 saw monetary policy assuming a more central role in the Jamaican economy. The monetary authority's objective of stable prices using operating targets of short term interest rates and controlling base money resulted in a slowing of the economy's growth rate. As a consequence, the contractionary monetary policy stance by the Bank led to a significant increase in interest rates and a resultant shift in investors' portfolio choice from an inflation linked assets to money market based instruments. Additionally, containment in inflation created liquidity problems, as financial institutions found it difficult to dispose of real estate without incurring capital losses. As a consequence, this weakened financial institution performance, evidenced by a strong growth in non-performing loans. Concurrently, this led to depressed stock market activity, given the disruptions to financial intermediation.

5.2 The Microeconomic context:

A descriptive analysis of Jamaican Secondary Money Market 1990-2000

Prior to the early 1990s however, the domestic money market remained underdeveloped. Apart from traditional deposits, the only form of alternate domestic investments was in

the form of mutual funds. Fund managers operating under the Unit Trust Act (1970) channeled investments into income and growth funds and capital growth funds, which primarily reflected real estate and equity investments.

Figure 1

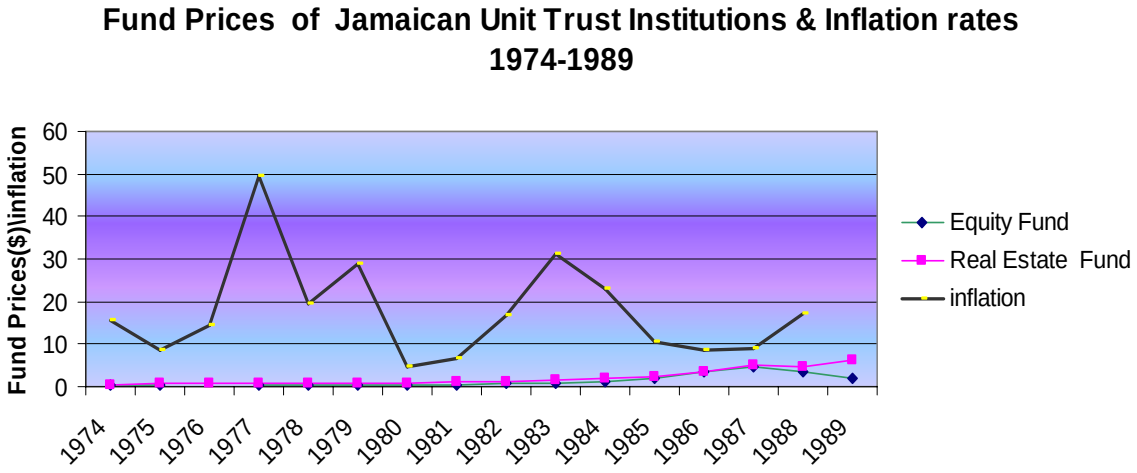
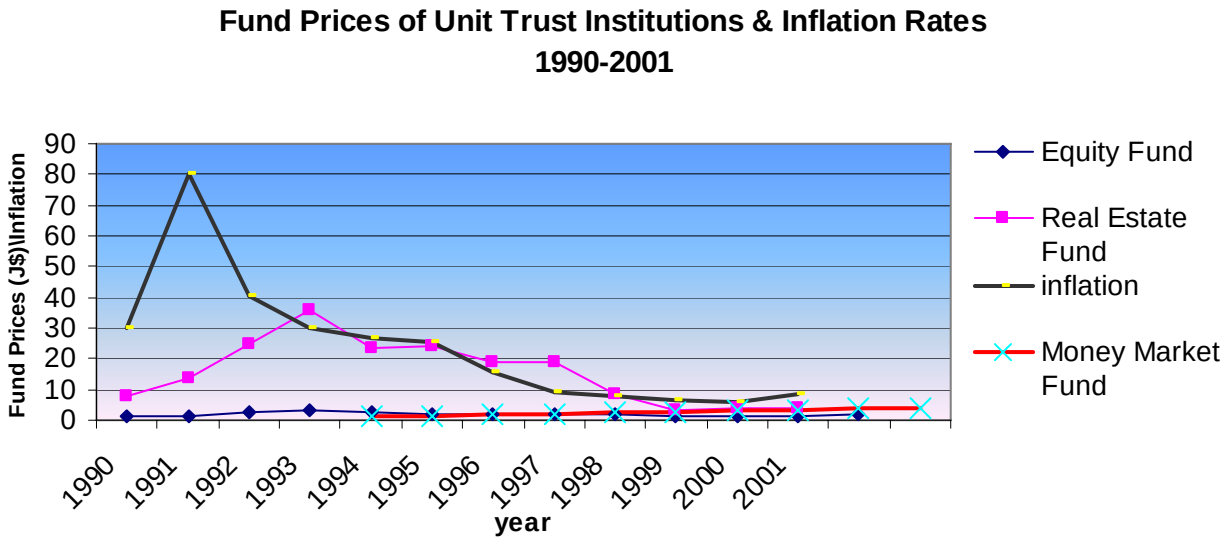


Figure 1 illustrates changes in fund prices of investment instruments offered by these collective unit trust investment institutions. [5] Between the 1970s to the mid 1990s, the only options offered to investors were the income and growth fund and the capital growth funds. These represented an equity fund and a real estate fund respectively. There was a minor acceleration in fund prices in the mid 1980s, consistent with the beginning of the structural reform process in the financial sector. However, there was much slower growth in fund prices subsequent to this period. This was largely due to the fact that investors were unfamiliar with these investment options.

[5] This calculation represents the institution's net asset values divided by the outstanding units.

Figure 2



The process of economic liberalization of the 1990s precipitated numerous structural changes in Jamaica's financial sector. Firstly, the high inflationary environment facilitated a rise in the price of real estate. As a consequence, investments in real estate and related assets increased as economic agents sought to protect the value of their investment portfolio. As such, the value of the real estate fund increased to approximately $39 million in 1993 relative to $9 million in 1990. However, the boom in the real estate market was short-lived.

At the end of 1994, investors readjusted their portfolios to primarily reflect money market investments, in a context of attractive returns on these instruments. As a result, the real estate fund prices slumped while fixed income (gilt-edged fund) became a viable alternative. Prior to this period, there was a boom in the real estate market, with a bust in market in the mid to late 1990s.

Figure 3

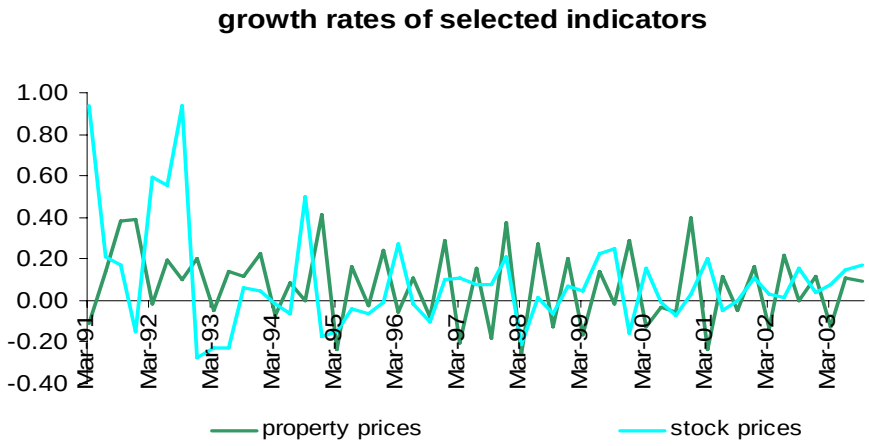
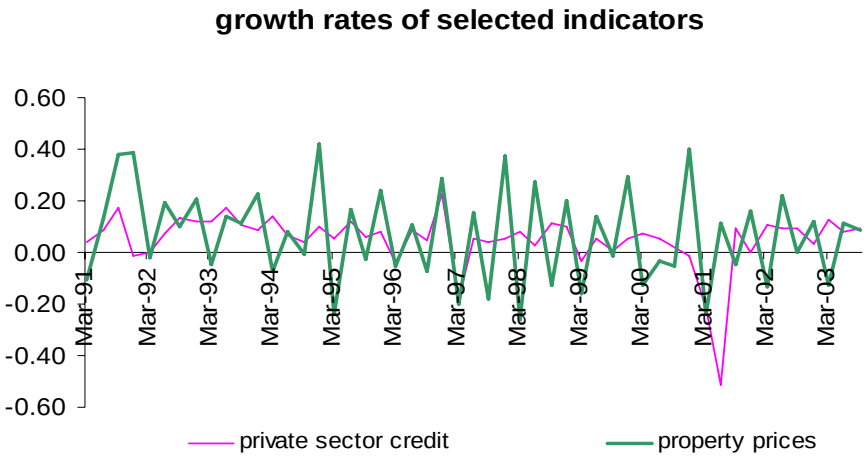


Figure 3 depicts the growth rates of property and stock market prices during the period March 1991 and March 2003. The strong positive correlation in the growth of property and stock prices suggests that buoyancy in the stock market augurs well for the property market performance. Further, a slump in the real estate market could dampen stock market performance. Additionally, Figure 4 shows that a boom in credit expansion is associated with a rise in real estate prices as the demand for increases.

Figure 4



6. Empirical Specification

6.1 DATA

The empirical analysis is conducted using a structural vector autoregression (VAR) model and a Logit framework**.** The Logit-Probit framework is used to examine whether real estate activity is influential in precipitating financial distress, while the VAR framework is used to capture the impact of real estate market activity on the financial market behaviour. Both framework employ real GDP, private sector credit, property price, stock price and interest rate data, where equity prices and equivalent 180-day Treasury bill yields are used indicators of stock and bond market behaviour, respectively.[6]

The formula for equivalent yield is specified as follows:

$$\frac{\text{actual days in year}}{360}\left(\frac{\text{discount yield}}{1-\left(\frac{\text{days to maturity}}{360}\right)\text{discount yield}}\right)$$

The analysis utilizes quarterly data and covers the period March 1991 to December 2003, in order to provide a reasonable sample size for the investigation. Difficulty in obtaining a series for property prices greater than annual data was tackled by using the proportional

[6] The 180-day Treasury bill rate is the signal rate for monetary policy.

Denton Least squares benching technique (see Equation 1). This allowed interpolation of the annual data series by using a related series with strong correlation to extract quarterly real estate data series.

$$(X_1.....,\overset{MIN}{X}_{4\beta},.....X_T)\sum\left[\frac{X_t}{I_t}-\frac{X_{t-1}}{I_{t-1}}\right]^2 \qquad (1)$$

$\sum_{t=4y-3}^{4y} X_t = A_y$ i.e. the sum of the quarters should equal to the annual data for each year.

In order to include an indicator for vulnerability to financial sector, this study employs Kibritcioglu (2002) bank fragility index, where high, medium and low fragility are specified [7] This index is employed in the Logit model as a dependent variable.

6.2 Methodology

6.2.1 LOGIT-PROBIT BINARY MODEL

The probit –logit approach is a binary regression model, and is use to explore the role of property price movements in precipitating financial market distress. Logit and Probit models are used to model a relationship between a dependent variable Y and one or more independent variables X. The dependent variable in this case would be the occurrence of bank fragility while real GDP, stock prices, 180-day Treasury bill rate (T-bill) and property prices as explanatory variables.

[7] See appendix 2

In the simple probit-logit model, the likelihood function of a sample of T observations is

$$l = \prod_{t=1}^{T} F\left(x_i^1 B\right)^{Y1} \left[1 - F\left(X_t^1 B\right)\right]^{(1-Y_t)} \qquad (1)$$

Where $F(.)$ is either the standard normal or logistic cumulative density function for a probit or logit model, respectively. The dependent variable y_t or B is a dummy variable measuring financial sector stress[8]. In the explanatory variables set $x_t^{'}$ includes GDP, Property Prices Private Sector Credit, equity prices and180-day T-bill rates. Taking advantage of the symmetry of both standard normal and logistic distribution functions, we can simplify the log-sample likelihood function as,

$$\ln l = \sum_t \ln f(q_t x_t^{'} \beta), \qquad (2)$$

where $q_t = 2y_t - 1$ and $f(.)$ is the probability density function of either the standard normal or logistic distribution. Our objective here is to maximize the sample log-likelihood and find out the estimators for the coefficient vector β .

6.2.2 Structural VAR Framework

The second proposed methodology is a Structural VAR which represents the reduced form of a linear dynamic simultaneous equation model in which all variables are treated as endogenous. This framework is employed to study the joint behaviour of property prices, realgdp, T-bill rates, private sector credit and equity prices. Each variable is regressed on a number of lags of itself and of all other variables in the information set.

[8] See appendix 2 for the calculation of banking system fragility index used in this study. Kibritgoclu(2002)

6.2.3 Structural VAR Set Up

Based on Bernanke and Sims (1986) the structural VAR (p) model takes the following form:

$$X_t = \delta_0 + \delta_1 X_{t-1} + ...\delta_p X_{t-p} + U_t \qquad (1)$$

Where $X_t = (X_{1,t}....., X_{k,t})'$ is a vector of 5 x 1 endogenous variables δ_1 and δ_2 are k x k parameter matrices. While δ_0 is a k vector of intercept parameters, the vector U_t includes innovations or surprise movements in the variables. The vector U_t is assumed to be normally distributed with expectation equal zero and variance the matrix Σ. The vector X_t includes the endogenous variables; real GDP, private Sector Credit, equity Prices and T-bill rates.

In order to add the structural innovations, equation 1 is modified as follows;

$$B.X_t = a_0 + A_1 X_{t-1} + ... + A_p X_{t-p} + e_{t'} \qquad (1a)$$

where e_t is independently and identically distributed. $N_k[0, I_k]$. The matrix B represents the contemporaneous relations between the components of X_t.

$$B.X_t = a_0 + A_1 X_{t-1} + ... + A_p X_{t-p} + e_{t'}$$

$$X_t = B^{-1}a_0 + B^{-1}A_1 X_{t-1} + ... + B^{-1}A_p X_{t-p} + B^{-1}e_{t'} \qquad (2)$$

Hence $\delta_0 = B^{-1}a_0, \delta_j = B^{-1}A_j$ for $j = 1.....p$ and $U_t = B^{-1}e_t$ [9] referred to as $B.U_t = e_t$

Therefore effectively, the matrix B of structural parameters links the nonstructural innovations of U_t to the structural innovations of e_t.The main difference with the non-structural approach is the way the variance matrix $\sum$ of U_t is decomposed ,i.e., instead of writing $U_t = \Delta e_t$ with Δ a lower triangular matrix we now have $U_t = B^{-1}e_t$, hence

$\sum = (B^{-1})(B^{-1})' = (B'B)^{-1}$ thus $B'B = \sum^{-1}$

Enders (1995) outlined that the aim of structural VAR is to use economic theory (rather than Choleski decomposition) to recover the structural innovations from the residuals.

Justification of Ordering

The ordering shown below is based on a priori expectations and indicates that Real GDP impacts all other variables within the same quarter, but does not respond contemporaneously to innovations in any of the other variables. The interest rate is ordered last because policymakers may react quickly to all innovations but it usually takes a while for policy to become effective.

GDP ⟶ **Private Sector credit** ⟶ **property prices**

↓

Equity prices ⟶ **interest rates**

[9] $\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = [1/(1 - b_{12}b_{21})]\sum_{i=0}^{\infty}\begin{pmatrix} 1 & -b_{12} \\ -b_{21} & .1 \end{pmatrix}\begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$ see Enders(1995)

These assumptions are fairly standard in the existing literature. Finally, the ordering of private sector credit, property prices and equity prices is based on the fact that while bank credit or financing conditions may affect property prices contemporaneously and equity prices can respond immediately to shocks in other variables (2003).

The next step is to provide some quantitative estimates of the dynamic interaction among the variables of interest. To do this we orthogonalised the estimated reduced form model to identify the effect of the innovations of the variables in the system. The identification procedure is based Sims' lower triangular ordering or the standard Choleski Decomposition.

Based on the identifying assumptions embodied in the specified ordering of the variables, the key outputs of the VAR model are the variance decomposition and impulse responses. The variance decomposition is able to break down the variance of the forecast error for each variable into components that can be attributed to each of the endogenous variables. In addition, the impulse response functions are computed and the results show the interrelationship between any two of the variables of interest.

7. Estimation Results

7.1 Findings of the Probit -Logit Model

The probit-logit exercise was conducted for Jamaica during the period 1991 to 2003. The estimation results for both logit and probit models are shown below (see Table 1).

Real estate price data was used in the absence of a real estate price index for Jamaica.

Table 1: Estimation Results using Logit/Probit Models

	Coefficients					
	C	*GDP*	*PROPPRIC*	*PSC*	*STOCK*	*TBILL*
LOGIT	*0.600632*	*6.81312*	*2.533718***	*`-2.032201**	*-0.782911*	*0.021901*
	`(0.455191)	*`(0.500948)*	*`(2.237727)*	*`(-2.462243)*	*`(-1.029093)*	*`(0.445375)*
PROBIT	*0.29880*	*6.072002*	*1.362325***	*`-1.065284**	*-0.449495*	*0.012742*
	`(0.449601)	*`(0.765534)*	`(2.324350)	`(-2.686966)	`(-1.015859)	`(0.516541)

*Notes: Numbers within Parentheses are z-statistics.Significance levels of 1% and 5% are denoted by *.,** respectively*

Table 1 shows that there is a positive sign for PROPRIC (property prices), reflecting that a downturn in the property market will increase the probability for financial sector stress. Secondly, we observe that the signs for PSC (which variable is this?) were negative and significant. This implies that a decline in the provision of credit increases the probability for financial stress. A contraction in credit implies a slowing of the economy and subsequently acts as an indicator for economic recession, and dampens the health of the financial sector. Given financial institutions' overexposure to the real estate market, recessionary pressures that translate into a downturn in property prices, could result in a systemic negative shock to the financial sector.

7.2 Findings from the Structural VAR model

7.2.1 VAR Stationarity Tests

The variables used in the model were first tested for stationarity using both Augmented Dickey Fuller and the Phillips Peron unit root tests.

Table 2

	Phillips -Peron Unit Root Test		Augmented Dickey -Fuller Test	
Variable	LEVEL	1st diff	LEVEL	1st diff
LREALGDP	-3.09		-3.36	
LPSC	-2.12	-3.89	-2.07	-5.54
LPROP	-4.51		-4.12	
LEQUITY	-1.55	-5.03	-2.80	-6.79
INTRTE	-3.59		-2.80	

From the table above, all variables except LPSC and LEQUITY were stationary at levels. This problem was corrected by first differencing the non—stationary variables.

7.2.2 VAR lag order Selection Criteria

The lag order of the VAR was selected based on several information criteria. As such, an optimal lag length of 1 was determined. Studies done by Ivanov and Kilian (2005) argued that for quarterly VAR models, the Hannan-Quin information criterion is best for sample sizes greater than 120. For sample sizes less than 120, the Schwartz criterion is more accurate. As a result, the Schwartz criterion was used to determine lag length (see Table

3. The robustness of the model was examined by testing the stability of the model.[10] The results in Appendix 1 indicate that all the inverse roots lie within the unit circle implying that the model is stable.

Table 3

Var Lag Order Selection Criteria

Endogenous Variables: TBIL LPROPERTYPRICES LPRIVATECREDITCH LREALGDP LSTOCKPRICES

Exogenous variables :C
Date: 02/07/06 Time :15:20
Sample 1991Q1 2003Q4
Included Observations :47

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-79.1190	NA	2.47E-05	3.57953	3.776354	3.653596
1	32.35021	194.4781	6.29E-07	-0.100009	1.080936*	0.344389
2	78.18287	70.21173	2.68E-07	-0.986505	1.178561	-0.171776
3	103.7513	33.72852	2.88E-07	-1.010692	2.138495	0.174368
4	150.365	51.57266*	1.40E-07	`-1.930426*	2.202882	`-0.375035*

* indicates lag order selected by the criterion
LR: sequential modified
FPE: Final Prediction error
AIC:Akaike Criterion
SC:Schwartz criterion
HQ : Hannan-Quinn information criterion

7.3 Generalized Impulse Response Analysis

7.3.3 Real estate response to Selected Variables

The figure below plots the impulse responses of property prices (LPROPPRIC) with respect to a one standard deviation increase in real GDP (*LREALGDP), private sector credit (LPRIVATECREDITCH), stock prices (LSTOCKPRICES) and T-bill rates (TBILL*) over a horizon of 24 months. The VAR coefficients and standard errors from the model

[10] The VAR stability condition check suggests that the model satisfies the stability condition. (see Appendix 1)

are calculated by the Monte Carlo method with 1000 repetitions (of $\pm$ 2 standard deviations.

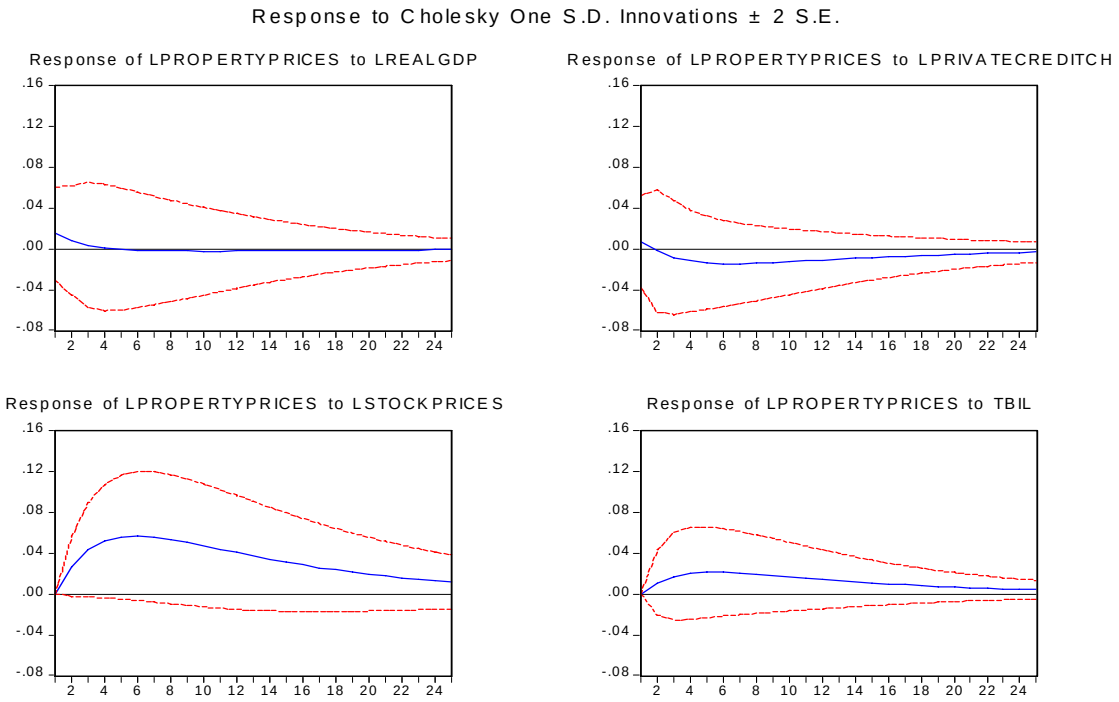
The positive response of property prices to a shock to real GDP in the first two months is due to increases in real purchasing power, which increased the effective demand for property. This effect, is short lived however, as demand-pull inflation quickly erodes the increase in purchasing power.

The impulse response also suggests that shocks in private sector credit results in an initial increase in real estate prices. This initial impact is consistent with a priori expectations that shocks to private sector credit results in an increase in the ability to purchase real estate. Against the background of a shortage in supply for real estate, there is upward pressure on property prices. As such, there is an initial increase in real estate prices within the first two months.

Throughout the forecast horizon, real estate prices reflected a consistent increase in response to shocks in the stock market. This occurrence typifies the reinforcing effect of the stock market on real estate investments. Increase investor confidence and buoyant stock market activity translate into increased holdings of real estate.

In the Jamaican context, the Treasury bill rate is market determined, and is influenced by the monetary policy directives of the regulatory authorities.

Concisely, once Treasury bill rates increases, this triggers increases in lending rates and the cost of borrowing. This increases the cost of acquiring real estate, thereby driving up property prices. This result is displayed in the positive response of real estate prices to shocks to Treasury bill rates over the forecast horizon.



8.0 Response of Variables to Shock in Real estate prices

The figure below shows the response of the respective variables to a one unit shock in real estate prices over a 24 month period. With the exception of stock prices, the results suggest that shocks to property prices have a negative impact on all other variables over the forecast horizon. Despite the initial negative impact, stock prices reflected a consistent increase from month 3 with the impulse persisting beyond the forecast horizon. One possible explanation rests in the fact that an increase in the value of real estate results in a requisite rise in the value of the asset base of institutions with significant real

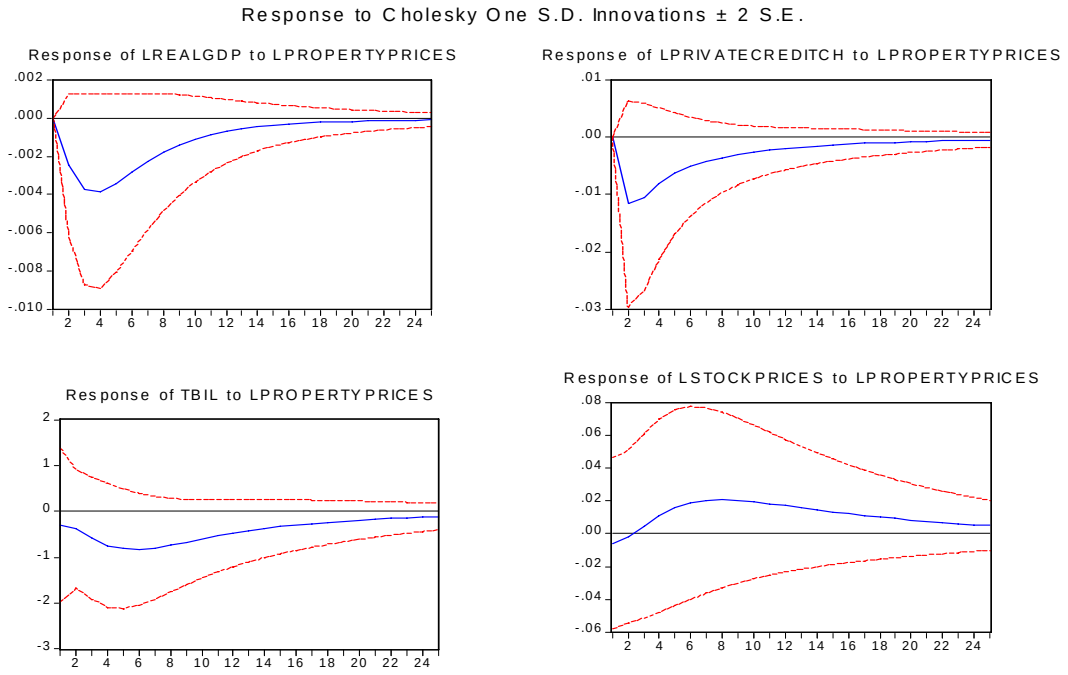
estate holdings. This result is consistent with both findings of the descriptive analysis of the Jamaican experience and the findings from various country studies.

Secondly, the results suggest a negative response of real GDP to a one-unit shock in property prices. Over the forecast horizon, a one-unit shock in property prices saw real GDP declining consistently in the first six months with near full recovery occurring in month 20. This result concurs with numerous studies, which illustrate that increases in real estate prices are inflationary, as such investors experience a decline in purchasing power as indicated by the reduction in real GDP.

Thirdly, similar to the results in real GDP, the impulse response suggests that shocks in real estate prices results in an initial decline in private sector credit. This initial impact is consistent with a priori expectations that shocks to real estate prices results in decline in credit extended. One possible explanation rest in the fact being a luxury good, the price elasticity of demand for housing solutions is high. As such, any increase in house prices results in demand shrinking. A reduction in demand for housing solutions translates into a reduced demand for credit to finance acquisitions. This results in a decline in the demand for private sector credit.

A one-unit shock to property prices however has a negative impact on Treasury bill rates throughout the forecast horizon. This is mainly as a result of portfolio switching, as investors substitute real estate investments for investments in the money market.

Consequently, this results in a fall in the price of the money market instruments as investors switch resources into real estate.



8.1 Variance Decomposition.

The results from the variance decomposition indicate that each selected variable accounts for the largest proportion of the error in forecasting its own variation. Over a twenty – four month horizon, property prices contributes to 82.4 per cent of its own variation while accounting for 14.3 per cent of the variation in stock prices. This result lends support to the enforcing relationship between the stock and property markets observed in most countries.

The decomposition of the Treasury bill rate reveals that it accounts for 54.9 per cent of its own variation while accounting for 21.9 and 15.8 per cent of the variation in real GDP

and the stock market index respectively. This result is consistent with a priori expectations of the impact of policy directives on key macroeconomic variables in the economy. Concisely, a deviation in the Treasury bill rate is a critical factor in influencing deviations in both real sector and the stock market.

Percentage of Variance of LREALGDP Explained by

Months	S.E.	LREALGDP	LPSCCH	LPROPPRICES	LSTOCK	INTRTE
6	0.0356	84.4230	4.3145	4.2689	5.7331	1.2607
12	0.3589	83.0760	4.2499	5.1908	6.1318	1.3520
24	0.3591	82.9860	4.2465	5.2577	6.1556	1.3545

Percentage of Variance of LPSCCH Explained by

Months	S.E.	LREALGDP	LPSCCH	LPROPPRICES	LSTOCK	INTRTE
6	0.13699	1.53874	94.49851	1.99786	0.45456	1.51034
12	0.13735	1.53776	94.01885	2.82243	0.64663	1.51452
24	0.13753	1.53445	93.78689	2.34525	0.80412	1.52930

Percentage of Variance of LPROPPRICESExplained by

Months	S.E.	LREALGDP	LPSCCH	LPROPPRICES	LSTOCK	INTRTE
6	0.2851	0.3890	0.8020	82.4443	14.2574	2.1120
12	0.3266	0.3188	1.5441	70.4271	24.3545	3.3555
24	0.3432	0.3088	1.8516	65.8095	28.2390	3.7911

Percentage of Variance of LSTOCKPRICES Explained by

Months	S.E.	LREALGDP	LPSCCH	LPROPPRICES	LSTOCK	INTRTE
6	0.3472	1.3866	3.6676	0.6579	91.4723	2.8156
12	0.3777	1.2904	4.0788	2.1341	88.9475	3.5492
24	0.3874	1.2424	4.1352	2.9251	87.9296	3.7677

Percentage of Variance of INTRTE Explained by

Months	S.E.	LREALGDP	LPSCCH	LPROPPRICES	LSTOCK	INTRTE
6	9.0736	21.9269	4.4264	3.0011	15.7918	54.8538
12	9.4557	20.6578	4.7204	5.5288	18.4364	50.6566
24	9.6211	19.9666	4.7278	6.2102	19.9286	49.1668

9.0 Conclusions and Policy Recommendations

The paper explored the relationship between activity in the real estate market and the behaviour of financial markets in the Jamaican economy. The findings confirm that the probability of financial system fragility is influenced by property prices primarily due to institutions direct and indirect overexposure to real estate market. Secondly, the stock market, lending to the private sector and real GDP impulses all contribute to a positive shock in property prices consistent with both a priori expectations and the findings in other countries.

The credit channel represents one primary avenue which links the financial sector to other sectors in the economy. Bank lending represents the primary source of funding for real estate. As such, the significant decline in property values was responsible for the deterioration of the financial sectors asset quality. The positive relationship between property prices and bank credit is also confirmed by empirical evidence based on the structural VAR analysis. The empirical evidence is also consistent with studies done by Hofmann (2001) and Zhu (2004) which suggests a positive long-run relationship between bank credit and property prices.

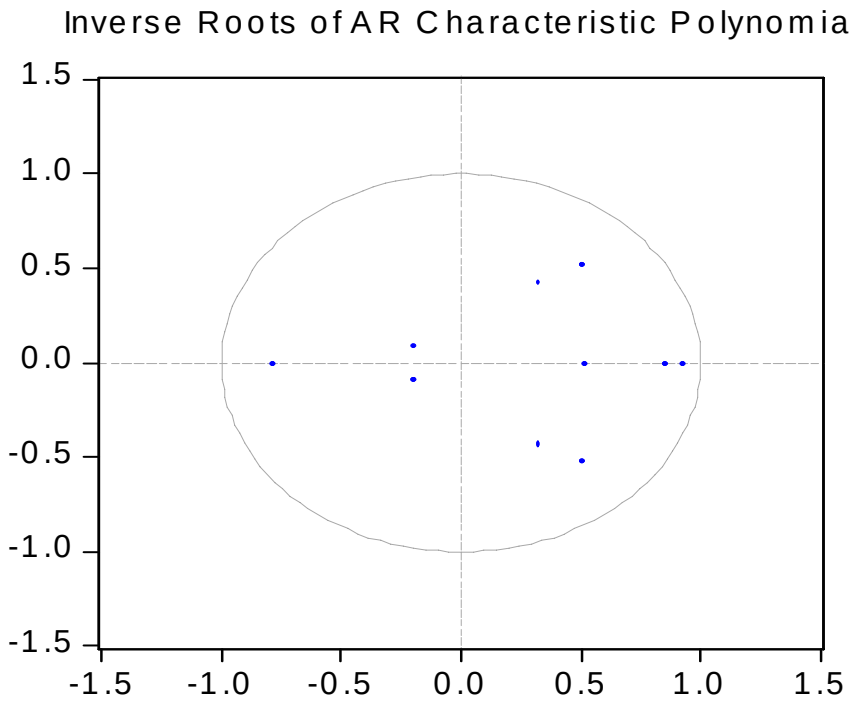
The recommended policy mix based on the empirical analysis is that financial system risk management should incorporate the impact of different monetary policy scenarios. Firstly, with regards to financial stability, policymakers need to monitor closely banks'

credit risk exposure. This process involves adapting a capital adequacy framework aimed at improving the measurement of the credit risk exposure of banks. [11]

Since 1996, the Jamaican monetary authorities have been targeting base money so as to achieve low inflation. Inflation-induced property prices and its link with aggregate demand suggest that the monetary authorities will gain an advantage from monitoring the developments in property markets. Based on the empirical analysis, the sources and nature of property price fluctuations were identified in order to understand their implications for price stability and the general economy. This will be critical in formulating appropriate policy responses. Additionally, the development of a real estate price index would assist the relevant authorities in monitoring developments in the real estate market.

[11] The revision of the Basle Committee on banking supervision (BCBS) is aimed at improving the measurement of Banks' credit exposure.

APPENDIX 1



APPENDIX 2

Banking System fragility indicator (Kibritcioglu (2002)

This study employs the banking system fragility indicator made popular by Kibritcioglu (2002). Against the background of the Logit-Probit framework, banking sector fragility (BSF) index was constructed as a signal for banking system fragility. The study includes bank deposits, credit to the private sector and foreign liabilities, where fluctuations in any of these indicators represented changes in the fragility of the banking sector.

BSF SET UP

$$BSF_t = \frac{1}{3}\left[\left(\frac{CPS_t - \mu_{CPS}}{\sigma_{CPS}}\right) + \left(\frac{FL_t - \mu_{FL}}{\sigma_{FL}}\right) + \left(\frac{DEP_t - \mu_{DEP}}{\sigma_{DEP}}\right)\right] \qquad (1)$$

Where

$$DEP_t = \left(\frac{LDEP_t - LDEP_{t-12}}{LDEP_{t-12}}\right) \qquad \text{(i)}$$

$$CPS_t = \left(\frac{LCPS_t - LCPS_{t-12}}{LCPS_{t-12}}\right) \qquad \text{(ii)}$$

$$FL_t = \left(\frac{LFL_t - LFL_{t-12}}{LFL_{t-12}}\right) \qquad \text{(iii)}$$

Based on equation 1 above the BSF index is defined as an average of the standardized values of *CPS, FL and DEP* , where μ and σ represent the arithmetic average and standard deviation of the three variables, respectively. The variables *DEP, CPS* and *FL* represent total real deposits, private sector credit and foreign liabilities respectively. To avoid seasonality this paper employs the 12-month percentage changes in monthly data.

BANK FRAGILITY INDEX

SERIES_CODE	34326C..ZF...		34324...ZF...	34325...ZF...	34322D..ZF...			
	FOREIGN LIABILITIES		TOTAL DEPOSITS		PRIVATE SECTOR CREDIT			
	Z -VALUE	**FLIAB**	**Z -VALUE**	**TDEPOSITS**	**Z -VALUE**	**PSC**	INDEX	**HIGH FRAGILITY INDEX >-0.5** **zrealprices**
WEIGHTS		**0.80**		**0.10**		**0.10**	**1.00**	
Mar-91	-1.51	-1.21	-1.08	-0.11	0.28	0.03	**-1.29**	0
Jun-91	-1.09	-0.87	-1.80	-0.18	-0.27	-0.03	**-1.08**	0
Sep-91	0.82	0.65	-2.16	-0.22	-0.43	-0.04	**0.39**	1
Dec-91	0.71	0.57	-2.31	-0.23	-0.68	-0.07	**0.27**	1
Mar-92	-0.46	-0.37	-2.24	-0.22	-1.21	-0.12	**-0.71**	0
Jun-92	-0.68	-0.55	-1.99	-0.20	-1.44	-0.14	**-0.89**	0
Sep-92	-0.59	-0.47	-1.53	-0.15	-1.39	-0.14	**-0.76**	0
Dec-92	0.30	0.24	-1.02	-0.10	-1.13	-0.11	**0.02**	1
Mar-93	0.58	0.46	-0.96	-0.10	-0.89	-0.09	**0.28**	1
Jun-93	1.05	0.84	-0.58	-0.06	-0.67	-0.07	**0.72**	1
Sep-93	0.79	0.64	-0.98	-0.10	-0.53	-0.05	**0.49**	1
Dec-93	0.55	0.44	-0.78	-0.08	-0.46	-0.05	**0.32**	1
Mar-94	0.37	0.30	-0.51	-0.05	-0.44	-0.04	**0.20**	1
Jun-94	1.27	1.02	-0.46	-0.05	-0.21	-0.02	**0.95**	1
Sep-94	1.48	1.18	-0.35	-0.04	-0.22	-0.02	**1.12**	1
Dec-94	2.10	1.68	-0.11	-0.01	-0.17	-0.02	**1.65**	1
Mar-95	1.79	1.43	0.02	0.00	0.07	0.01	**1.44**	1
Jun-95	1.81	1.45	0.12	0.01	0.14	0.01	**1.47**	1
Sep-95	1.03	0.83	0.39	0.04	0.34	0.03	**0.90**	1
Dec-95	0.93	0.74	0.21	0.02	0.19	0.02	**0.79**	1
Mar-96	0.31	0.25	-0.37	-0.04	0.19	0.02	**0.23**	1
Jun-96	0.48	0.39	-0.64	-0.06	-0.08	-0.01	**0.31**	1
Sep-96	0.16	0.13	-0.40	-0.04	0.13	0.01	**0.10**	1
Dec-96	0.10	0.08	-0.10	-0.01	0.24	0.02	**0.10**	1
Mar-97	0.28	0.22	0.04	0.00	1.07	0.11	**0.33**	1
Jun-97	0.00	0.00	0.10	0.01	0.14	0.01	**0.02**	1
Sep-97	0.07	0.05	-0.01	0.00	0.19	0.02	**0.07**	1
Dec-97	-0.07	-0.06	0.13	0.01	0.29	0.03	**-0.01**	1
Mar-98	-0.16	-0.13	-0.02	0.00	0.44	0.04	**-0.08**	1
Jun-98	-0.32	-0.26	0.05	0.01	0.65	0.06	**-0.19**	1
Sep-98	-0.58	-0.47	0.09	0.01	0.66	0.07	**-0.39**	1
Dec-98	-0.74	-0.59	0.11	0.01	1.13	0.11	**-0.47**	1
Mar-99	-0.73	-0.58	0.19	0.02	1.64	0.16	**-0.40**	1
Jun-99	-1.03	-0.82	0.32	0.03	1.35	0.13	**-0.65**	0
Sep-99	-1.40	-1.12	0.63	0.06	1.49	0.15	**-0.91**	0
Dec-99	-1.25	-1.00	0.29	0.03	1.42	0.14	**-0.83**	0
Mar-00	-1.53	-1.22	0.76	0.08	1.63	0.16	**-0.98**	0
Jun-00	-1.62	-1.30	0.73	0.07	1.91	0.19	**-1.03**	0
Sep-00	-1.80	-1.44	0.64	0.06	2.04	0.20	**-1.17**	0
Dec-00	-1.67	-1.34	0.90	0.09	2.18	0.22	**-1.03**	0
Mar-01	-1.55	-1.24	0.98	0.10	2.00	0.20	**-0.94**	0
Jun-01	-1.65	-1.32	0.84	0.08	0.62	0.06	**-1.18**	0
Sep-01	-0.69	-0.55	1.22	0.12	-1.70	-0.17	**-0.60**	0
Dec-01	-0.18	-0.15	0.91	0.09	-1.54	-0.15	**-0.21**	1
Mar-02	0.29	0.23	0.96	0.10	-1.55	-0.16	**0.17**	1
Jun-02	0.37	0.29	1.05	0.10	-1.35	-0.13	**0.26**	1
Sep-02	-0.09	-0.07	1.31	0.13	-1.19	-0.12	**-0.06**	1
Dec-02	-0.27	-0.22	1.28	0.13	-1.00	-0.10	**-0.19**	1
Mar-03	0.73	0.58	1.36	0.14	-0.90	-0.09	**0.63**	1
Jun-03	0.83	0.66	1.06	0.11	-0.72	-0.07	**0.70**	1
Sep-03	1.01	0.80	1.01	0.10	-0.62	-0.06	**0.84**	1
Dec-03	0.71	0.57	1.00	0.10	-0.44	-0.04	**0.63**	1
Mar-04	0.93	0.75	1.29	0.13	-0.28	-0.03	**0.85**	1
Jun-04	1.44	1.15	1.22	0.12	-0.25	-0.02	**1.25**	1
Sep-04	1.88	1.51	1.30	0.13	-0.22	-0.02	**1.61**	1

APPENDIX 3

CORRELATION MATRIX

	LREALGDP	*LPRIVATECREDIT*	*LPROPERTYPRICES*	*LSTOCKPRICES*	*TBIL*
LREALGDP	*1.00*	*-0.27*	*-0.12*	*0.00*	*0.40*
LPRIVATECREDIT		*1.00*	*0.91*	*0.69*	*-0.48*
LPROPERTYPRICES			*1.00*	*0.84*	*-0.45*
LSTOCKPRICES				*1.00*	*-0.50*
TBIL					*1.00*

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