

***Stock and Bond Market Indices in the
CARICOM sub-region
Construction and Use***

**Cécile Pemberton
Patrick Kent Watson**

*Sir Arthur Lewis Institute of Social & Economic Studies
&
Economic Measurement Unit*

University of the West Indies

St. Augustine
Trinidad & Tobago

Tel: (868) 662-6965

Fax: (868) 645-6329

Corresponding E-mail: patrick.watson@sta.uwi.edu

The authors of this paper gratefully acknowledge the generous financial and other material assistance given to them by the Caribbean Money Market Brokers (CMMB) of Trinidad & Tobago. They also acknowledge the invaluable research assistance provided by Kevin Deopersad. The usual caveat about responsibility for errors applies.

June 2004

ABSTRACT

Stock and Bond Market Indices in the CARICOM sub-region: construction and use

Cecile Pemberton and Patrick Watson

If the embryonic financial markets of CARICOM are destined to play a major role in the development of the individual economies as well as the region as a whole within the framework of the CSME, then a minimum informational requirement is the existence of appropriate CARICOM wide and, by implication, national stock and bond market indices. The main purpose of this paper is the construction of CARICOM-wide stock and bond market indices, including stock indices for important sub sectors, based on data obtained from Barbados, Jamaica and Trinidad & Tobago. This in turn will require the construction (we should really say reconstruction) of the individual country indices. These indices will be used to evaluate and compare rates of return and risk on the various portfolios implied by the indices as well as to make a preliminary analysis of the efficiency of the markets.

1. Introduction

Notwithstanding the absence of formally “harmonized” markets in the CARICOM sub region, there is considerable evidence of trading in securities across frontiers of the CARICOM member states. This trend is likely to become more pronounced in the future if only because of the decision to create in the very near future a CARICOM Single Market and Economy (CSME), as well as the decision of some CARICOM member states to join the FTAA process. The question arises, in such a context, as to the need for indices of stock and bond market activity that are wider in scope than the national indices that now exist, and which will be better guides to portfolio choice and management among investors. The main purpose of this paper is the construction of CARICOM-wide stock and bond market indices, including stock indices for important sub sectors, based on data obtained from Barbados, Jamaica and Trinidad & Tobago. This in turn will require the construction (we should really say reconstruction) of the individual country indices. The various indices will be used to evaluate and compare rates of return and risk on the various portfolios implied by the indices as well as to make a preliminary analysis of the efficiency of the markets.

This paper is not of interest only to the handful of investors that now dominate the CARICOM markets. Indeed, research is showing more and more that overall growth and development in any country or region are related to, and to a large extent caused by, the development of financial, including capital, markets. See Classens (1995) and Demirgüç-Kunt and Levine (1996). The mere existence of these markets, however, is neither a necessary nor sufficient condition for such growth and development. Indeed, some have opined, notably Stiglitz (1991), that they contribute little to economic efficiency and may even be welfare-decreasing. If we are to avoid this, we must at least have in place the basic informational requirements. A CARICOM wide index is one step in the right direction.

The prospect of the birth of the FTAA in 2005 as well as the possible entry of CARICOM member states into this grouping renders such an exercise all the more useful. After all, the fellow traveller of the FTAA is economic liberalization and, with liberalization, stock and bond markets will have to play an even greater role given that privatization and, more generally, a greater involvement of the private sector will imply a large demand for equity and non equity finance. The wherewithal for the evaluation of

CARICOM-wide portfolios must exist for this to be feasible.

Within the CARICOM sub region, it may be still too soon to say whether the emerging capital markets have made any such contribution, and it is certainly not the intention of this paper to do so in any great detail although we will use the constructed indices to do a preliminary analysis of the efficiency of the stock and bond markets. Formal stock exchanges do exist and the oldest has been in existence for close to four decades now. They are, however, still quite underdeveloped and remain quite passive compared to those of the developed countries. See Sergeant (1995) for a study of the Trinidad & Tobago Stock Exchange and Kitchen (1986) and Jackson (1986) for studies of the Jamaican Stock Exchange. The story is even less encouraging in the case of the market for bonds, which has remained quite informal and is still largely in its embryonic stages (some may opine that for all intents and purposes it is non-existent). Whatever the potential of the stock and bond markets in the Caribbean for growth and development, it could be realized only if the markets are more than just “institutions”. If the embryonic financial markets of CARICOM are destined to play a major role in the development of the individual economies as well as the region as a whole within the framework of the proposed CARICOM Single Market and Economy (CSME), then the wider market for stocks and for bonds in the Caribbean must cease being a mystery to most people in the Caribbean region.

The rest of the paper is made up as follows: in the following section, we discuss the structure and functioning of Stock Markets in the CARICOM sub region. We then turn our attention, in section 3, to the structure and functioning of bond markets in the CARICOM region. In section 4, we attempt to construct (in some cases, reconstruct) stock and bond indices for three CARICOM countries and we use these to determine CARICOM-wide indices. This exercise required substantial revision of existing country stock price indices, either to correct for current errors in their construction or to ensure compatibility across the indices. We also construct CARICOM wide sector indices based on the same principles. In section 5, we analyse the Stock market activity in the CARICOM sub region over the period covered by the indices and, in particular, discuss on the basis of these indices the efficiency of the various markets as well as the relative gains of holding the “CARICOM” portfolio rather than the individual national portfolios as represented by the national stock indices. In section 6, we carry out a similar analysis of the bond market. Section 7 contains some recommendations for the way forward and, in section 8, we conclude the paper.

2. Structure and functioning of Stock Markets in the CARICOM sub region

The Jamaica Stock Exchange (JSE), the oldest of Exchanges in the CARICOM region, came into being in 1968. The Trinidad & Tobago Stock Exchange (TTSE) followed in 1981 and the Barbados Stock Exchange (BSE) in 1987. The newest kid on the block is the Eastern Caribbean Stock Exchange (ECSE) which was established in 2001. Three other known exchanges, the Guyana Stock Exchange, the Bahamas Exchange and the Belize Stock Exchange, will not be considered in this paper.

Stock markets in the Caribbean are small and characterized by few market players. See Sergeant (1995) and Kitchen (1986). Trading of stocks takes place on formal exchanges located in each of the countries, with the notable exception of the Eastern Caribbean, which hosts the Western Hemisphere's first regional exchange in St Kitts. The exchanges are privately owned and run by boards consisting mainly of brokers and corporate players and, in some cases, of government or Central Bank representatives. The JSE is the only stock market amongst the four that conducts continuous electronic trading. The other markets essentially employ auction-type call market trading with variations in the level of automation. However, clearings are done electronically across the board by central depositories. In fact, the ECSE has dematerialised its record-keeping altogether, so that even stock certificates have been replaced by electronic records. The failure to harmonize the CARICOM markets is often blamed on the manual trading system still employed in all the markets save Jamaica.

The markets are hybrids of what are typically labelled broker and dealer markets. Brokers tend to act in two capacities, both to execute trade orders, and to trade based on their own inventory. Yet, none of the exchanges allow short sales which is a key component of dealer trades in more sophisticated markets, especially in the trading of derivatives. Further, on all the exchanges in question trades must take place through registered brokers and these are few in each market. Jamaica has the highest tally with a mere ten (10) brokers. The reason for this seems intuitive – the size of the market, both on the supply and demand side, simply does not warrant higher numbers.

Actual trading is quite limited in that it is only on the JSE and the ECSE that trading is conducted on all five (5) weekdays. On the BSE and TTSE, trades are allowed on

Tuesdays, Wednesdays and Fridays. However, with the introduction of electronic trading it is anticipated that this will change and all exchanges will be open for business on the five weekdays. The volume of trading is most heavy on the TTSE and the JSE. The BSE regularly experiences low volumes of trade, as does the ECSE which currently only has (6) listed securities. It should also be noted that the BSE, JSE, and TTSE explicitly restrict price movements of shares, while the ECSE also reserves the right to stop trades that may adversely affect the market.

Availability of information is fairly good, considering the actual structures of the markets. Information on past prices and volumes is available from the respective exchanges for at least the past 5 years. Current bid data is available from the JSE only, and in that case, only at the exchange's public gallery or to subscribers to their online service. The system of trade on the other exchanges does not lend to an automatic posting of prices while trades are being negotiated. These prices are only posted after trading is complete.

3. Structure and functioning of Bond Markets in the CARICOM sub region

Bond markets in the Caribbean are even less active than stock markets. Few bonds are listed on exchanges. In fact sales usually take place over the counter (this is not an unusual feature of bond markets the world over). Trading is almost non-existent and, as such, listed prices are unavailable as practically all bonds are bought and held until maturity. In the case of the JSE, a few corporate bonds are listed. It is a very illiquid market where traders generally buy and hold sovereign debt (Treasury bills and notes as well as government bonds). There is also some trading in Eurobonds (the most liquid of the bonds traded) and Investment Debentures. Most bonds are plain vanilla coupon bonds, but some have variable coupons while others still are indexed. As far as trading goes, a secondary market for bonds exists in the form of an Over-the-Counter market. The major players on this market are broker/dealers and include JMMB, D.B & G, Maybury and Pan Caribbean Financial.

In the case of Trinidad & Tobago, bonds are not currently traded on the TTSE. Government bonds and Treasury notes are issued in the primary market by the Central Bank while there is some secondary trading of Government bonds and Treasury notes, as well as some Corporate bonds by the CMMB. In fact the latter appears to be the only

bond broker in Trinidad & Tobago. Most bond holders in Trinidad & Tobago are institutional investors like insurance companies.

Some bonds are listed on the BSE. These include Corporate bonds, Government bonds and Treasury Bills. The BSE in fact acts as a primary market for Treasury Bills. Bonds are hardly traded: they are generally bought and held to maturity.

There is very little evidence of trade in Corporate bonds in the OECS countries and precious little trading activity in Treasury Bills and Government bonds. Once again they are generally held to maturity once purchased.

4. The Construction of Stock and Bond Indices for the CARICOM region

There are some compelling reasons for the construction of CARICOM-wide stock and bond indices, which could be the precursor to the construction of similar indices covering the wider Caribbean region. In the first place, the activity covered in the individual markets is way too limited and may even account for the disinterest of the wider public in these markets. A larger playing field is a minimum requirement for ending this state of affairs. This has long been recognized and the notion of harmonized stock exchange has been already mooted. If a harmonized exchange should come into existence, then a harmonized stock index would be a minimal requirement for its proper functioning (although the existence of a harmonized exchange is by no means a necessary condition for the existence of such an index). Another compelling reason is the proposed CSME, a fundamental tenet of which is the free movement of labour and capital. This would necessarily have to cater for activity from all over the region, in any part of the region, in much the same way as an investor in California can do trades on the New York Stock Exchange.

4.1 National Composite and Sector Stock Price Indices

The composite and sector stock indices for Barbados, Jamaica and Trinidad & Tobago¹, were calculated using the following basic formula applied to daily trading data from

¹ There is insufficient participation by companies in Barbados to allow for the calculation of meaningful sector indices but they are calculated nevertheless.

January 2, 1998 to December 31 2003:

$$SPI_{j,t} = \frac{\sum_{i=1}^n (p_{j,it} * q_{j,it})}{C_{j,t} * \sum_{i=1}^n (p_{j,i0} * q_{j,i0})} * 100$$

where:

- $SPI_{j,t}$ = Stock price index of country j;
- n = number of stocks in market or sector;
- $p_{j,i0}$ = price of stock i at base date on exchange j;
- $q_{j,i0}$ = number of shares of company i at base date on exchange j;
- $C_{j,t}$ = adjustment factor for base date market/sector capitalization for exchange j;
- t = time period.

The index is calculated using both local and US dollar values (for prices and for the market/sector capitalization adjustment factor), the latter to allow for easier comparison across markets as well as for construction of the CARICOM composite market and sector indices.

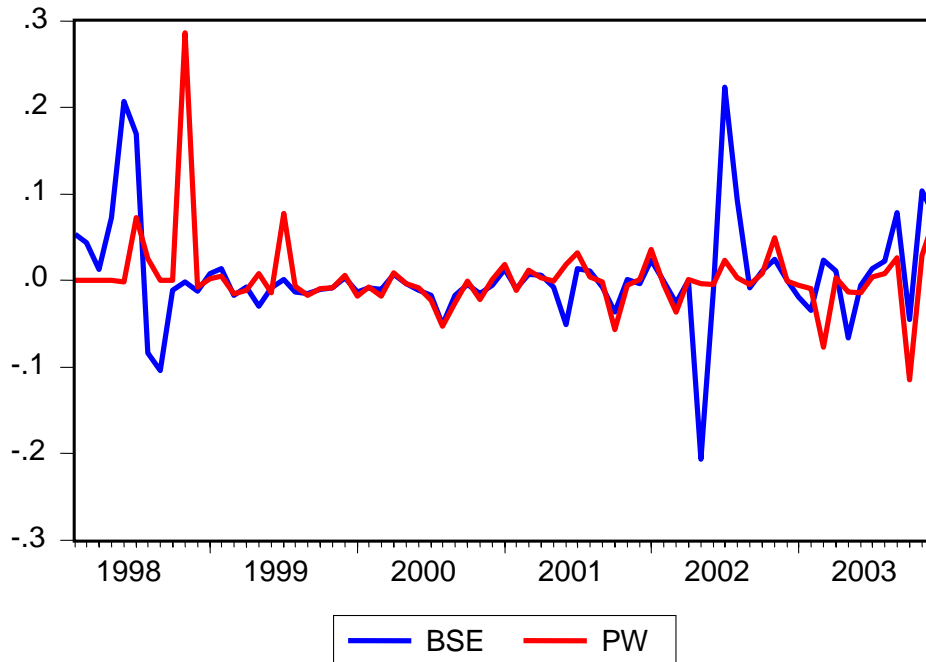
This type of index is widely used by Stock Exchanges the world over. The formula used is a fairly classic Laspeyres price index. Each Stock Exchange (the BSE, JSE and the TTSE) does, of course, calculate for each national jurisdiction a composite index similar to this one using local currency, but we had to re-do this exercise to ensure consistency across the three indices (including having the US dollar based index) and, in some cases, to correct for errors in computation.

The index is based solely on ordinary first tier shares, which is the standard practice for composite index calculation on major exchanges, and the prices are the last traded price. The weights are updated quarterly, while adjustments are made for additions, deletions, mergers and takeovers at the end of the relevant trading day, as they happen. Cross-listed stocks are treated as if listed only on the domestic exchange. Indeed, one of the reasons for recalculating the individual indices was to avoid a potential double counting problem. To determine W_j from the formula above, total market capitalization for each exchange is converted to US dollars. These weights are also updated quarterly.

It is extremely important to emphasize, however obvious it may be, that changes in the indices calculated in this section DO NOT measure total returns to the portfolios that make up the indices. Since dividend payments are excluded, they measure only the return on the portfolio resulting from capital gains. We will call it the rate of capital gain. It will be quite another challenge to make the necessary adjustments to these indices so that changes in their value measure total returns, and that is the task of future work.

In Figure 1 and Table 1 below, we compare the month-to-month growth rate in our newly calculated series with those provided by the exchanges, for the period for which data are available for both series. All data are monthly (only monthly data were available from the Exchanges) and the periods covered are: Barbados Dec. 1998-Dec. 2003, Jamaica May 2000- Dec. 2003 and Trinidad & Tobago Feb. 1999-Dec. 2003. The label “PW” refers to the index calculated by the authors of this paper.

Figure 1
Comparison of Rate of Capital Gain Using Two Different National Stock Price Indices



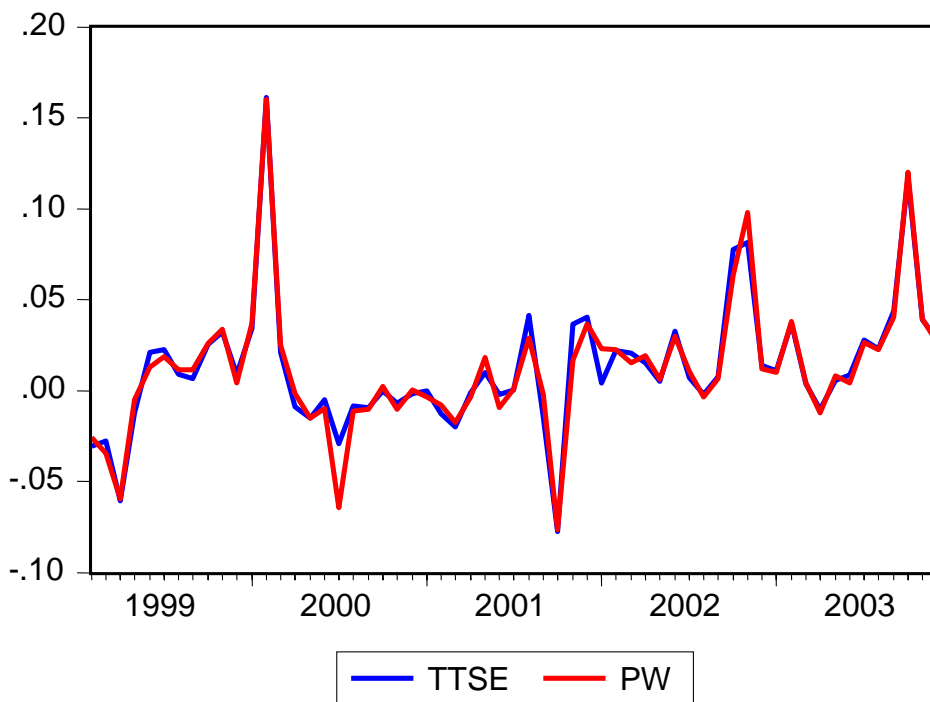
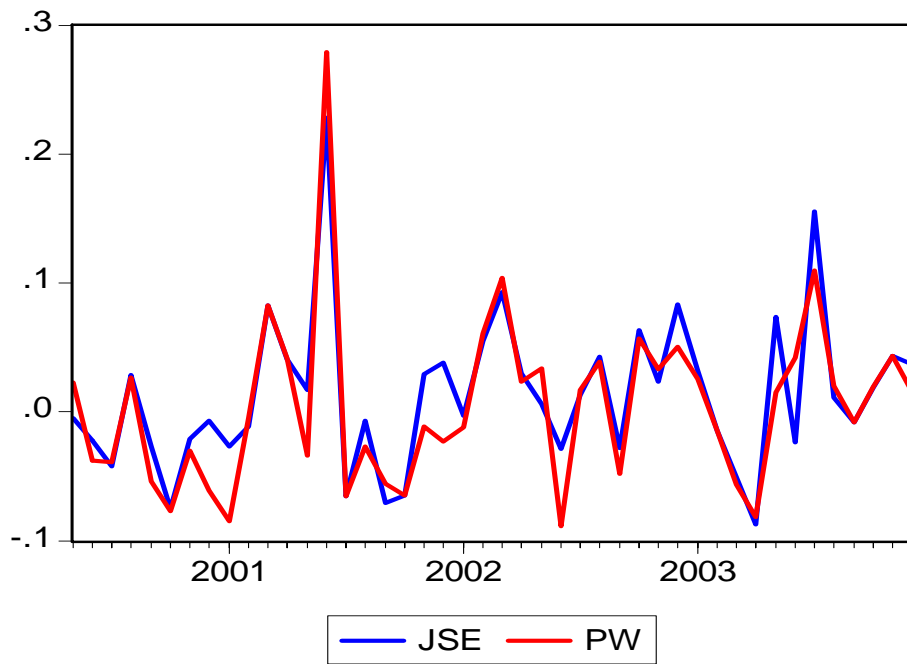


Table 1
Test of Equality of Mean Rate and Variance of Capital Gain of the Two Different
National Stock Indices

Exchange	Mean	Variance
BSE	Mean BSE = -0.0007 Mean PW = -0.0031 p-value = 0.730	SD BSE = 0.049 SD PW = 0.029 p-value (F) = 0.000 p-value (S-T) = 0.282
JSE	Mean JSE = 0.013 Mean PW = 0.004 p-value = 0.528	SD JSE = 0.060 SD PW = 0.066 p-value (F) = 0.519 p-value (S-T) = 0.327
TTSE	Mean TTSE = 0.012 Mean PW = 0.012 p-value = 0.925	SD TTSE = 0.036 SD TTSE = 0.037 p-value (F) = 0.869 p-value (S-T) = 0.949

SD = Standard deviation

F refers to the classic F test for the difference of two variances

S-T refers to the Siegel-Tukey test for the difference of two variances discussed in Sheskin, 1997, pp. 196-207

The graphs show that the closest match is obtained in the TTSE case, followed by the BSE and then the JSE. The test for equality of means and variances show that there is no significant difference between the means of the two series as well as between the two variances, although there is some ambiguity in the BSE case (this may be due to the extreme movements in the BSE index on two occasions in 2002).

4.2 CARICOM Composite and Sector Stock Price Indices

The CARICOM Composite and Sector² Stock Price Indices (respectively, CCSPI and CSSPI) are calculated as

$$CXSPI_t = \sum_{j=1}^m SPI_{j,t} W_j$$

Where

- CXSPI is either CCSPI or CSSPI
- $SPI_{j,t}$ is the composite or sector index of the j^{th} market
- W_j is the weight of each market based on the relative share of total market capitalization in US\$

The indices of the exchanges are weighted by their issued share capital and indeed this index is commonly referred to as a market capitalization weighted index. When

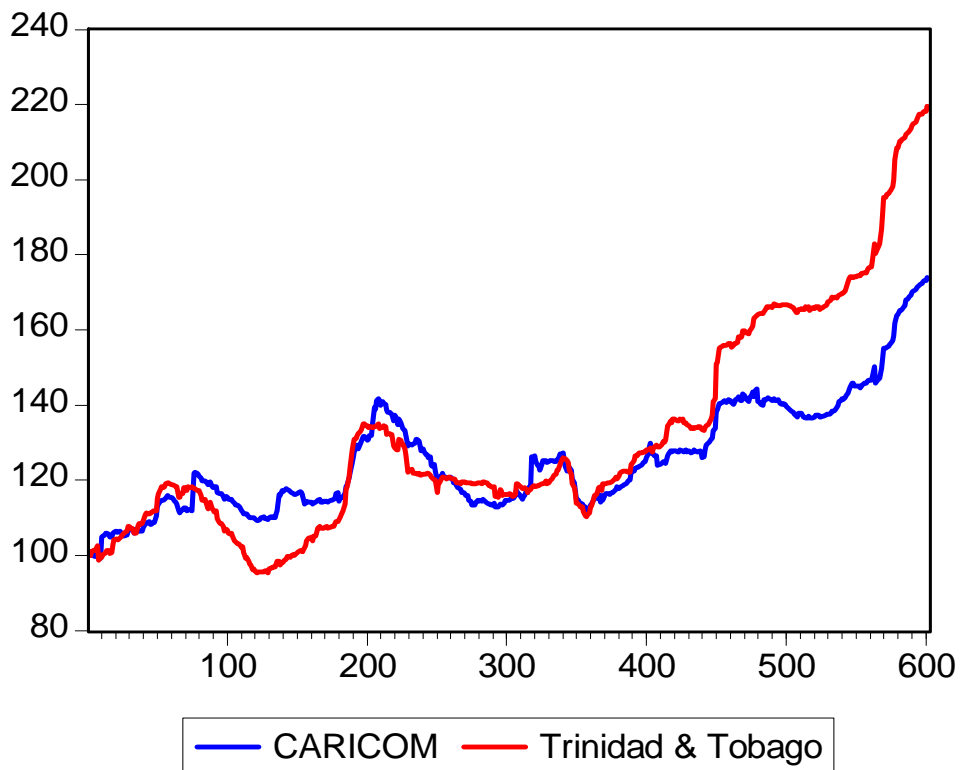
² Indices are calculated for the following sectors of the economy: banking, conglomerates, finance and manufacturing.

amalgamated like this, the CCSPI and CSSPI give a picture of all equity price movements across the individual exchanges.

An adjustment for free float market capitalization was also considered. However, the requisite historical data are not readily available, so this adjustment is not used in the current index. It will be modified to do so, however, as from January 1, 2004.

The time path of the CCSPI is shown in Figure 2 below. The composite Trinidad & Tobago index is shown for comparison:

Figure 2
CARICOM and Trinidad & Tobago Composite Stock Price Indices compared



4.3 National Composite Bond Indices

We calculate two kinds of Bond indices: a price index and a total returns index. For each of the three countries considered, the price index is calculated as:

$$BPI_{j,t} = BPI_{j,t-1} \frac{\sum_{i=1}^n P_{j,it} Q_{j,it-1}}{\sum_{i=1}^n P_{j,it-1} Q_{j,it-1}}$$

where

$BPI_{j,t}$ = Price Index of country j at time t

$BPI_{j,0} = 100$

$P_{j,it}$ = clean price (in US dollars) of i^{th} bond at time t

$Q_{j,it}$ = size of issue of i^{th} bond at time t

The total returns index, on the other hand, was calculated as:

$$BTRI_{j,t} = BTRI_{j,t-1} \frac{\sum_{i=1}^n (P_{j,it} + A_{j,it} + G_{j,it}) Q_{j,it-1}}{\sum_{i=1}^n (P_{j,it-1} + A_{j,it-1}) Q_{j,it-1}}$$

$BTRI_{j,t}$ = Total Return Index (bonds) at time t, country j

$BTRI_{j,0} = 100$

$A_{j,it}$ = accrued interest to settlement date t, country j

$G_{j,it}$ = value of any coupon payment received from i^{th} bond for normal settlement at time t or since time (t-1)

$Q_{j,it}$ = size of issue of i^{th} bond at time t

The total returns index is the preferred bond index of the European Union. See Brown (2002).

The instruments included are fixed rate government securities from Barbados, Jamaica and Trinidad, ranging in maturity from 1 to 30 years. The indices therefore do not measure movement in Corporate Bonds. Each bond chosen has at least one year remaining to maturity (reviewed on a monthly basis). In addition, to be selected, a bond has to satisfy a minimum liquidity constraint. For Barbados this means that the issue size had to be at least \$40 million, for Jamaica \$750 million and for Trinidad & Tobago at least \$100 million. The base period for each country is March 2002.

Prices are derived using approximated yield curves. Primary data are drawn, in the case of Barbados, from the Central Bank of Barbados' Annual Statistical Digest, in the case of Jamaica Bank of Jamaica's Statistical Digest and for Trinidad & Tobago the Central Bank's Monthly Statistical Digest. Unfortunately, the data were plagued with missing values, and we proceeded to fill the gaps in the following three steps:

Step 1

We identified for each country the series with the least missing values and called these the foundation data series sets. Fortunately, for each country, there was at least one series with very few missing values. This was the 90-day Treasury Bill yield for Barbados (no missing data from January 2002 to April 2004) and Trinidad & Tobago, and the 180-day Treasury Bill yield for Jamaica (six missing data points for January 2000 to April 2004)

Linear interpolation methods were used to fill the gaps within the chosen data sets. Since the gaps were never more than two months, this was a reasonable procedure to follow.

Step 2

Where required, ARIMA models were used to forecast beyond the last available observation, to extend the foundation data set series to April 2004.

Step 3

The foundation data set values were compared to those of the yields of instruments of different tenor where the data for the latter were available. The mean and standard deviations of the spreads were calculated and, assuming that the spreads were normally distributed, the missing values for bonds of different tenors were generated by adding randomly generated spreads to the yields of the foundation data set.

4.4 CARICOM Composite Bond Indices

The CARICOM wide Bond Price Index is calculated as follows:

$$BPI_t = \sum_{j=1}^3 W_{j,t} BPI_{j,t}$$

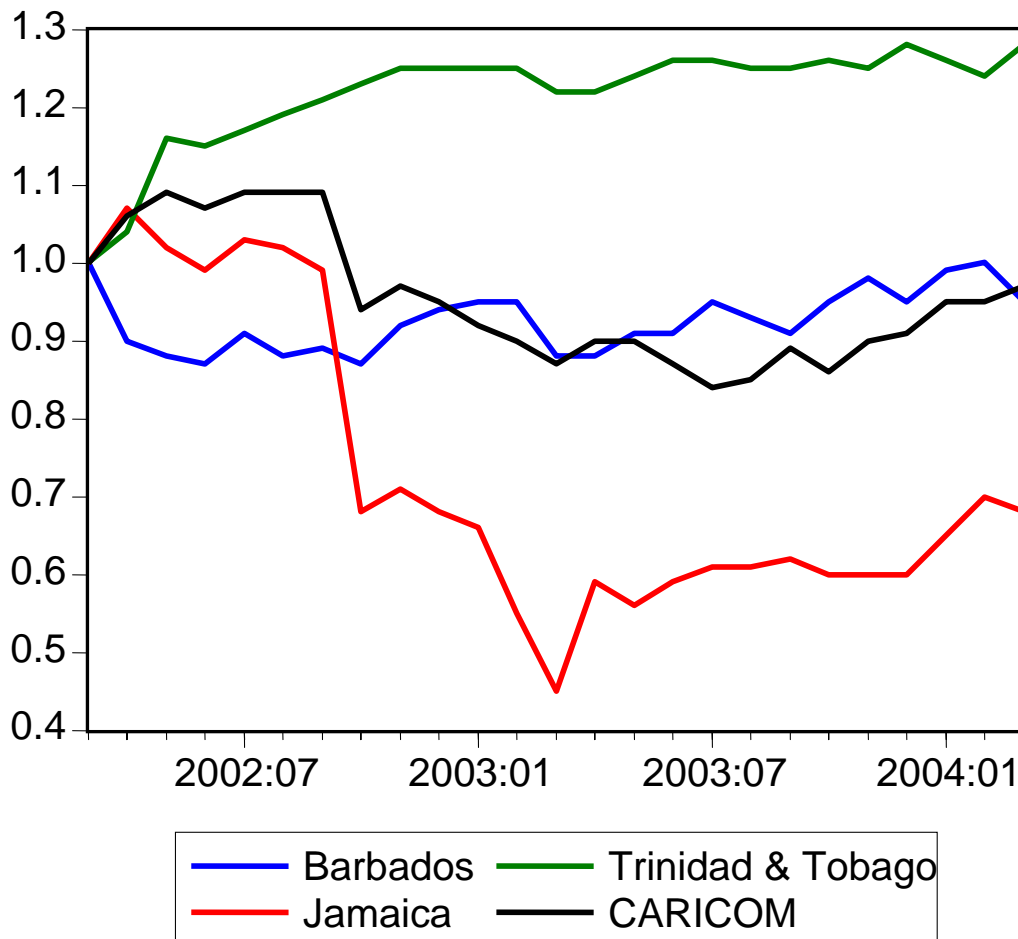
and the CARICOM wide total returns index is calculated as:

$$BTRI_t = \sum_{j=1}^3 W_{j,t} BTRI_{j,t}$$

where BPI and BTRI are calculated as in the preceding section. The weights, $W_{j,t}$, for each country's contribution to the index, is the relative market value share (in US dollars) of that country's bond market.

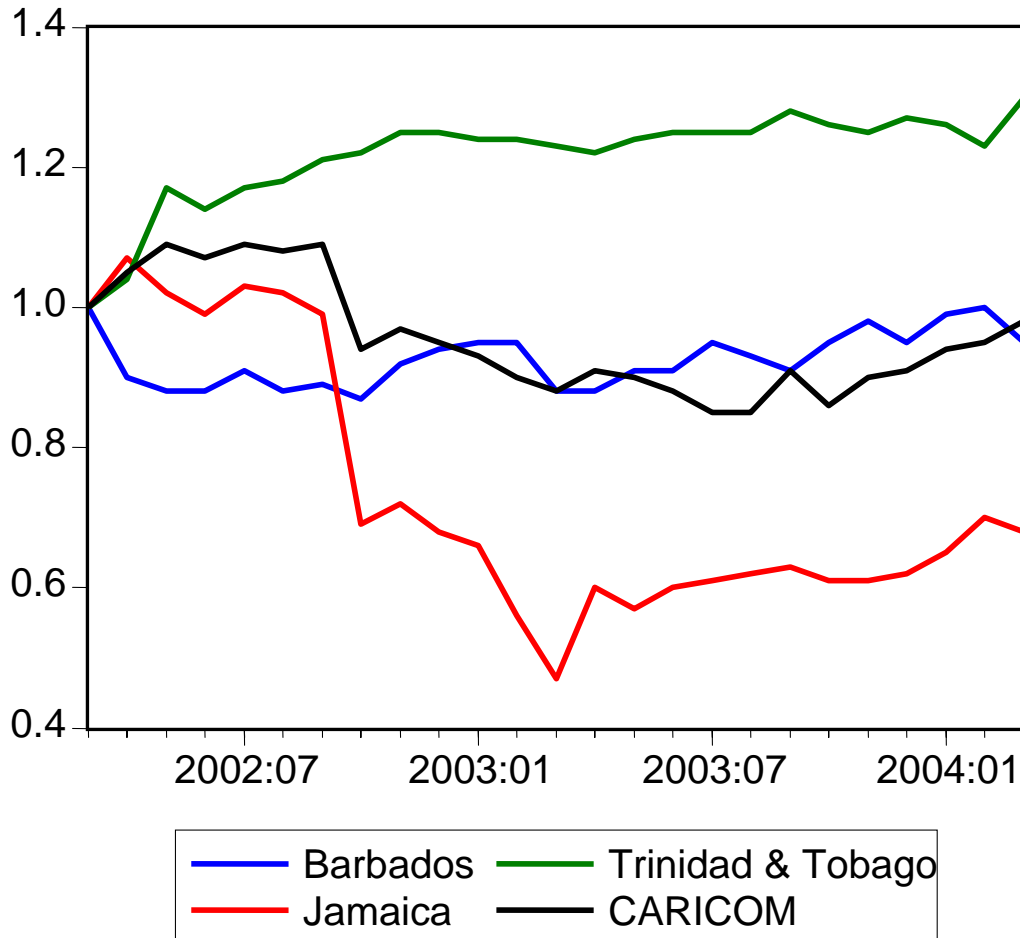
The time path of the bond price indices of the 3 countries is shown in Figure 3 below:

Figure 3
Time path of Bond Price Indices of Barbados, Jamaica and Trinidad & Tobago



The total returns index for the three countries is shown in Figure 4 below:

Figure 4
Total Returns Bond Indices for Barbados, Jamaica and Trinidad & Tobago



5. Evaluation of Stock Market activity in the CARICOM sub region

5.1 Market efficiency

A particular market is deemed to display weak form efficiency if stock prices follow a random walk process:

$$\ln p_t = \alpha + \ln p_{t-1} + u_t$$

where p_t is the stock price at time t , α is a constant (drift) term and $\{u_t\}$ is a white noise process. Alternatively stated, the market is weak form efficient if $\ln(p_t/p_{t-1})$, which is

nothing other than the rate of capital gain, is a white noise process. The well known Box-Ljung Q statistic may be used to test this assumption.

The p-values associated with the Q statistics at lags 4, 10 and 20 for the composite and sector indices are shown in Table 2 below. Based on these results, both the Barbados and Jamaican markets, including the sectors³, display evidence of weak form efficiency. The Trinidad & Tobago market, on the other hand, is not efficient (we may even say that it is highly inefficient given the very low p-values), even at the sectoral levels. Overall the CARICOM market is not efficient either, probably because of the weight of the inefficient Trinidad & Tobago market in its calculations. It is interesting to note, however, that there is evidence of weak form efficiency in the CARICOM banking and manufacturing sectors.

³ Given that very few firms are used in the construction of the Barbados sector indices, the latter should be interpreted with great caution.

Table 2
Box-Ljung Tests for White noise of Stock Price Indices

p-values:

	Barbados	Jamaica	Trinidad & Tobago	CARICOM
Composite	Q ₄ = 0.196 Q ₁₀ = 0.642 Q ₂₀ = 0.979	Q ₄ = 0.183 Q ₁₀ = 0.410 Q ₂₀ = 0.311	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0.001
Banking Sector	Q ₄ = 0.155 Q ₁₀ = 0.607 Q ₂₀ = 0.979	Q ₄ = 0.065 Q ₁₀ = 0.165 Q ₂₀ = 0.099	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0	Q ₄ = 0.251 Q ₁₀ = 0.485 Q ₂₀ = 0.778
Conglomerates Sector	Q ₄ = 0.998 Q ₁₀ = 0.999 Q ₂₀ = 1.00	Q ₄ = 0.889 Q ₁₀ = 0.792 Q ₂₀ = 0.326	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0
Financial Sector	Insufficient variation in the data.	Q ₄ = 0.491 Q ₁₀ = 0.639 Q ₂₀ = 0.514	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0	Q ₄ = 0.003 Q ₁₀ = 0 Q ₂₀ = 0
Manufacturing Sector	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0	Q ₄ = 0.422 Q ₁₀ = 0.455 Q ₂₀ = 0.068	Q ₄ = 0 Q ₁₀ = 0 Q ₂₀ = 0	Q ₄ = 0.815 Q ₁₀ = 0.636 Q ₂₀ = 0.203

The inefficiency of the Trinidad & Tobago Stock Market was also verified by Sergeant (1986).

5.2 Stock Portfolio Analysis

Is there an advantage to be gained in investing in the CARICOM portfolio rather than, say, a “national” portfolio? Is one sector of the economy a better bet than another, both at the national and regional levels? In this section we attempt to give some answers to these questions.

Tables 3 below gives the values of the mean and standard deviation of capital gains associated with the various indices.

Table 3
Mean Rate and Standard Deviation of Capital Gains based on Different Stock Price Indices

	Barbados	Jamaica	Trinidad & Tobago	CARICOM
Composite	Mean = 0.00039 SD = 0.016889	Mean = 0.00028 SD = 0.024600	Mean = 0.00131 SD = 0.00765	Mean = 0.00092 SD = 0.00844
Banking Sector	Mean = 0.00023 SD = 0.24424	Mean = 0.00107 SD = 0.02753	Mean = 0.00154 SD = 0.010212	Mean = 0.001153 SD = 0.011501
Conglomerates Sector	Mean = 0.000811 SD = 0.019801	Mean = 0.001051 SD = 0.02376	Mean = 0.001483 SD = 0.015640	Mean = 0.001272 SD = 0.011285
Financial Sector	Mean = NC SD = NC	Mean = 0.0030608 SD = 0.056238	Mean = 0.003196 SD = 0.014336	Mean = 0.003180 SD = 0.014168
Manufacturing Sector	Mean = 0.000846 SD = 0.012148	Mean = -0.000074 SD = 0.034890	Mean = 0.000532 SD = 0.010916	Mean = 0.000324 SD = 0.015420

NC = Not calculated

Table 4 below compares the equality of means and variances (the square of the standard deviations) of the CARICOM and national indices for both the composite and the sector level indices. For instance, we see a p-value for comparing the means (using the classic ANOVA F-test) of 0.7101. This is interpreted to mean that there is no difference in the mean return of the CARICOM financial sector taken as a whole and the mean return of the various national jurisdictions. However, the p-value of 0 associated with the test of equality of the variances means that the various portfolios are not of equal risk. In this case, the portfolio with the lowest risk, that of Trinidad & Tobago (standard deviation of 0.010212) should be preferred to the others (as it turns out this portfolio also has the largest estimated mean return).

Table 4
P-values for Comparing Mean Rate and Variances of Capital Gains of CARICOM and National Stock Indices

	Composite	Banking	Conglomerates	Finance	Manufacturing
Mean	0.6587	0.7101	0.9290	0.9726	0.8910
Variance	0	0	0	0	0

The figures displayed in Tables 3 and 4 show portfolios based on Trinidad & Tobago

stocks are generally to be preferred, even to a CARICOM wide portfolio. However, CARICOM-wide portfolios are generally second choice.

6. Evaluation of Bond Market activity in the CARICOM sub region

6.1 BondMarket Efficiency

Using a framework analogous to our analysis of the stock markets, we determine that there is no evidence of weak form inefficiency in all the bond markets, including the “CARICOM” market. The results of the Box-Ljung tests are shown in Table 5 below:

Table 5
Box-Ljung Tests for White noise of Bond (Total returns) Indices

p-values:

Barbados	Jamaica	Trinidad & Tobago	CARICOM
Q ₄ = 0.897	Q ₄ = 0.910	Q ₄ = 0.940	Q ₄ = 0.491
Q ₈ = 0.724	Q ₈ = 0.124	Q ₈ = 0.964	Q ₈ = 0.579
Q ₁₂ = 0.664	Q ₁₂ = 0.231	Q ₁₂ = 0.988	Q ₁₂ = 0.362

6.2 Bond Portfolio Analysis

Table 6 and Figure 6 below show the monthly rates of return (in percentages) on bonds based on the Total returns index.

Table 6

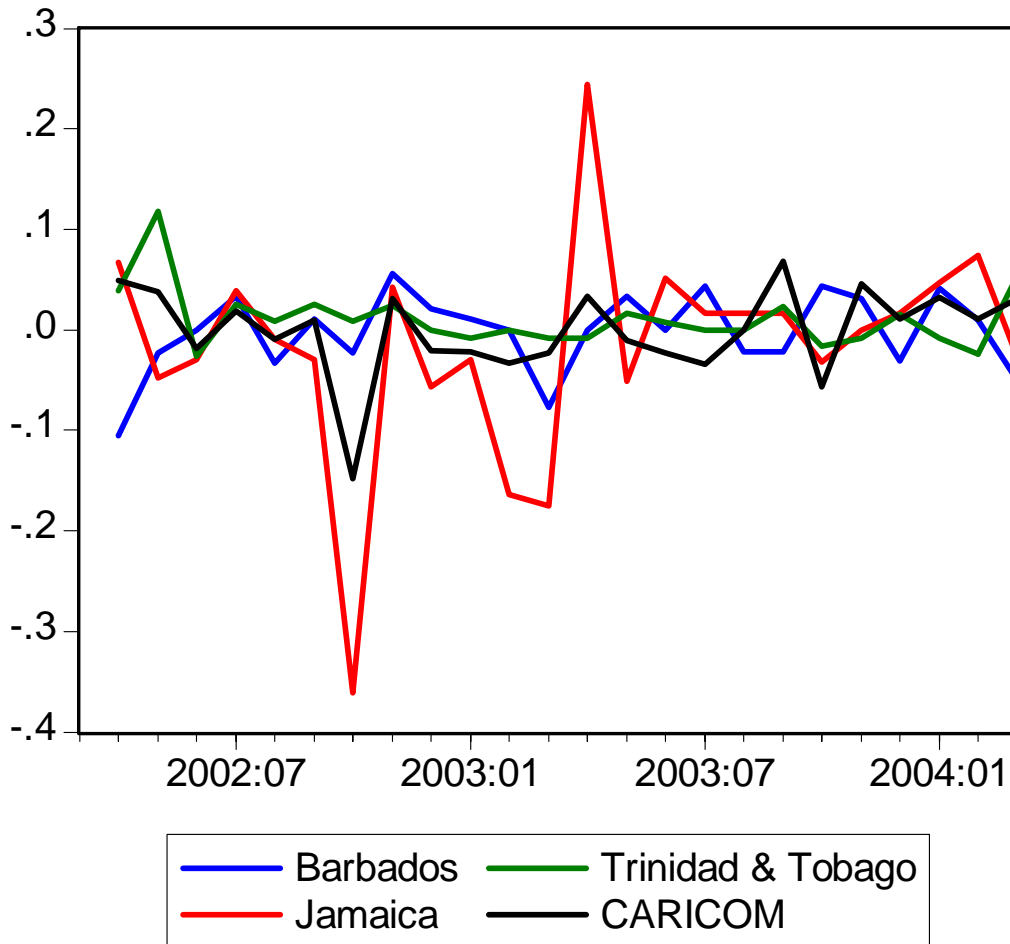
Monthly rates of Return on Bond Total Returns Index (%)

Date	Barbados	Jamaica	Trinidad	CARICOM
30-Apr-02	-10.470	6.938	3.733	5.341
31-May-02	-2.027	-5.028	11.556	3.337
30-Jun-02	-0.789	-2.513	-1.751	-2.163
31-Jul-02	3.825	3.719	2.105	2.014
31-Aug-02	-3.251	-1.146	0.949	-0.543
30-Sep-02	1.364	-3.288	2.789	0.449
31-Oct-02	-2.602	-35.831	0.676	-14.150
30-Nov-02	5.588	3.750	2.450	2.620
31-Dec-02	2.301	-4.971	-0.582	-1.513
31-Jan-03	1.208	-2.734	-0.220	-3.106
28-Feb-03	0.078	-17.297	-0.071	-2.969
31-Mar-03	-7.791	-18.039	-1.029	-2.339
30-Apr-03	-0.318	25.537	-0.738	3.170
31-May-03	3.310	-5.051	1.607	-0.155
30-Jun-03	-0.262	4.990	1.188	-3.323
31-Jul-03	4.569	2.346	-0.181	-3.373
31-Aug-03	-1.986	0.989	-0.383	0.162
30-Sep-03	-1.973	1.302	2.273	6.850
31-Oct-03	4.247	-2.583	-1.548	-5.039
30-Nov-03	2.969	0.042	-0.722	4.722
31-Dec-03	-3.243	0.598	2.076	0.890
31-Jan-04	3.935	5.744	-1.455	3.389
29-Feb-04	0.865	7.363	-2.154	0.275
31-Mar-04	-4.255	-2.805	5.637	3.404
Mean	-0.196	-1.582	1.092	-0.085
Std. Dev.	3.943	11.155	2.949	4.277

p-value difference in means = 0.5434

p-value difference in variances = 0

Figure 6
 Monthly Rates of Return on Bond Total Returns Index



Rates vary widely from month to month, especially in the case of Jamaica, showing greater opportunities for successful speculative gains (and losses) in that country. . There is no significant difference in the mean rate of return of all portfolios but very significant differences in the variances (riskiness). On the average, the Trinidad & Tobago offers the safest and best returns

7. Recommendations on the way forward

The usefulness of the stock indices calculated in this paper will be considerably improved if they are adjusted to take into account dividend payments. The rates of change will then measure total returns of the various portfolios and not just rates of capital gain. Once this is done, more meaningful return-risk analysis may be performed, including β -analysis of individual company stock being traded on the exchanges.

In the case of the bond indices, there is considerable interest in catering or movements in corporate bonds and not simply government bonds as is done in this paper. The data requirements are straightforward but the data are difficult to obtain. There is little doubt, however, that much is to be gained by pursuing this objective. There is a growing demand in the Caribbean for non equity financing and, as limited as the transactions now are, the time has come for the construction of indices to capture the activity of corporate players on this market. Portfolios will include more and more bonds in the future and the relevant instruments must exist to evaluate them.

8. Conclusion

In this paper, we set out to construct CARICOM-wide stock and bond market indices, including indices for important sub sectors, based on market activity data obtained from Barbados, Jamaica and Trinidad & Tobago. This in turn required the construction of individual country indices. These indices were used to evaluate and compare rates of return and risk on the various portfolios implied by the indices as well as to make a preliminary analysis of the efficiency of the markets. We showed that investors will prefer portfolios based solely on Trinidad & Tobago instruments to other portfolios in both the stock and bond markets, and will prefer CARICOM portfolios to Barbadian and Jamaican portfolios. We also showed that the TTSE was functioning inefficiently while the other two stock exchanges, the BSE and the JSE, showed evidence of weak form efficiency in their operations. All bond markets function efficiently.

References

- Brown, P. (2002), Constructing and Calculating Bond Indices, 2nd Edition, Gilmore Drummond Publishing 2002
- Classens, S.(1995), “The emergence of equity investment in developing countries: overview”, The World Bank Economic Review, 9:1, 1-17.
- Demirgüç-Kunt, A. and R. Levine (1996), “Stock markets, corporate finance and economic growth: an overview”, The World Bank Economic Review, 10:2, 223-240.
- Jackson, J. (1986), “The stock market in the Caribbean: the Jamaican experience”, Caribbean Finance & Management, 2:2, 61-69.
- Kitchen, R. (1986), “The role of the Jamaican stock exchange in the capital market: an historical analysis”, Caribbean Finance & Management, 2:2, 1-23.
- Sergeant, K. (1995), “The Trinidad & Tobago Stock Exchange” in R. Ramsaran (ed.),

Insights into an emerging financial structure: the experience of Trinidad & Tobago,
Caribbean Centre for Monetary Studies.

Sheskin, D.J. (1997), Parametric and non parametric statistical procedures, CRC Press.

Stiglitz, J. (1991), "Government, financial markets and economic development", NBER,
Working Paper 3669.