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Regional Financial Integration in the Caribbean: Evidence from Financial and Macroeconomic Data

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Regional Financial Integration in the Caribbean: Evidence from Financial and Macroeconomic Data

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Abstract

This paper assesses the extent of regional financial integration in the Caribbean Community (CARICOM) by analyzing equity prices in the region and rigidity of external financing constraints. The results are presented in a cross-regional perspective. The Caribbean stock markets are not as well integrated as one would expect from the extent of cross-listing and importance of regional banking groups: price differentials of cross-listed stocks reach an average of 5 percent. Auto-Regressive models suggest that these price differentials are only slowly arbitraged away, with half-lives exceeding 7 worked days, even when looking only at large arbitrage opportunities (using a Threshold Auto-Regressive model). A speculative methodology using macroeconomic data seems to confirm these findings. A strong mean reversion of the current account (respectively regional trade imbalances) is interpreted, following Obstfeld and Taylor (2004), as a lack of ways to finance current account deficits, i.e. a lack of global (respectively regional) financial integration. The region appears to be much less integrated than the EU15 or the ASEAN+3 groups, although it fares well compared to other LDCs.

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Keywords: CARICOM, cross-market premium, cross-listed stock, Threshold Auto-Regressive model, current account dynamics

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I. Introduction

This paper assesses the extent of regional financial integration in the 15 countries that are part of the Caribbean Community (CARICOM). The CARICOM community was founded by the Treaty of Chaguaramas in 1973 by Barbados, Jamaica, Guyana and Trinidad and Tobago and replaced the Caribbean Free Trade Association to further regional economic integration. Antigua and Barbuda, Belize, Dominica, Grenada, Montserrat, Saint-Kitts and Nevis, Saint Lucia and Saint Vincent and the Grenadines soon joined the union (1974), which was later extended to Bahamas (1983), Suriname (1995) and Haiti (1998). The GDP of this 15 million inhabitants region hovers around US$40 billion (2004).

Although most of the CARICOM countries share the common heritage of the Commonwealth (exceptions are Suriname and Haiti), economic and social differences remain significant between the more developed micro-states - Antigua and Barbuda, Bahamas, Barbados, St Kitts and Nevis have less than 300 thousand inhabitants and benefit from a GDP per capita greater than US$10,000 in PPP - and the poorer and populated Jamaica and Haiti. Following an increase in income from oil exports, Trinidad and Tobago, overtook Jamaica in 2000 as the largest economy of the region with a GDP exceeding US$12 billion (2005). Trinidad and Tobago, the only country with a current account surplus in the recent past, became the main exporter of capital and the main financial center: 5 of the 10 largest regional financial institutions are based in Trinidad and Tobago. The history of large financial regional conglomerates, the expansion of Trinidad and Tobago as a financial center, and the importance of bank's regional exposure suggested a deepening of regional financial integration that is worth studying.

The benefits of financial integration have traditionally been divided into three categories. First, financial liberalization is thought to promote efficiency in the allocation of capital, in the same way that trade liberalization improves the use of resources. Capital should flow to countries with highest rates of return and thus allows inter-temporal consumption smoothing. Increased competition in the financial sector helps increasing savings and investment. Second, risk-diversification may improve, and the reduced risk profile of profits and consumption should improve welfare. Third, a reduction in government regulations enhances transparency and shifts in international markets' assessment of an economy may act as a disciplinary device. The case for regional financial integration of course follows these established arguments but three additional points are put forward. First, efficiency gains may be attained because of economies of scale in the financial industry. This is particularly true in regions such as the CARICOM that are composed of many small states. The presence of large financial institutions whose activities are spread in the Caribbean region suggests that these gains have indeed been a major source of regional financial integration. Second, because trade flows make extensive use of trade credit, neighboring countries with tighter trade links also have tighter financial links. Hence, impediments to the movement of regional capital flows certainly limit the possibility for a country to run trade deficits. In fact, several authors (Zhang et al, 2005 and Ronci, 2004) confirmed this prior and showed that FDI and trade credit flows also determine trade links. Third, countries that envisage or are already engaged in regional currency unions will ripe larger benefits from exchange rate stability if financial integration is already advanced.

There are however limitations associated with regional integration. Risk-diversification benefits may be small if the business cycles are already synchronized. Furthermore, the risk of contagion between countries that are similar, or perceived as such, is greater the deeper financial integration. Nevertheless, initiatives such as exchange rate cooperation, swap agreements or regional monetary funds have been put forward as possible solutions to this dilemma.

The measurement of regional financial integration is itself a recent topic. European integration has fostered the creation of financial integration indicators (see Adam et al, 2002) with the ECB publishing regularly its own set of estimates (ECB, 2005). Regional integration in East-Asia also attracted attention with the dynamism of the Chang Mai Initiative. Park and Bae (2002) assess the extent of East-Asian integration, analyzing nationality of managers, Japanese overseas portfolio investment, and investigating the extent of co-movement of interest rates and stock prices. Cowen et al. (2006) cover macroeconomic, institutional, and capital flow evidence on Asian integration. Kim et al. (2005) use the Coordinated Portfolio Investment Survey (CPIS) bilateral portfolio data compiled by the IMF, as well as data from the Bank of International Settlements (BIS), which reports consolidated international bank claims of reporting banks by nationality of both lenders and borrowers. Unfortunately, these datasets are not very informative for Caribbean countries. The flows reported by the BIS data always originate from developed or advanced emerging markets and therefore cannot be used for an assessment of regional Caribbean integration. The CPIS data is of more interest. Unfortunately, out of the 15 CARICOM countries, only data for Bahamas and Barbados is available and the flows reported correspond to investment channeled through these financial centers to other economies. The UNCTAD also compiles disaggregated FDI data for several Caribbean countries (see section 2), but the last data available is out-of-date and does not help in capturing recent trends.

The unavailability of flow data forces us to look for more indirect measures of regional financial integration. Assessment of financial integration to world markets has usually pursued two directions: price-based evidence and quantity-based evidence. Price convergence occurs in integrated financial markets because a spread is arbitraged away by flows that will seek the highest returns. In absence of detailed capital flow data, quantity-based evidence often follows the way opened by Horioka and Feldstein (1980) who argued that data for open economies should not exhibit strong correlation between savings and investment because the financing of the gap between them (i.e. the current account) would be made easier by open capital accounts. It is in fact necessary to look at both types of evidence together. First because it is possible, in theory, that common shocks drive price co-movements without involving capital flows. Second because capital flows may occur even in poorly integrated countries if arbitrage opportunities are very large. Third because, while price-evidence tends to have too narrow a focus, current-account evidence remains elusive. We first give some background information on the financial sector, financial accounts and interest rate convergence in the Caribbean (section II). Since the functioning of the T-Bills markets is deficient, we investigate in section III convergence between stock prices, for 9 stocks that are cross-listed in two of the CARICOM stock exchanges. These 9 stocks account for more than 50 percent of the market capitalization of the Trinidad and Tobago Stock Exchange and are therefore representative of the regional markets. We assess the dynamics of the arbitrage opportunity to see whether stock-prices adjust quickly or not in order to arbitrage away price differences. We use an Auto-Regressive (AR) model and a Threshold Auto-Regressive (TAR) model to account for the possible non-linearities in the data, following closely Levi Yeyati et al. (2006). We find that markets are still inefficient and seem fragmented, even when compared to other emerging markets.

We then look at indirect quantity evidence. We apply here the methodology of Taylor (2002) and Obstfeld and Taylor (2004) who study the dynamics of the current account to estimate financial integration. We extend this method to regional trade imbalances because they explain a large part of current account deficit and because they may have more to say about regional financial integration than simple current account data (section IV). The region appears to be much less integrated than the EU15 or the ASEAN+3 group, although it fares well compared to other LDCs.

II. Background

Since most of the CARICOM countries gained independence between 1962 (Jamaica) and 1983 (St. Kitts and Nevis), the 1960s and 1970s decades witnessed major institutional foundations, among them the establishment of central banks[1] and stock markets. The creation in the early 80s of the Eastern Caribbean Currency Union (ECCU), which comprises seven CARICOM members[2], institutionalized monetary integration and confirmed the move of the region towards currencies pegged to the U.S. dollar. Out of the 15 CARICOM countries, 5 (Guyana, Haiti, Jamaica, Suriname and Trinidad and Tobago) chose a floating exchange rate regime, albeit heavily managed in the case of Suriname and Trinidad and Tobago.

Until a recent past, many of the CARICOM countries had some form of exchange or capital controls. However, foreign investments were traditionally promoted and exchange controls not deterrent. They often targeted domestic residents who were limited in their ability to buy foreign currencies, while international business corporations benefited from special regimes. The financial account of the CARICOM (table 1) witnesses this situation, with inward FDI representing more than two thirds of the financial account. The attractiveness of the CARICOM resides in the positive business climate and the tax concessions available in many of the Caribbean countries (see Chai and Goyal (2006) for an analysis of the effects of FDI tax incentives in the ECCU). The UNCTAD 2001 FDI stock data details the sources and destinations of flows (tables 2 and 3). The U.S. and Canada are the major investors in the region. Outward FDI is much smaller. Trinidad and Tobago and Jamaica had recently FDI outflows, although, according to UNCTAD stock data, the major outward stocks come from Barbados and Bahamas, two countries that redirect investment towards Brazil and the USA. Portfolio investments, both inward and outward, are of a limited magnitude too, with trade in debt instruments being much more significant than trade in equities, especially following Jamaica's 2003 issue of debt securities. Bank loan flows are not preponderant in the CARICOM, except for the Bahamas, where transit more than US$20 billion.

[1] The creation of the Central Bank of Trinidad and Tobago dates from 1964, while the Eastern Caribbean Central Bank (ECCB) was founded in 1983.

[2] Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, Saint Vincent and the Grenadines.

The low volumes of equity flows recorded[3] remind us that stock exchanges are relatively recent in the region. Although the Jamaica Stock Exchange (JSE), which was founded in 1968, and the Trinidad and Tobago Stock Exchange (TTSE), founded in 1981, are now well-established institutions, the development of the regional stock markets became more significant only in the recent years, with the settlements of the Barbados Stock Exchange (BSE, re-incorporated in 2001) and of the Eastern Caribbean Securities Exchange (ECSE, founded in 2001). Market capitalization grew fast since 2000 and is high by emerging market standards above 100 percent for Trinidad and Tobago, Jamaica and Barbados. This may be compared with market capitalization of around 25–50 percent for Argentina, Brazil, Colombia, Mexico or Peru. However this boost in market capitalization (growth of 544 percent for JSE between 1997 and 2003, 246 percent for TTSE) was mostly due to an outstanding price performance that saw composite indexes increasing two or three-fold for the main regional stock markets (240 percent increase for JSE between 1997 and 2003, 97 percent for TTSE) and to the multiplication of cross-listing, which created double-accounting and overstated stock market capitalization measures. In fact, the number of listed companies in the regional stock exchanges was constant since their creation. Furthermore, liquidity remained low and is generally below 5 percent (TTSEC, 2004), to be compared with an average of 17 percent for the above cited Latin American countries.[4] The picture that emerges from these few statistics is therefore one of a large albeit inflated importance, while diversification and liquidity are limited.

We do not have enough volume data to distinguish between regional and extra-regional flows. One should expect regional flows to be important because neighboring countries are also trade partners. In the theoretical model of Rose and Spiegel (2002) with endogenous sovereign default, the probability of default is lower the higher is the expected volume of trade between the partners, because it is assumed that the default penalty is proportional to the volume of bilateral trade. As a result, creditors will prefer to lend to trade partner countries in order to minimize default. Rose and Spiegel (2002) tested their predictions using the bilateral foreign bank lending from BIS, and found that trade links indeed increase bank lending. In the Caribbean, regional trade is significant: regional exports reached 9.5 percent of GDP in 2005, above other LDCs but well below the EU15 the ASEAN groups (table 4).

Other determinants of regional flows may be the size of regional firms, institutions and the size of regional financial conglomerates. In the CARICOM, the banks that were in activity at the time of the Commonwealth naturally spread regionally after independence. The regional financial groups now hold assets worth on average 166 percent of regional GDP, 60 percent of which are held by the 10 largest regional financial institutions (see Chai (2006) for a study of the banking sector in the ECCU). A further question is however how important non-domestic regional activities are. For instance, in most Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, Panama), banks hold more than 65 percent of their wealth in domestic assets (Brenner and Morales, 2006).

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[3] For most CARICOM countries, equity flow data is not compiled.

[4] The liquidity measure used by TTSEC (2004) and reported here is the turnover ratio, calculated as the value of total shares traded divided by market capitalization. The source for other emerging markets is World Exchanges website (http://www.world-exchanges.org). OECD countries enjoy commonly liquidity ratios above 60 percent.

For the CARICOM, we know that Trinidad and Tobago financial institutions hold around 76 percent of their assets domestically, and 20 percent regionally, which suggests a good extent of regional integration (IMF, 2006). Kwon et al. (2008) analyze in more detail the structure of the financial sector in the CARICOM. Unfortunately we do not have access to more bilateral data for the region. A natural exploration method is thus to look at price evidence, starting with interest rates series. The main difficulty that arises when working with CARICOM T-Bills data is that the near-absence of re-trading limits the economic significance of the interest rate series: the yields we have access to most often represent first auction prices and are not volatile[5] (figure 1). In the 1990s, Jamaica and Guyana suffered from a long crisis that drove interest rates at high levels for almost 5 years. The other countries do not exhibit clear patterns but a Principal Component Analysis sheds some light on the determinant of interest rates (see table 5).[6] The first component is strongly linked to the U.S. interest rate, but the main economies of the region (Jamaica and Trinidad and Tobago) seem to follow their own stochastic process. The 2004 Jamaican exchange rate crisis had for instance no effect on its neighbors. To take into account exchange rate depreciations, we use Uncovered Interest Parity (UIP) yields[7] converting the domestic yields into their Trinidad and Tobago Dollar (TTD) equivalents, by computing

$$i^{TTD}_{i,t} = i_{i,t} + 100\,(\pi^{USD}_{tto,t} - \pi^{USD}_{i,t})$$

where $i_{i,t}$ is T-Bill rate in country i at time t, $\pi^{USD}_{i,t}$ is exchange rate depreciation of country i currency with respect to the U.S. dollar, and $\pi^{USD}_{tto,t}$ is TTD depreciation of with respect to the U.S. dollar. Three forms of exchange rate expectations are used: rational expectations (depreciation over the future 12 months), backward expectations (depreciation over the past 12 months), and mixed expectations (depreciation over the period ranging from 6 months before to 6 months after current time).

The correlation coefficients between the Trinidad and Tobago rate and the regional bond yields appear to be low, for all expectation specifications (table 6), with an average correlation around 0.2. This contrasts with a high correlation between the U.S. and the Trinidad and Tobago rates (0.9) that points at a rather high integration to global markets. When compared to other LDCs regions, this correlation seems also low: for instance, correlations between four West African countries reach estimates of 0.3 to 0.4. Despite

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[5] The inexistence of secondary markets is by itself an important question, outside of the scope of this paper. The inefficiency of the settlement system is probably an element of explanation.

[6] We do not work with spreads because since the domestic rates are much less volatile than the U.S. T-Bill rate, the volatility of the spread is almost entirely due to the U.S. rate, a result that makes impossible any sound analysis of spread movements.

[7] The rational expectation UIP fails in actual data, see surveys by Taylor (1995) and Sarno and Taylor (2002). In particular, this method does not reflect the progress made in the literature on the UIP using expectation surveys, time-varying risk-premia, etc, and in general the methods that were developed to test for market efficiency. Nonetheless, we use it since we only want to estimate a proxy for same-currency return and a natural and available proxy is the rational expectation and time-invariant risk premia estimate. We do not have data on forward exchange rates so tests of the Covered Interest Parity are made impossible. With the relatively short time period that we have in mind, the use of RIP tests is also difficult.

limited co-movement, sigma-convergence,[8] a measure of regional integration popularized by the ECB, seems present in the data since 1995 (figure 1, third panel). However, sigma convergence is driven by interest rates in Jamaica and Guyana, two countries that were recovering from a crisis in the 1990s. Sigma convergence is absent when these two countries are excluded from the sample, and this casts doubt on the actual degree of yields convergence in the region.

III. Stock Price Convergence

Since bond markets are illiquid, we explore pricing behavior in the stock markets, which allows for more powerful statistical inference since daily data is available. The measurement of financial integration with stock price data initially relied on aggregate stock market indices because they were readily available. Examples of this literature are Cashin et al (1995), or more recently, Chen et al. (2002). A major inconvenient of such analyses is that, when composite stock price indexes are used, the two time series compared do not correspond to the prices of the same asset. The lack of correlation between two stock market indexes may be due to diverging risk-premia, exchange risk, or lack of synchronization of business cycles.

An analysis of prices of identical stocks traded in two markets is therefore a better measure of financial integration since it does not suffer from aggregation bias. However, cross-listed stocks are less common and may not be representative. This is not detrimental to the analysis of integration in the CARICOM though, because the large companies in the region have issued cross-listed shares for several years, mostly in the TTSE, the JSE and the BSE. The 9 companies that we study in this section account for more than 50 percent of the TTSE market capitalization. Since market capitalization is high in the region (often above 100 percent GDP), the study of cross-listed stock prices becomes even more relevant.

Detailed analysis of cross-listing in developed financial markets has become more common for the literature interested in the pricing mechanism. Using cross-listed prices to assess the extent of financial integration for emerging markets is less common. Levy Yeyati et al. (2006) estimate the Auto-Regressive dynamics (AR) of the cross-market premium, i.e. the premium between the prices of two identical stocks traded in two different markets. Since it is known that standard AR regressions underestimate convergence speeds in presence of non-linearities, the authors also use of a Threshold Auto-Regressive model (TAR). They use data of stocks listed in several emerging markets that are also cross-listed in the U.S., and estimate that the cross-country premium is low, at 0.16 percent. The authors also show how the behavior of the premium is affected by liquidity and capital account regulations.

We apply this framework to the Caribbean cross-listed stocks. The stock markets in the Caribbean are illiquid and individual stocks are not traded every day. Solibakke (2001) studied the property of thinly traded assets. He showed that illiquid assets returns tend to be negatively auto-correlated (contrary to returns for liquid assets) which would suggest that

[8] i.e. the fact that the cross-country standard deviation of interest rates is declining. We show in figure 1 sigma convergence using the mixed backward and forward expectations adjusted interest rates, but sigma-convergence is present for all expectation mechanisms.

thinly traded asset prices tend to overreact to news. He also showed that variance autocorrelation is higher for illiquid assets, and as a result, GARCH models tend to leave some remaining data dependency in the residual of the mean equation. Furthermore, Solibakke (2001) found that illiquid asset prices movements followed with a lag liquid asset prices, which react more quickly to news, a feature that will clearly appear with our cross-listings data. In a study of illiquid stocks of the Istanbul Stock Exchange, Antoniou et al. (1997) also showed that the behavior of thinly traded assets is not the same as that of liquid stocks. The authors first corrected for non-trading days, following Miller et al. (1994) by estimating a moving average model that reduces the importance of data reflecting lagged trading rather than actual trading. Subsequently, the authors rejected market efficiency (i.e. the Random Walk hypothesis on rates of return) using an AR-GARCH model, although efficiency seemed to have improved after the liberalization and regulatory changes initiated between 1989 and 1992. Rayhorn et al. (2007) used similar methods to assess whether the New Zealand stock market had become more efficient in the 1990s.

A. Data

We apply similar AR-GARCH models, although we focus on the cross-market arbitrage premium of 9 stocks that are cross-listed in the JSE, the TTSE and in the BSE. We looked for data from other Emerging Market regions to use as control groups. Regional cross-listing within Emerging Markets is not frequent. The search engine in DataStream was used systematically to search for cross-listings within different regions covering the main emerging markets in Asia (Hong-Kong, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand) and Latin America (Argentina, Brazil, Colombia, Chile, Uruguay, Venezuela) and the more developed African markets (Ghana, Namibia, South Africa, Zimbabwe). Some isolated cross-listings were found, notably in Malaysia, Korea, India, Thailand, and several more in South Africa and Namibia, but the data was not available in DataStream. As a result, our control sample may suffer from selection bias since it covers mostly large companies' stocks in fairly advanced EM stocks markets. It will nonetheless provides a useful benchmark for discussion.

We only kept the series that were long enough (with more than 100 trading days) and that were found for cross-listed stocks in Brazil and Argentina, Singapore and Hong-Kong, and France and Germany[9]. We excluded from the time series all days in which trading volumes were not positive for both markets, in order to keep only meaningful price information. The 9 CARICOM firms generated 11 cross-premium series: 8 Trinidad and Tobago-Jamaica series (TTO-JAM), 3 Trinidad and Tobago –Barbados series (TTO-BRB). These series are shorter than the initial data because only simultaneous trading days data were kept. Since liquidity is limited in the Caribbean stock markets, the probability that a stock be traded with positive volume simultaneously in both markets is low: the average number of week days between two simultaneous trading reaches 5.4, more than twice what is obtained for stocks in Hong-Kong-Singapore or in France-Germany (table 7). The illiquidity of the CARICOM

[9] We use stocks data of French firms that are cross-listed in one of the main German stock exchanges (Frankfurt, Berlin, XETRA) according to DataStream, and choose, among the first 10 companies in alphabetical order, the three stocks which witness liquid trading.

cross-listed stocks[10] is a first sign of the under-functioning of these markets, considering that the 9 companies studied here are among the most important in the CARICOM. Figure 2, which shows stock prices after currency conversion, confirms that stock prices evolve together, although arbitrage opportunities exist. As pointed out by Solibakke (2001), the illiquid stocks tend to move after the liquid ones: for instance, the prices of the GKC, JMMB, NCBJ, DBG and CCMB stock traded in the TTSE always lag that of their cross-listed counterpart in the JSE. Since our interest is on the size of the price differential, we show in table 8 the summary statistics for the *cross-market premium*, defined as

$$p_t = 100\left(\frac{ER_t^1 S_t^1}{ER_t^2 S_t^2} - 1\right)$$

where ER^1 and ER^2 are the exchange rates of country 1 and 2 (local currency per U.S. dollar), and S^1 and S^2 are the stock prices in the regional markets, in local currency. The premium seems to be of the same magnitude than what was found by Levy Yeyati et al. (2006) for illiquid stocks in emerging markets, with values all greater than 3 percent.

B. AR Results

We run AR regressions on the premium to estimate the speed at which price differences are arbitraged away. To avoid taking into account spurious data assigned to non-traded days, we only kept the data in days when positive trading was recorded for both stocks. We preferred this solution to the moving average smoothing method proposed by Miller et al. (1994), since we know the days in which there was no trading and we do not need to have data for all days in our analysis of cross-market premia.[11] We correct for both conditional heteroscedasticity and serial correlation using a GARCH(1,1) model, i.e. we use a maximum likelihood estimator on the following model

[10] Note that Levy Yeyati et at (2006) classify as illiquid all stocks that are not traded more than 200 days a year, i.e. more often than once every 1.3 week days. None of the CARICOM stocks would be considered as liquid therefore in Levy Yeyati et at (2006) study. The authors also show that the average value of the cross-market premium for is much higher for illiquid stocks (average is 5.39, standard deviation is 9.39) than for liquid stocks (average is 0.16, standard deviation is 2.12). The 9 stocks we analyze here show therefore comparable statistics than the ones found by Levy Yeyati et at (2006) for illiquid stocks.

[11] Estimates of half-lives differ for two reasons. First, as expected since new information creates price movements in one market while the other one is not reacting, estimates of beta are smaller in absolute values if all opening days are used. For instance, for GHL, beta is -0.1 if all days are used, while it is -0.24 if only positive trading days are used. This would tend to create longer half-lives with all opened day estimates. However, since the gap between two opened days is small (1.7 week days) while the gap between two positive trading days is large (13 week days), computing the half-life by multiplying the gap by the regression half life gives larger half-lives estimated when one use only positive trading days. The difference between the estimates is small for liquid assets, but is very large for illiquid assets (the half-life for GHL is only 10 days – against the 30 day estimate presented here – if one estimates it using all opened days data. We prefer the estimate using only positive volume data because it allows us to distinguish well between problems of liquidity and problems of arbitrage opportunities.

$$\begin{cases}\Delta p_t &= \alpha + \beta p_{t\text{-}1} + \sum_{k=1}^{3} \varphi_k \Delta p_{t\text{-}k} + \varepsilon_t \\ \sigma_t^2 &= \alpha_0 + \alpha_1^i \varepsilon_{t-1}^2 + \lambda_1 \sigma_{t-1}^2\end{cases}$$

where the first equation is the mean equation, and the second equation is the variance equation of the GARCH model. The GARCH model includes one ARCH lag (coefficient α_1) and one GARCH lag (coefficient λ_1). In the mean equation, we add three lags of the dependent variable to control for the serial correlation that is apparent in the data. We use the Quasi-Maximum Likelihood Estimator to account for the non-normality of errors suggested by the Jarque-Bera test. The results are reported in table 9.

All beta-coefficients (column a) have the expected sign and all but two are highly significant. The half-life estimates are reported in table 9 column b. The time unit is a period between two simultaneous trading days. We also multiply these half-lives by the average number of week days between two simultaneous trading days (shown in table 7) to express the half-life in week days rather than trading days (column c).

On average, the half-life is 18 week days for the TTO-JAM premium, 9 times higher than what we found for France-Germany or for Argentina-Brazil cross-listings, and more than twice larger than the estimate for Singapore-Hong-Kong. Even larger is the BRB-TTO half-life since liquidity is very low in the BSE. Although market forces eventually guarantee that stock prices evolve in parallel, market inefficiencies are still significant and undermine stock price convergence.

Part of the explanation for this slow convergence can be found in low liquidity. To further analyze this, we show the regression half-lives in column b. These half-lives correspond to the number of simultaneous trading days (as opposed to the number of week days, as presented in column c, which will be bigger since not all week days witness trading in both markets) that are needed to halve an arbitrage opportunity. As a result, the lack of liquidity, and in particular the presence of no-trading days, should not bias this measure much, since the simultaneous trading days are days in which the assets were available to buy and to sell in both markets. According to this measure, the Caribbean stock markets fare better. In particular, the half-lives in the Caribbean are shorter than between Singapore and Hong-Kong, and of the same order of magnitude than between Argentina and Brazil. This suggests that, putting illiquidity issues aside, there are no major barriers to arbitrage trading within the Caribbean. Nonetheless, illiquidity is detrimental to the functioning of the markets, and by itself hampers financial integration. As a result, the two metrics presented in columns b and c need to be considered together.

We finally question whether the existence of a third 'efficient' cross-listing may bias our measure. When there is a third cross-listing in an advanced market, price determination and price convergence in the less developed markets may be facilitated by trading originating from the developed market. Since the Caribbean regional stocks are less often cross-listed in the US, it is possible that we underestimate Caribbean integration because we compare Caribbean stocks with other stocks that benefit from efficient pricing in advanced markets. We report in the last two columns of table 7 the number of cross-listings in advanced markets

(US, EU, UK, Australia). Two Caribbean stocks, GKC and GHL are listed in advanced markets. We checked whether cross-listing with advanced markets undermined our conclusion (that Caribbean stock markets are not well integrated) using a regression linking half-lives to a dummy variable for the Caribbean and the number of cross-listings. We found that half-lives in the Caribbean are higher than that of other regions even after controlling for the number of cross-listing with advanced markets, or after controlling for the total number of cross-listings. The difference is statistically significant, although the sample remains too small to give too much weight to this evidence.

C. Threshold Auto-Regression (TAR) Estimator

Since non-linearities may bias our estimates, we also applied a Threshold Auto-Regression (TAR) model due to Tong (1978) and popularized by Obstfeld and Taylor (1997). TAR models are used to separate the data into two samples: for "small" arbitrage opportunities a speed of convergence β^{in} is estimated, while for "large" arbitrage opportunities, a speed of convergence β^{out} is obtained. The threshold that divides the sample between "small" and "large" arbitrage opportunities is chosen endogenously. The goal of such a TAR estimator is to find three parameters: the size of a "neutral band" in which deviations of the LOOP are slowly - or even not at all - arbitraged away; the speed of convergence within the neutral band β^{in}; and the speed of convergence outside the neutral band β^{out}.

The method is described in Appendix A. The value of the optimal threshold is relatively high (column a, 8.1 on average for the TTO-JAM premium) and of the same order of magnitude than the mean absolute premium. The coefficients β^{out} are negative as expected (column c). In most cases, β^{in} is also negative and $|\beta^{in}| < |\beta^{out}|$ which justifies investigating a TAR model.[12] The TAR estimates[13] confirm that price convergence is slow in the Caribbean, even for large arbitrage opportunities: the half-lives outside of the band reach an average of around 7.3 week days for TTO-JAM premium (to be compared with around 5 days for Hong-Kong and Singapore cross-listings).

[12] However, the existence of non-linearities does not imply existence of a proper neutral band though. For most series, the in-band speed of convergence is significantly different from 0 at the 10 percent confidence level. And although betas out of the neutral band are relatively high, they remains twice lower than what is found for FRA-GER integration. We did not perform the likelihood ratio tests to check whether the ARCH-TAR is a better model than the standard ARCH-AR. The reason is that under the null hypothesis of AR model, the parameter c is not defined: therefore, standard inference is not valid and Monte-Carlo simulations would be needed. However, it was shown by Johansson (2001) and underlined by Levy Yeyati et al (2006) that these tests have low power: the probability to mistakenly reject a TAR model is high.

[13] Similar results are obtained if one follows Levy Yeyati et al. (2006) and forces $\beta^{in} = 0$ (on average, c= 8.35, $\beta^{out} = -0.56$ for the TTO-JAM premiums), or if the Obstfeld-Taylor (1997) two-equation estimator is used (on average, c = 6.4, $\beta^{out} = -0.57$). If the same estimators are used on de-trended data, estimates of neutral bands remain high (around 5) but speeds of convergence out of the band become smaller (around -0.2).

IV. CURRENT ACCOUNT CONVERGENCE AND REGIONAL TRADE BALANCE

After studying price-based information from a few stock prices, we investigate at a macroeconomic level the extent of integration of the CARICOM countries. The current account literature has followed the influential work of Feldstein and Horioka (1980) on savings-investment correlation, but has been now updated with dynamic models of the current account (Taylor, 2002 and Obstfeld and Taylor, 2004).

A. Theory

A theoretical framework due to Trehan and Walsh (1991) on the long-run budget constraint underpins this literature. Let B_t be debt at time t, Y_t output, NX_t the balance of trade and CA_t the current account. In lower case we write b_t the debt burden as a share of output, nx_t and ca_t the trade and current accounts as a share of GDP. The interest rate, r, and the growth rate, g, are assumed to be constant for simplicity (or at least their expectations are constant, in a more general framework with uncertainty).

The balance of payments at time t is $NX_t + rB_{t-1} = B_t - B_{t-1}$
Or equivalently, expressed in shares of GDP

$$nx_t + \frac{1+r}{1+g} b_{t-1} = b_t$$

At t+j, and dividing by $(1+r)^j/(1+g)^j$ this becomes

$$\frac{nx_{t+j}}{(1+r)^j/(1+g)^j} + \frac{b_{t+j-1}}{(1+r)^{j-1}/(1+g)^{j-1}} = \frac{b_{t+j}}{(1+r)^j/(1+g)^j}$$

Summing these equations for all j >0,

$$\sum_{j=0}^{\infty}\left(\frac{nx_{t+j}}{(1+r)^j/(1+g)^j}\right) + (1+r)/(1+g)\, b_{t-1} = \lim_{j\to\infty}\frac{b_{t+j}}{(1+r)^j/(1+g)^j}$$

The no-Ponzi game condition that $\lim_{j\to\infty}\frac{b_{t+j}}{(1+r)^j/(1+g)^j} = 0$ is the condition that rules out debt bubbles and therefore summarizes the long-run balance constraint. An important result for our study comes from Trehan and Walsh (1991) who show that a sufficient condition for this to hold is that ca_t be stationary, under the reasonable assumption that 1+r/1+g >1. The intuition is simple: if ca_t is stationary, then the debt b_{t+j} will be a linear function of time j, *i.e.* $b_{t+j} = m+nj$. Then,

$$\lim_{j\to\infty}\frac{m+nj}{(1+r)^j/(1+g)^j} = 0$$

Therefore, we can assess the tightness of the long-run constraint by testing whether the current account is stationary. Furthermore, according to Taylor (2002), the speed of adjustment of the current account to its equilibrium level is a measure of financial integration in the world economy. The intuition is that a country with good access to capital markets can finance a current account deficit over several periods, whereas a country with less access to foreign capital needs to re-balance quickly its current account under a threat of balance of payments problem. Thus, a large adjustment speed would mean that current account deficits cannot remain open for long, and hence that financial integration is low. Taylor (2002) defends this measure of capital mobility and shows that it replicates the findings that the Gold Standard and post-Bretton Woods eras had witnessed high capital mobility compared with the inter-war and Bretton-Woods periods.

B. Estimation Framework

We follow Taylor's interpretation of the speed of convergence of the current account and estimate a simple DF equation[14]

$$\Delta ca_{it} = \alpha_i + \beta_i ca_{it-1} + \varepsilon_{it}$$

To increase the power of the unit root test and the accuracy of the speed of convergence, we pool the data into five regional groups

i) the CARICOM14 : all CARICOM countries but Montserrat for which data was unavailable for a sufficiently long period;

ii) the EU15 group, where Belgium and Luxembourg were merged;

iii) the MERCOSUR+5 group of the 10 South American countries;[15]

iv) the ASEAN10+3 group of the 13 counties that participate to the Chiang Mai Initiative;[16]

v) the ECOWAS15 of all countries that participate in the Economic Community of West African States (ECOWAS) expect Liberia, for which data was unavailable for a sufficiently long period.[17]

We use four methods to estimate the convergence speed in a panel data: the Mean Group Estimator (put forward by Pesaran and Smith (1995) and Lee, Pesaran and Smith (1997)), the standard panel method used in Obtfeld and Taylor (2004) (in general Fixed Effects – FE - , unless the Breusch-Pagan and Hausman tests pointed at other estimators, i.e. pooled OLS – POLS – or Random Effects - RE), the Levin, Lin and Chu method (LLC, 2002) - which is a multiple ADF test and an extension of the Levin and Lin (1992) test,[18] and the Arellano and Bond GMM estimator, which is often used to correct for the downward Nickell bias in short

[14] We do not include the complex dynamics from Augmented Dickey Fuller tests in our regressions. The reason for this is that we are crucially interested in the value of the speed of adjustment and comparisons between regions, and not only in its statistical significance. With additional lags, comparing dynamics would be possible only by looking at impulse response functions, a more cumbersome method.

[15] Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela

[16] Brunei Darussalam, Cambodia, China , Indonesia, Japan, Korea, Lao People's Dem.Rep, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.

[17] Were included in this group Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.

[18]We use the STATA routines implemented by Baum and Bornhorst (2006). Unfortunately the Levin, Lin and Chu test cannot be used on un-balanced panels.

time series panel models (although the time dimension in our data is not fully appropriate for this GMM). Of the four estimators, the Mean Group Estimator, (MGE), which allows for slope and error term heterogeneity, seemed the most robust.[19] The standard panel models were less convincing. Most times, Breusch-Pagan and Hausman test confirmed the prior in favor of the FE model. The Levin, Lin and Chu model gave more robust results. The region rankings suggested by Arellano-Bond estimator[20] were also coherent with the other estimates, although, as expected, the speeds of convergence are larger when the Nickell bias is removed.

C. Global Financial Integration

The results are presented in tables 11 to 13. All estimators confirm that the beta is negative for all periods and regions, and all standard errors are small.[21] The CARICOM, with a beta of -0.4 close to the world average, is less integrated than the developed EU15 or ASEAN+3 groups, although it fares well with respect to both South-American and West-African countries. A similar beta is obtained by the other estimators too, and rankings are consistent across estimates, although the estimators disagree on the order of the MERCOSUR+5 and the ECOWAS15 groups.

How confident can we be about these statistics as a measure of financial integration? We compare the beta-coefficient with the log of the volume of foreign liabilities (in percentage of GDP, average of 1975-2005 data) for the countries of our 5 regional groups for which we have data. As the scatter plot in figure 3 and the correlation coefficient (0.35 for all countries, 0.66 after removing the 5 most obvious outliers) confirm, the relation is strong. This gives us more confidence in the pertinence of this estimator. We also test whether the Caribbean beta was significantly less negative than the MERCOSUR+5 coefficient using the following fixed-effects regression:

$$\Delta ca_{it} = \alpha_i + \beta_i ca_{it-1} + \beta_i^C ca_{it-1} \mathbf{I}_{\{CARICOM\}} + \varepsilon_{it}$$

where $\mathbf{I}_{\{CARICOM\}}$ is a binary variable equal to 1 for countries in the CARICOM. We find that β_i^C was significantly positive which would indeed suggest that the difference is statistically significant. However, statistical significance is not robust to adjustment for heteroscedasticity.

We divide the data into two sub-periods, 1975–90 and 1991–2005, to assess whether integration has been improving. The results are presented in tables 12 and 13. All estimators

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[19] The variance of the individual estimators was used to estimate the MGE standard deviation. The MGE does not follow a normal distribution; but since it is an average of ADF distributions, it converges to a normally distributed random variable.

[20] The following equation was estimated $ca_{it} = \alpha_i + \delta\, ca_{it-1} + \varepsilon_{it}$ and the speed of convergence the speed of convergence was deduced from $\beta = \delta - 1$.

[21] The Levin-Lin-Chu test confirm the stationarity of the current account at the 1 percent level for all regions. However standard statistical inference cannot be performed with the other estimators since they are not normally distributed.

confirm that the speed of adjustment was larger for the early period of our sample, for all regions we are studying. Unfortunately, the loss of accuracy due to the reduction of the sample is detrimental to our cross-region study since the four estimators disagree in regional rankings. However, all estimators but the LLC one point at the CARICOM14 as the least integrated region until the 1990s. According to these results, the progress in financial integration would therefore be due only to the last two decades. The evolution of the ECOWAS15 and MERCOSUR+5 regions are on the contrary disappointing since the value of the β coefficients remained about the same across periods. In conclusion, our results suggest that the CARICOM14 has become more integrated in the recent decades, with levels of financial integration above other LDCs, albeit its performance lags behind that of the EU15 or ASEAN+3 groups.

D. Intra-Regional Trade and Regional Financial Integration

Trade with other CARICOM countries is significant in the region, with exports approaching 10 percent GDP in the recent years (table 4). As for other LDCs, the CARICOM tends to export primary goods and depends more on world markets than do developed countries. The performance of the CARICOM is therefore positive, compared to the MERCOSUR+5 or ECOWAS15 groups. The literature on regional integration has commonly acknowledged the importance of trade links in determining financial links, both at the theoretical and at the empirical level (see Fernandez-Arias and Spiegel, 1998 and Rose and Spiegel, 2002). There may be several reasons for this. First, trade in services (especially in the financial sector) almost necessarily takes place through FDI settlements. This is however of a limited importance for the countries we are dealing with. More significant is the volume of trade credit which represents an important source of financial flows. Furthermore, sovereign risk and credibility-enhancement mechanisms tend to make trade links a key determinant of capital flows (Rose and Spiegel, 2002).

Importantly for our purpose, regional trade imbalances are a large component of current account deficits (more than 40 percent for most CARICOM countries). Hence, a separate study of the dynamics of the trade imbalances with respect to the region as a group may be worth doing if we want to assess regional financial integration, and not only world integration. We estimate the panel model

$$\Delta ca^{*}_{it} = \alpha_i + \beta_i^{*} ca^{*}_{it-1} + \varepsilon_{it}$$

where ca^{*}_{i} is the trade balance, as a share of GDP, of country i with respect to the CARICOM group, computed by summing relevant bilateral imports and exports.

The MGE estimates an average β of -0.34, lower than the beta found for global integration. This is reminiscent to results such as the ones in Bayoumi and Rose (1993) who showed that the slope parameter, in a Feldstein-Horioka estimation of investment regressed on savings, is lower when UK regional data is used than when national data is used. One has to be cautious with the meaning of this result though: when a regional trade balance is in deficit, the country can gain a trade surplus from third parties, i.e. from countries outside the region (*world trade integration*). Furthermore, another way to finance a regional trade deficit is to borrow from countries outside the region (*world financial integration*). As a result, the constraint on the regional current account may be less tight, but we cannot interpret this as a proof of regional financial integration.

We therefore need to control for the two possible ways to finance regional trade imbalances. We call $ca' = ca - ca^*$ the extra-regional current account, i.e. the difference between the current account and the regional trade balance. We first control for the simultaneous correlation of ca' and ca^* that signals trade co-movements (δ coefficient in our regression). In addition, if a CARICOM country borrows from the rest of the world, it is expected that it will pay back in the future with positive ca' surplus, and one should see that a negative ca^* will generate future adjustments in ca' captured by $\Delta ca'$. Our γ coefficient will capture this correlation, as a proxy for world financial integration.

Hence, we estimate the model[22]

$$\Delta ca^*_{it} = \alpha_i + \beta_i^* ca^*_{it-1} + \gamma_i \Delta ca'_{it} + \delta_i ca'_{it-1} + \varepsilon_{it}$$

which can also be interpreted as:

$$\Delta ca^*_{it} - \gamma_i \Delta ca'_{it} = \alpha_i + \beta_i^* ca^*_{it-1} + \delta_i ca'_{it-1} + \varepsilon_{it}$$

If $\gamma_i < 0$, the extra-regional current account adjusts when there is a deficit in the regional trade balance. If $\gamma_i = -1$ the adjustment is bore symmetrically by ca' and ca^*. If γ_i is close to zero, a small current account deficit requires a large adjustment of extra-regional trade balance, which suggests low financial integration. Since we now control for the adjustment due to ca'_{it}, we speculate that β_i captures the tightness of the current account constraint at the regional level, *i.e.* β_i would be a proxy for the extent of regional financial integration.

Since it is not possible anymore to use the LLC estimates with this form of equation, we look only at the mean group estimator (MGE), the fixed effects (FE) model and the Arellano-Bond estimator. MGE results are presented in table 14 along with the other estimators. The MGE estimates seemed again the most reliable ones. β and γ can help together to interpret the adjustment of the balance of payments. γ is a measure of world financial integration, and β, our parameter of interest, is a measure of regional financial integration.

For all regions we covered, the MGE give β parameters that have the expected signs and low standard errors. The estimates of γ complete the picture we drew earlier on global financial integration. For instance, we argued that the MERCOSUR+5 was restricted in its ability to borrow. Clearly this would come from lack of integration to world markets (the γ of MERCOSUR+5 is 0). At the opposite, the ASEAN+3 group is highly integrated to world markets. The CARICOM14 is in the middle, being less integrated than the developed countries but faring better than the MERCOSUR+5 and ECOWAS15.

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[22] Since we checked for stationarity of all the elements, estimating this equation is possible

The main variable of interest for us is the β that we argued would proxy for the extent of regional financial integration. As in the global integration estimates, the CARICOM14 ranks in the middle, with a performance comparable to the MERCOSUR+5 and faring better than the ECOWAS15 group. Since the regressions presented here rely on different data than the one analyzed earlier (here we are working with balance of trade disaggregated between regional partners and rest of the world), it is comforting that the results are consistent with our estimates of global integration.

However, the estimates seem here less robust to the method chosen. The MGE, that we favor because it does not force homogeneity in the parameters and the error terms, gives a more intuitive perspective than the FE or Arellano-Bond estimators. For these two estimators ECOWAS15 would be a well-integrated economy with a β similar to the ASEAN13 one, while the CARICOM14 would be a much less integrated economy.

We applied the same method to pre and post 1990 data to obtain estimates on recent changes (tables 15 and 16). Although the CARICOM group still ranks at the 3rd place far from the ASEAN13 region, it now fares significantly better than then MERCOSUR+5. The data therefore suggests that the extent of financial integration , both global and regional, is improving in the CARICOM, a feature that is less striking for the other emerging or developing economies.[23]

V. Conclusion

We provided in this paper an assessment of regional financial integration in the Caribbean using financial and macroeconomic data. The picture that emerges is that of a region that benefits from large volumes of flows, which help in financing current account imbalances, although illiquidity is still deterrent for the functioning of the markets. It is indeed a paradox that with high debt levels and large stock market capitalization, re-trading is almost inexistent in the bond markets and inefficient in the stock markets. This may be explained by institutional barriers, such as the inefficiency of the settlement systems, or by the relative novelty of large regional flows, which were mostly driven by the Trinidad and Tobago's recent current account surpluses. The challenge for the regional economies is then twofold. First, ensuring that regional flows persist. There is indeed a risk, since these flows where driven by oil price generated surplus, that the flows vanish with low oil prices. Second, the functioning of the financial markets, both in equities and in debt instruments, can be improved significantly. The benefits could be large considering the size of the CARICOM financial sector.

[23] Again the FE and Arellano-Bond give a more surprising picture, with the ECOWAS15 group being very integrated according to the Arellano-Bond estimator, while the CARICOM14 group would be second to the EU15 according to the FE estimator.

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APPENDIX A

Following Levy Yeyati et at (2006) method, we estimate a band-TAR model on the cross-market premium p_t. We call the threshold c>0. We use a single equation approach[24] in which both AR-in and AR-out coefficients are estimated in one equation, using two explanatory variables: the first one is the value of premium if it is inside the band, 0 otherwise; the second one is the difference between the premium and c if the premium is outside the band, 0 otherwise. We use the same estimation procedure as in the AR model above, i.e. we correct for ARCH and GARCH effects and for serial correlation, and rely on the Quasi-Maximum Likelihood Estimator. The model we estimate is therefore[25]:

$$\begin{cases} \Delta p_t = \alpha + \beta^{in} I^{in} p_{t-1} + \beta^{out} I^{out} (p_{t-1} - \text{sign}(p_{t-1})\, c) + \sum_{k=1}^{3} \varphi_k \Delta p_{t-k} + + \varepsilon_t \\ \sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^{i\,2} + \lambda_1 \sigma_{t-1}^2 \\ I^{in} = 1 \text{ if } c > p_{t-1} > -c, \quad 0 \text{ otherwise} \\ I^{out} = 1 \text{ if } \quad p_{t-1} > c \quad \text{or} \quad -p_{t-1} > c, \quad 0 \text{ otherwise} \end{cases}$$

where the first two equations refer to the GARCH dynamics of the premium, while the last two equations define the dummies I^{in} and I^{out} that generate the two sampled explanatory variables. As before, the first equation is the mean equation, while the second equation is the variance equation characteristic of GARCH models, with one ARCH lag (coefficient α_1) and one GARCH lag (coefficient λ_1).

The threshold c is chosen optimally following a maximum likelihood algorithm. More precisely, for each c in a certain range[26], the likelihood of each model L^{TAR} (c) is computed and the c that maximizes L^{TAR} is chosen as the threshold. The TAR–GARCH model requires a long span of data to ensure convergence and robustness. Hence, the method is not of much use for the least liquid stocks, but we present all results for comprehensiveness. The GARCH lag was also removed for RBTT and FCIB because they prevented the convergence of the ML estimator. The results are available in table 10.

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[24] The single equation approach in a GARCH model forces the behaviour of the error term and the conditional variance to be the same in the two segments of the data. To avoid this issue, we also estimated a slightly different model closer in spirit to Obstfeld and Taylor (1997), where the two samples are really divided and estimated separately. Since the number of data points is reduced significantly with this method, the GARCH estimates often do not converge and we therefore preferred to present here the one-equation method as in Levy Yeyati et al (2006). When convergence was achieved, the results seemed on average consistent.

[25] We also ran regressions on de-trended data and we removed the constant term μ in that case. The results were on average similar.

[26] The range c chosen is $c \in [p^{10th} ; p^{90th}]$ where p^{10th} and p^{90th} refer to the 10^{th} and 90^{th} percentile of the distribution of p. This is done to ensure that each regression always use at least 10 percent of the data. However, sometimes the GARCH model tends not to converge for the smallest and largest values of c. In that case the estimation results are discarded for these thresholds. c is incremented by steps of 0.1.

Table 1. Balance of Payments

Gross Financial Account and Reserves Items of the CARICOM (In millions of U.S.dollars)

	2002	2003	2004	2005	2006 a/
C. Financial Account	1684	2082	2574	3763	3543
Direct investment abroad	108	-39	230	-86	-116
Direct investment in CARICOM	2244	2409	2969	2791	2649
Portfolio investment assets	-1640	-1902	-1743	-543	-1784
Equity securities	-24	-55	-61	0	-4
Debt securities	-1614	-1837	-1688	-525	-1772
Portfolio investment liabilities	1153	1396	1429	386	1188
Equity securities	95	0	-5	4	0
Debt securities	889	1296	1400	352	1206
Financial derivatives (assets)	1	1	2	0	0
Financial derivatives (liabilities)	0	0	-1	0	0
Other investment assets	46087	19159	-11192	-9005	-15490
Monetary authorities	27	23	-71	13	72
General government	46	94	98	4	-3
Banks	45696	18575	-11733	-9501	-16143
Banks (excluding Bahamas)	56760	29639	-669	1563	-5079
Other sectors	23	98	-80	84	122
Other investment liabilities	-46268	-18942	10879	10220	17097
Monetary authorities	5	4	-4	2	1
General government	-229	352	195	160	73
Banks	-45878	-19017	12056	9577	16101
Banks (excluding Bahamas)	-56989	-30129	944	-1535	4989
Other sectors	228	51	-676	792	1251
E. Reserves and Related Items	-108	-1680	-1985	-589	-164

Table 2. UNCTAD FDI Inward Stock (In millions of U.S. dollars, 2001)

Source\ Destination	Bahamas	Barbados	Belize	Guyana	Haiti	Jamaica	St Lucia	Suriname	Trinidad &Tobago
Canada	4670	13123		97		395			64
Colombia	148	2				1			2
Estonia	2								
Germany	39	295							
Malaysia	51		0	2				28	
Netherlands								22	
Republic of Korea	24	0		4		6			
United States	3291	2141	103	131	55	2483	19	28	1550

Table 3. UNCTAD FDI Outward Stock
(In millions of U.S. dollars, 2001)

Destination\Source	Bahamas	Barbados	Belize	Guyana	Jamaica	Suriname	Trinidad & Tobago
Brazil	944	656	16	2			
Canada	121	156			1		
Colombia	311	9					
Estonia	10		5				
Germany	21						
Hong Kong, China	381						
Latvia	9		0				
Netherlands						53*	
Philippines	9						
Sri Lanka	13						
United States	1254	1560					40
Venezuela	67						

* 1999 data

Table 4. Regional Exports, as a Share of GDP
(In percent)

Region	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
EU15	27.6	26.6	27.2	31.3	34.3	33.4	32.3	32.3	33.1	33.5
ECOWAS15	5.2	5.8	6.2	6.0	6.5	6.0	6.5	5.9	7.1	7.1
ASEAN+3	11.4	11.9	10.7	11.1	13.2	13.1	14.3	16.2	18.4	20.2
MERCOSUR+5	4.8	5.2	5.2	5.2	5.9	6.1	6.5	6.6	7.6	7.5
CARICOM	7.1	7.3	7.1	7.7	7.0	8.3	7.3	8.2	9.5	9.6

Table 5. Interest Rates: Principal Component Analysis, 1980m1–2005m12

	BHS	BRB	BLZ	GUY	JAM	SKT	SLU	SVG	TTO	USA
BHS	1									
BRB	0.61	1								
BLZ	0.7	0.4	1							
GUY	0.38	0.58	0.16	1						
JAM	-0.25	0.13	-0.48	0.39	1					
SKT	-0.46	-0.54	-0.37	-0.5	-0.18	1				
SLU	0.16	0.08	0.11	0.38	0.35	-0.33	1			
SVG	0.36	0.29	0.31	0.32	0.1	-0.16	0.57	1		
TTO	-0.39	0	-0.65	0.23	0.64	-0.13	0.36	0.19	1	
USA	0.76	0.52	0.77	0.2	-0.41	-0.53	0.05	0.3	-0.41	1
f1	**0.89**	**0.72**	**0.83**	**0.51**	**-0.22**	**-0.66**	**0.28**	**0.48**	**-0.34**	**0.87**
f2	**-0.11**	**0.27**	**-0.39**	**0.61**	**0.83**	**-0.37**	**0.64**	**0.4**	**0.82**	**-0.27**
f3	**-0.01**	**-0.41**	**0.17**	**-0.25**	**-0.2**	**0.33**	**0.56**	**0.65**	**-0.02**	**-0.01**

Table 6. Interest Comovements

2000-2005	Backward exp.	Forward exp.	Back and forward exp.
Trin. & T- Bahamas	-0.21	-0.47	-0.41
Trin. & T - Barbados	0.42	0.56	0.46
Trin. & T - Belize	0.71	0.35	0.43
Trin. & T - Grenada (since 2001)	-0.11	0.07	-0.26
Trin. & T - Guyana	0.31	0.68	0.7
Trin. & T - Jamaica	-0.22	0.05	-0.01
Average TTO-CARICOM	**0.15**	**0.2**	**0.15**
Trin. & T - USA	0.88	0.96	0.93
Control group:			
Ghana-Gambia	0.66	0.39	0.35
Ghana-Nigeria	0.64	0.1	0.3
Ghana-Sierra Leone	0.63	0.07	0.24
Average GHA-GAM-NIG-SLE	0.64	0.19	0.3
Ghana-USA	0.65	0.29	0.35
Ghana-France	0.56	0.17	0.19
Italy-Germany	0.99		
USA-Germany	0.77	0.35	0.56

Table 7. Cross-Listed Stocks

Company Name (Full name)	Start date	End date	trading days 1/	n. of days since first trading	Average trading Period 2/	Adv market listings 3/	Regional Market listings
TTO-JAM premium (avg)			**241**	**1345**	**5.41**		
GKC (Grace Kennedy and Co)	2/2/2001	7/18/2006	430	1992	3.31	1	4
JMMB (Jamaica Money Market Broker)	2/7/2003	7/21/2006	383	1260	2.35	0	3
RBTT (Royal Bank of Trinidad and Tobag	11/28/2001	6/28/2006	129	1673	9.26	0	3
FCIB (First Caribbean International Bank)	1/15/2003	6/30/2006	116	1262	7.77	0	5
NCBJ (National Commercial Bank Jamaic	11/21/2003	7/21/2006	329	973	2.11	0	2
CCMB (Capital and Credit Merchant Bank	10/1/2003	7/4/2006	267	1007	2.69	0	2
DBG (Dehring, Bunting & Golding)	10/15/2004	7/21/2006	166	644	2.77	0	2
GHL (Guardian Holdings Ltd)	2/20/2001	6/21/2006	107	1947	13	1	3
TTO-BRB premium (avg)			**88**	**2015**	**18.53**		
FCIB (First Caribbean International Bank)	2/7/2003	12/23/2005	114	1050	6.58	0	5
BST (Barbados Shipping and Trading Co	4/20/1999	12/20/2005	89	2436	19.55	0	2
RBTT (Royal Bank of Trinidad and Tobag	12/8/1998	12/9/2005	62	2558	29.47	0	3
HKG-SGP premium (avg)			**642**	**1532**	**2.45**		
Guangzhou (Guangzhou Investment Co L	6/24/1999	7/5/2001	114	742	4.65	2	3
Sunway (Sunway International Holdings Lt	9/6/1999	8/23/2006	849	2543	2.14	2	2
TPV (TPV Technology Ltd)	10/11/1999	8/31/2006	1638	2516	1.1	4	2
Burwill (Burwill Holdings Ltd)	3/11/1999	9/7/2000	308	546	1.27	3	2
Benefun (Benefun International Holdings L	8/13/1998	3/19/2002	301	1314	3.12	2	3
BRA-ARG premium			**297**	**439**	**1.1**		
Petrobras	4/28/2006	7/11/2007	297	439	1.1	14	11
GER-FRA premium (avg)			**1575**	**2887**	**1.36**		
Accor (Accor SA)	8/3/1998	9/5/2006	1551	2955	1.36	33	0
AirFranceKLM (Air France-KLM)	2/23/1999	9/5/2006	1171	2751	1.68	24	0
AirLiquide (Air Liquide SA)	8/3/1998	9/5/2006	2004	2955	1.05	36	0

Table 8. Cross-Market Premium

	mean	Standard dev.	10% percentile	90%percentile
TTO-JAM premium (avg)	**6.6**	**5.8**	**0.9**	**13.0**
GKC	5.7	4.2	1.0	10.9
JMMB	7.8	5.6	1.7	16.1
RBTT	4.9	5.8	0.4	13.3
FCIB	7.1	5.3	0.4	11.0
NCBJ	5.3	5.0	0.9	9.3
CCMB	6.2	5.5	0.9	11.5
DBG	6.0	4.2	1.1	11.2
GHL	9.7	11.1	0.7	20.5
TTO-BRB premium (avg)	**5.2**	**4.1**	**0.9**	**10.3**
FCIB	4.9	3.7	1.3	8.6
BST	4.0	3.5	0.7	8.8
RBTT	6.9	5.1	0.7	13.4
HKG-SGP premium (avg)	**6.2**	**5.4**	**1.0**	**13.1**
Guangzhou	4.3	3.4	0.7	9.2
Sunway	9.0	6.7	2.0	18.4
TPV	3.6	4.4	0.3	8.9
Burnwill	3.8	3.4	0.4	7.9
Benefun	10.3	9.1	1.6	21.0
BRA-ARG	**1.1**	**1.0**	**0.1**	**2.4**
Petrobras	1.1	1.0	0.1	2.4
GER-FRA premium (avg)	**1.1**	**1.2**	**0.1**	**2.5**
Accor	1.7	1.7	0.2	3.8
AirFrance KLM	1.0	1.3	0.0	2.3
AirLiquide	0.6	0.7	0.0	1.4

Table 9. (G) ARCH-AR Model

	β	regression half-life 1/	week day half-life 2/	ARCH lag	GARCH lag
	(a)	(b)	(c)	(d)	(e)
TTO-JAM premium	**-0.2**	**3.8**	**18.3**		
GKC	-0.14 ***	4.58	15.2	0.18 ***	0.8 ***
JMMB	-0.12 ***	5.61	13.2	0.21 **	0.29
RBTT	-0.18	3.41	31.5	0.53	0.01
FCIB	-0.18	3.42	26.6	0.12	0.74
NCBJ	-0.17 ***	3.61	7.6	0.17 *	0.48 *
CCMB	-0.15 ***	4.14	11.1	0.25 **	0.62 ***
DBG	-0.2 ***	3.11	8.6	0.17 *	0.24
GHL	-0.24 ***	2.48	32.2	0.51	0.11
TTO-BRB premium	**-0.3**	**2.2**	**40.3**		
FCIB (no GARCH)	-0.27 **	2.23	14.7	0.37	
BST (no GARCH)	-0.31 ***	1.85	36.3	0.73 *	
RBTT (no GARCH)	-0.25 **	2.38	70.1	0.17	
HKG-SGP premium	**-0.2**	**4.3**	**8.4**		
Guangzhou	-0.34 ***	1.69	7.8	0.17	0.65 ***
Sunway	-0.08 ***	8.71	18.6	0.07 ***	0.92 ***
TPV	-0.1 ***	6.64	7.3	0.07	0.93 ***
Burwill	-0.21 ***	2.89	3.7	0.68	0.01
Benefun	-0.37 ***	1.5	4.7	0.31 ***	0.12 ***
BRA-ARG premium	**-0.22**	**2.8**	**2.9**		
Petrobras	-0.22	2.8	2.9	0.11 **	0.86 ***
GER-FRA premium	**-0.6**	**1.5**	**2.4**		
Accor	-0.89 ***	0.32	0.4	0.07 **	0.92 ***
AirFrance KLM	-0.17 **	3.66	6.1	0.28	0.81 ***
AirLiquide	-0.65 ***	0.65	0.7	0.14	0.88 ***

1/ ln(1/2)/ln(1+β)
2/ ln(1/2)/ln(1+β)*(n.of days between simultaneous trading)

Table 10. (G) ARCH-TAR Model

	c (a)	β^{in} (b)	β^{out} (c)	Regression half-life 1/ (out band) (d)	Week days half-life 2/ (e)	α_1 (f)	λ_1 (g)
TTO-JAM premium	**8.1**	**-0.1**	**-0.43**	**1.43**	**7.26**		
GKC	6.5	-0.2 ***	-0.35 ***	1.58	5.24	0.18 ***	0.8 ***
JMMB	14.3	-0.1 **	-0.64 ***	0.67	1.59	0.23 **	0.25 ***
RBTT (no GARCH)	4.2	-0.4 *	-0.39 ***	1.39	12.84	0.62 *	
FCIB (no GARCH)	7.3	-0.4	-0.49 ***	1.03	8.03	0.81	
NCBJ	2.2	0.7	-0.23 ***	2.69	5.69	0.26	0.33
CCMB	11.4	-0.2 ***	-0.28 **	2.07	5.59	0.27 **	0.64 ***
DBG	4.9	0.46 ***	-0.66 ***	0.64	1.78	0.35 *	0.32 **
GHL	14.1	-0.4 ***	-0.41 ***	1.33	17.35	0.54 *	0.17
TTO-BRB premium	**5.2**	**5.8**	**-0.7**	**1.4**	**38.19**		
FCIB (no GARCH)	8.6	-0.2	-1.12 ***	n.a.	n.a.	0.26	
BST (no GARCH)	6.3	-0.6 ***	-0.66 ***	0.65	12.63	0.82 **	
RBTT (no GARCH)	0.7	18.2 ***	-0.27 ***	2.16	63.76	0.2	
HKG-SGP premium	**4.7**	**-0.8**	**-0.3**	**3.2**	**5.6**		
Guangzhou	2.6	0.58	-0.54 ***	0.89	4.14	0.13	0.72 ***
Sunway	13.4	-0.1 ***	-0.16 ***	3.98	8.51	0.07 ***	0.92 ***
TPV	4.5	-0.2 ***	-0.08 **	7.93	8.7	0.35 ***	4.34 ***
Burwill	1.2	-1.4 **	-0.27 ***	2.23	2.83	0.7	0.02
Benefun	1.9	-3	-0.43 ***	1.22	3.79	0.34 ***	0.62 ***
BRA-ARG premium	**1.8**	**-0.4**	**-0.21**	**2.9**	**3**		
Petrobras	1.8	-0.4 ***	-0.21	2.9	3	0.12 ***	0.86 ***
GER-FRA premium	**0.6**	**-8.2**	**-0.7**	**0.6**	**0.81**		
Accor	0.2	-1.9 *	-0.92 ***	0.28	0.38	0.07 **	0.92 ***
AirFrance KLM	1.5	-0.2 ***	-0.57 ***	0.83	1.39	0.28 *	0.8 ***
AirLiquide	0	-23 ***	-0.67 ***	0.62	0.66	0.14	0.88 ***

1/ $\ln(1/2)/\ln(1+\beta^{out})$

2/ $\ln(1/2)/\ln(1+\beta^{out})$*(n.of days between simultaneous trading)

Table 11. β Coefficient from 1975–2005

Region	MGE		Panel Model*		LLC Test		Arellano-Bond	
EU15	-0.25	-0.03	-0.25	-0.03	-0.18	-0.03	-0.34	-0.03
ASEAN10+3	-0.31	-0.04	-0.29	-0.08	-0.38	-0.05	-0.36	-0.04
CARICOM14	**-0.4**	**-0.04**	**-0.39**	**-0.06**	**-0.37**	**-0.03**	**-0.39**	**-0.04**
MERCOSUR+5	-0.41	-0.05	-0.48	-0.04	-0.52	-0.05	-0.55	-0.05
ECOWAS15	-0.43	-0.04	-0.43	-0.07	-0.44	-0.04	-0.44	-0.04

*POLS for EU15, EU25 and SAM, FE otherwise

Table 12. β Coefficient from 1975–90

Region	MGE		Panel Model*		LLC Test**		Arellano-Bond	
EU15	-0.47	-0.06	-0.44	-0.05	-0.45	-0.06	-0.57	-0.04
ASEAN10+3	-0.46	-0.07	-0.55	-0.21	-0.67	-0.1	-0.59	-0.07
CARICOM14	**-0.54**	**-0.06**	**-0.6**	**-0.09**	**-0.49**	**-0.05**	**-0.61**	**-0.06**
MERCOSUR+5	-0.44	-0.07	-0.5	-0.06	-0.57	-0.07	-0.61	-0.07
ECOWAS15	-0.51	-0.06	-0.47	-0.09	-0.52	-0.06	-0.55	-0.07

*POLS for EU15, SAM
**LLC has to be performed on balance panel; start date was therefore 1976 for EU groups and 1982 for ASEAN13, with Brunei excluded

Table 13. β Coefficient from 1991–2005

Region	MGE		Panel Model*		LLC Test**		Arellano-Bond	
EU15	-0.25	-0.05	-0.2	-0.05	-0.15	-0.04	-0.31	-0.05
MERCOSUR+5	-0.46	-0.08	-0.47	-0.1	-0.53	-0.08	-0.67	-0.08
CARICOM14	**-0.46**	**-0.07**	**-0.42**	**-0.07**	**-0.44**	**-0.06**	**-0.52**	**-0.06**
ASEAN10+3	-0.34	-0.06	-0.29	-0.1	-0.31	-0.06	-0.39	-0.07
ECOWAS15	-0.49	-0.06	-0.42	-0.1	-0.45	-0.06	-0.41	-0.07

Table 14. Regional Financial Integration 1975–2005

MGE	β		γ		δ	
EU15	-0.18	(0.03)	-0.09	(0.03)	-0.08	(0.02)
ASEAN13	-0.23	(0.04)	-0.16	(0.04)	-0.06	(0.03)
CARICOM14	-0.32	(0.04)	-0.08	(0.02)	-0.04	(0.02)
MERCOSUR+5	-0.33	(0.04)	0.00	(0.04)	-0.09	(0.03)
ECOWAS15	-0.41	(0.04)	-0.10	(0.02)	-0.04	(0.02)

*Countries that were clearly very large outliers and with unreliable data were dropped (Ecuador, Suriname)

Fixed effects	β		γ		δ	
EU15	-0.18	(0.04)	-0.28	(0.11)	-0.10	(0.04)
ECOWAS15	-0.18	(0.08)	-0.06	(0.02)	-0.04	(0.02)
ASEAN13	-0.21	(0.06)	-0.40	(0.11)	-0.08	(0.04)
MERCOSUR+5	-0.26	(0.07)	-0.03	(0.03)	-0.10	(0.02)
CARICOM14	-0.30	(0.07)	-0.07	(0.04)	-0.02	(0.03)

*Countries that were clearly very large outliers and with unreliable data were dropped (Ecuador, Suriname)

Arellano-Bond	β		γ		δ	
EU15	-0.22	(0.03)	-0.37	(0.37)	-0.15	-(0.15)
ASEAN13	-0.22	(0.03)	-0.40	(0.03)	-0.09	(0.03)
ECOWAS15	-0.22	(0.04)	-0.07	(0.02)	-0.06	(0.02)
MERCOSUR+5	-0.27	(0.04)	-0.03	(0.03)	-0.10	(0.03)
CARICOM14	-0.32	(0.04)	-0.08	(0.02)	-0.03	(0.02)

*Countries that were clearly very large outliers and with unreliable data were dropped (Ecuador, Suriname)

Table 15. 1975–90 Estimates of Regional Financial Integration

MGE	β		γ		δ	
EU15	-0.36	(0.06)	0.04	(0.04)	-0.02	(0.05)
ASEAN13	-0.54	(0.07)	0.02	(0.05)	-0.04	(0.05)
MERCOSUR+5	-0.59	(0.08)	0.08	(0.04)	0.01	(0.04)
ECOWAS15	-0.62	(0.07)	-0.12	(0.03)	-0.08	(0.04)
CARICOM14	-0.69	(0.06)	-0.11	(0.03)	-0.10	(0.03)

*Ecuador, Guinea and Suriname were dropped for having unreliable data and outlying estimate

Fixed effects	β		γ		δ	
ASEAN13	-0.40	(0.09)	0.03	(0.04)	0.01	(0.04)
EU15	-0.42	(0.07)	-0.12	(0.07)	-0.05	(0.05)
MERCOSUR+5	-0.42	(0.10)	0.06	(0.03)	-0.01	(0.03)
ECOWAS15	-0.54	(0.11)	0.00	(0.01)	-0.01	(0.01)
CARICOM14	-0.56	(0.11)	-0.11	(0.05)	-0.11	(0.05)

*Ecuador, Guinea and Suriname were dropped for having unreliable data and outlying estimate

Arellano-Bond	β		γ		δ	
ASEAN13	-0.38	(0.06)	0.04	(0.03)	0.02	(0.03)
EU15	-0.46	(0.05)	-0.20	(0.03)	-0.12	(0.03)
MERCOSUR+5	-0.47	(0.08)	0.05	(0.03)	-0.01	(0.03)
CARICOM14	-0.57	(0.07)	-0.12	(0.03)	-0.11	(0.04)
ECOWAS15	-0.67	(0.07)	0.01	(0.01)	0.01	(0.02)

*Ecuador, Guinea and Suriname were dropped for having unreliable data and outlying estimate

Table 16. 1991–2005 Estimates of Regional Financial Integration

MGE	β		γ		δ	
ASEAN13	-0.26	(0.05)	-0.38	(0.06)	-0.15	(0.05)
EU15	-0.27	(0.06)	-0.24	(0.05)	-0.09	(0.04)
CARICOM14	-0.37	(0.05)	-0.03	(0.02)	-0.02	(0.02)
MERCOSUR+5	-0.57	(0.07)	-0.04	(0.04)	-0.03	(0.05)
ECOWAS15	-0.68	(0.07)	-0.23	(0.04)	-0.17	(0.05)

*Suriname and Nigeria were dropped for having unreliable data and outlying estimate

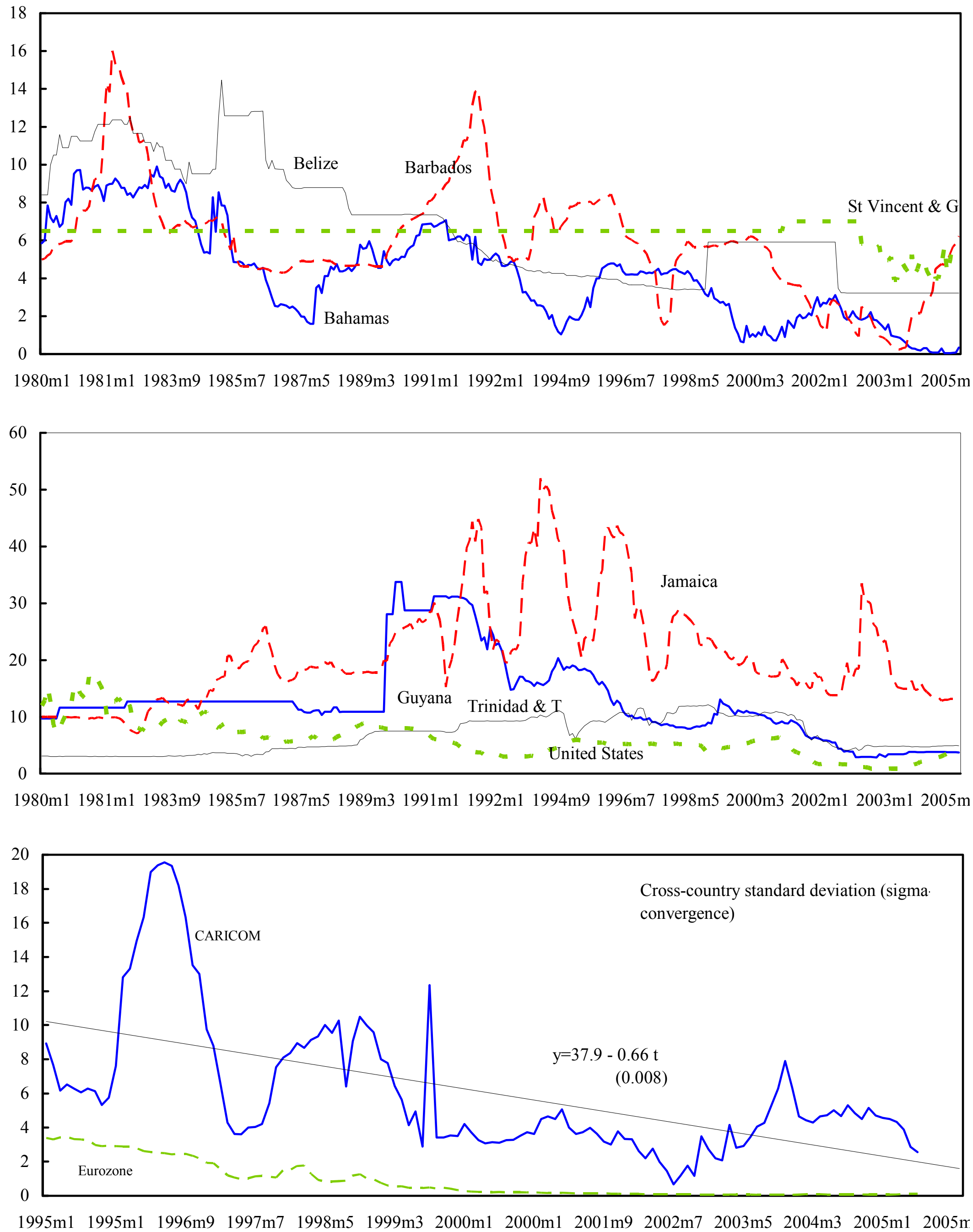
Fixed effects	β		γ		δ	
EU15	-0.14	(0.05)	-0.66	(0.09)	-0.13	(0.04)
CARICOM14	-0.21	(0.07)	-0.03	(0.03)	0.01	(0.02)
ASEAN13	-0.26	(0.08)	-0.59	(0.09)	-0.10	(0.07)
ECOWAS15	-0.28	(0.12)	-0.18	(0.04)	-0.10	(0.04)
MERCOSUR+5	-0.38	(0.10)	-0.08	(0.06)	-0.10	(0.03)

*Suriname and Nigeria were dropped for having unreliable data and outlying estimate

Arellano-Bond	β		γ		δ	
EU15	-0.24	(0.06)	-0.70	(0.03)	-0.21	(0.05)
ASEAN13	-0.33	(0.06)	-0.57	(0.05)	-0.11	(0.07)
ECOWAS15	-0.35	(0.08)	-0.19	(0.03)	-0.11	(0.04)
CARICOM14	-0.36	(0.09)	-0.05	(0.02)	-0.04	(0.02)
MERCOSUR+5	-0.42	(0.07)	-0.11	(0.05)	-0.15	(0.06)

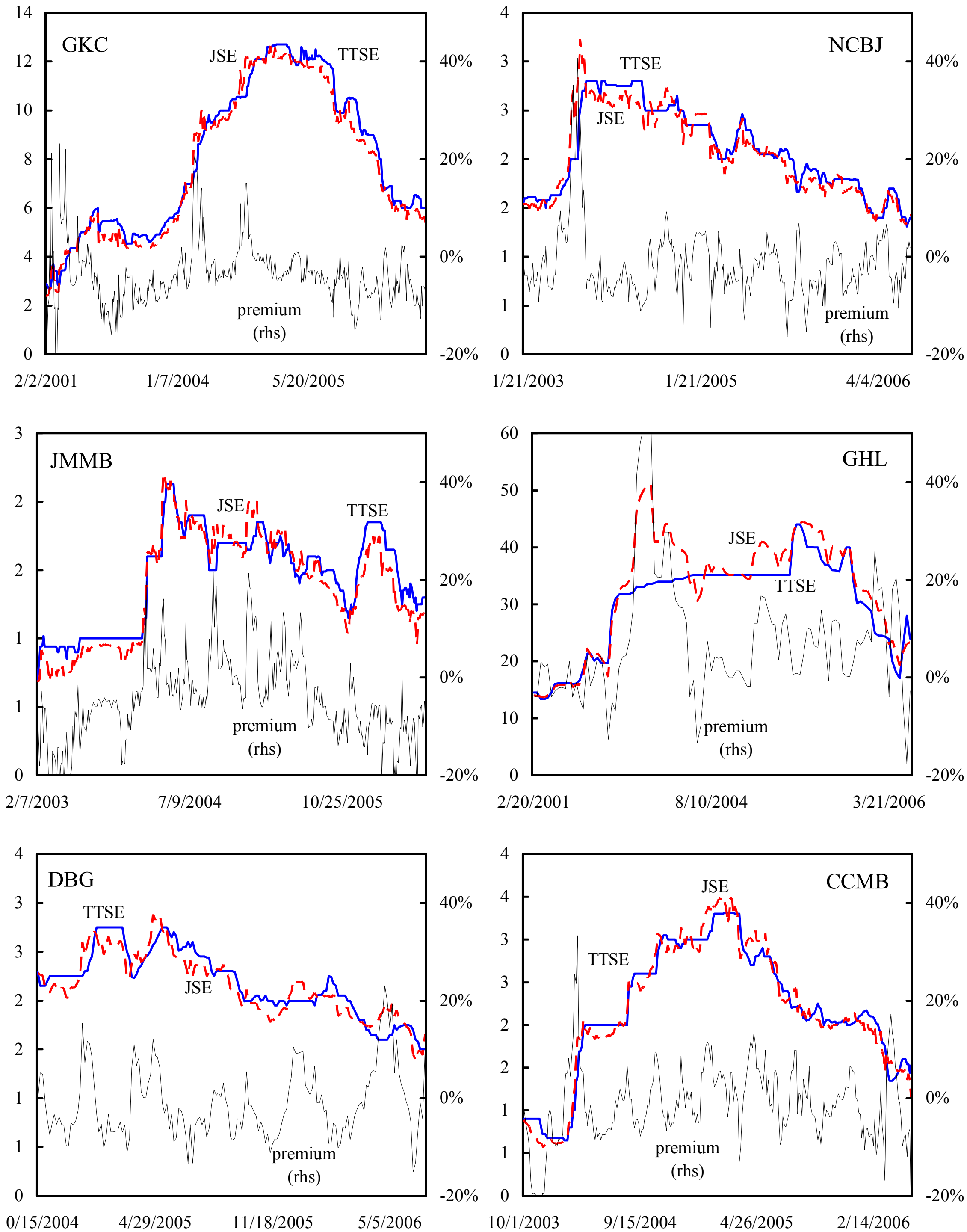
*Suriname and Nigeria were dropped for having unreliable data and outlying estimate

Figure 1. Interest Rates in the CARICOM and Sigma-Convergence (3 month T-Bills)

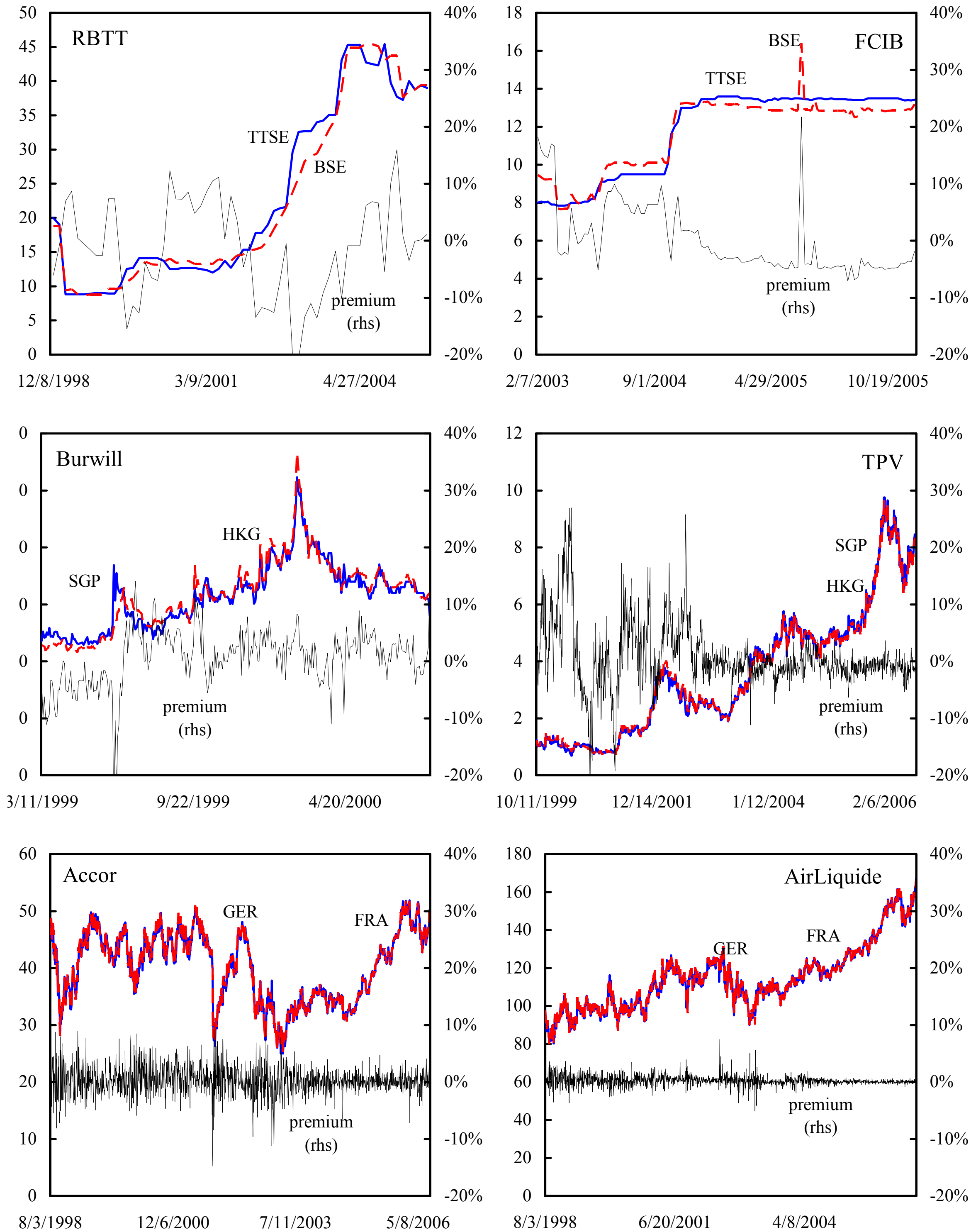


Source: IMF

Figure 2. Cross-Listed Stocks



Source: Trinidad and Tobago Stock Exchange and Jamaica Stock Exchange



Source: Barbados Stock Exchange, Trinidad and Tobago Stock Exchange, Bloomberg

Figure 3. Convergence Speed vs. Foreign Liabilities