Evidence of moderate degree of capital mobility in 15 Caribbean countries and the absence of the Feldstein-Horioka (F-H) puzzle.

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Abstract

The paper seeks to explore the connection between saving and investment among 15 Caribbean countries for the period 1960-2008. The empirical results suggest that a moderate degree of capital mobility exists among regional economies, thus, implying that the Feldstein-Horioka (F-H) puzzle is absent. This finding is consistent with the observed macroeconomic performances of many of these countries during the period under review.

Keywords: Saving-Investment correlation, Panel Unit Roots, Panel Cointegration and Capital Mobility

JEL Codes: C32, F21, F32

Introduction

There is little doubt that many countries in the Caribbean had major restrictions on the flow of capital and it was not until the period of the 90s that many of these states begun to dismantle some of the barriers to capital mobility(World Bank, 1998). This notwithstanding, foreign direct investment have traditionally performed a critical role in regional economies but the region's ability to keep on attracting foreign direct investment will depend largely on the extent to which it is integrated in the world capital market (Bennett, 1995).

Capital mobility, inter alia, plays two critical roles in every economy. One, it provides a framework that determines the optimal choice of fiscal and monetary policies that will allow a country to attract and maintain suitable levels of investment. And, two, it is a means of accessing savings which may be used to promote economic growth and development (Murphy, 2007)s. It is therefore critical that the level of capital mobility for economies in the region be determined because it will provide a useful reference point in policy direction.

Rocha (2000) listed several approaches, i.e., savings- investment correlations, interest parity conditions, Euler equation tests and the consumption smoothing technique, which can be used to measure the degree of capital mobility in developing countries. The paper proposes to use the well known Feldstein-Horioka hypothesis (1980) or the savings-investment correlations approach to test the relationship between the savings ratio (S/Y) and the investment ratio (I/Y) to determine the degree of capital mobility.. As a consequence, the primary focus of the paper is to establish the extent to which these countries are integrated in the world financial markets and the implication it holds for accessing savings even when there is a paucity of domestic savings.

The methodology adopted by Feldstein and Horioka(1980) involved the use of the following model $(I/Y) = \alpha + \beta(S/Y) + \mu$ to estimate the so-called saving retention coefficient, β. A large and statistically significant β would suggest that capital mobility is weak because if there were significant movement in capital β should be close to zero as domestic savings would be attracted to higher returns offered in other markets. The coefficient, however, was estimated at β = 0.887

which was considered to be extremely high and puzzling because with the integration of world capital markets the expectation was that there would be a steady flow/ movement of flow of capital across countries/ regions.

Given the level and sometimes volatile international movement of capital within Caribbean markets especially since the liberalization of world financial system, it is critical to determine the levels of savings retention within Caribbean markets and its impact on investment levels. This study differs from previous investigations as there is no similar study assessing the impact of savings and investment ratios across 15 Caribbean countries. The paper focuses on the period 1960-2008, with the capital markets of Antigua and Barbuda, Bahamas, Barbados, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago being assessed

The paper, however, begins with a brief review of the literature that emerge in response to the FH thesis. The rest of the paper is organized as follows. Section 2 presents the latest literature. In Section 3 the methodology, data and empirical results are presented and discussed. Section 4 our conclusion and implications are outlined.

Literature Review

The work by Feldstein and Horioka has spawned an extensive body of empirical research in the so called capital mobility literature that straddled the use of three different statistical methodologies. One group, including Capiro and Howard (1984), Murphy (1984), Tesar (1991),Dooley et al (1987) and Baxter and Crucini (1993) among others, adopted the cross sectional technique used by Feldstein and Horioka, while others, such as Coakely et al.(1997), Jansen (2000) and Ho (2002) relied on the panel data method to test for the existence of the H-F thesis. In spite of the differences in statistical orientation the research results of both groups lent strong support to the F-H puzzle. A third group of researchers, see De Vita and Abbot (2002), Sinha and Sinha (2004) and others focusing on time series analysis generated which showed that the saving-investment retention coefficients exhibited much larger variations than anticipated. Put differently, these studies have provided some evidence of a moderate degree of capital mobility.

A further review of the literature would show that limited research has been completed for developing countries (see, Rocha (2000), Murth (2005), Montiel (1994), Kim et al. (2005), Murthy (2007) and, yet, fewer studies for Caribbean markets. A major study by (Murthy 2007) was confined to 4 Caribbean nations and 14 Latin American countries. No econometric study has been conducted on a wide cross–section of island nations of different cultural influences, nor attempted to analyze the individual country savings retention coefficient.

Methodology

Given the diversity of the Caribbean market, our research effort will focus on conducting a panel data regression to derive the retention coefficients in the Caribbean using the maximum likelihood-based cointegration of Larsson, Lyhagen and Lothgren (LLL) (2001). In this regard, the paper will model the work of (Murthy, 2007) and Feldstein-Horioka (1980, 1983), as the panel data cointegration study will include fifteen (15) Caribbean markets and employ an approach based on a utility maximization procedure, which would attempt to establish savings coefficients within the region. Results of the panel data will be compared to the single equation cointegration analysis from each market, as we review the effects each coefficient will have on the region verses the individual market.

Panel data analysis has some advantages over the time series econometric models, as it incorporates both time series and cross sectional data plus it reduces the problem of multicollinearity and provides more degrees of freedom.

Larsson et al (2001) panel cointegration will be used instead of Pedroni (2004) as Banderjee et al (2004) stated that for samples sizes below 100 data points Pedroni was less reliable and Larsson et al (2001) panel provide stronger parametric panel and group ADF-statistic tests.

Our model is specified as:

$$\Delta(\omega_t) = \prod \omega_{t-1} + \sum_{i=1}^{k-1} \lambda_i \Delta\omega_{t-1} + \delta\alpha_t + e_t \qquad (1)$$

Where $(\omega_j) = [(Sav/GDP)_t, (Invt/GDP)_t]$ is the data vector explaining the relationship between savings ratio and investment ratio within each Caribbean island. The term α_t is a vector of deterministic variables, and the random term e_t is expected to be white noise.

Panel unit root tests

Generally before most cointegration tests, researchers usually conduct stationarity tests of the series to determine whether there is a unit root in the variables or series. Standard panel unit roots tests will be employed on the series [Sav/GDP and Invt/GDP] to check if the series are stationary in levels I(0) or in their first differences I(I).

We used the following panel unit roots tests in our computations, as we assumed either individual intercepts (fixed effects) or both individual intercepts and individual trends:

Levin, Lin and Chu (LLC) (2002)

Breitung (B) (2000)

Im, Pesaran and Shin (IPS) (2003)

Two Fisher-type tests (Augumented Dickey-Fuller and Phillips-Perron) as per Maddala and Wu (1999) and Choi (2001)

Hadri (H) (2000).

Except for Hadri (2000) all the tests have as their null hypothesis the presence of unit root.

In selecting the appropriate lag number we used the Akaike information criterion (AIC) in the LLC, B, IPS and the ADF-Fisher tests. Fisher tests probabilities were computed using an asymptotic Chi-square distribution; For the IPS test, the W-statistic is used and the H test, the heteroscedastic consistent Z statistic is used. All other tests assume asymptotic normality

Data.

In analyzing the model, panel data regression (PDR) will be used on annual secondary data for fifteen (15) Caribbean island states. The stochastic properties of the data will be examined, and

the long run relationships will be determined by using maximum likelihood cointegration by Larsson et al (2001). Inadequacy of available data has limited the study in covering all islands within the Caribbean[2]. All our analysis was completed using EViews 6.1 software.

3.4 Data Variables

The following variables will be used in estimating the level of Caribbean capital mobility

$(\omega_j) = [(Sav/GDP)_t, (Invt/GDP)_t]$ Is the data vector explaining the relationship between savings ratio and investment ratio within each Caribbean island

The annualized data (period 1960 -2008) was obtained from the World Development Indicators [World Bank website, 2009] and internet searches.

3.5 Empirical Results and Findings

As we start our analysis we check the stationary of the series (Sav/GDP and Invt/GDP) by the conducting of our panel unit root tests, thereafter we will attempt to ascertain if the series can be cointegrated and the order of this cointegration.

Below please see the panel unit root group and individual tests results using the following tests in table 1 and 2:

Levin, Lin and Chu (LLC) (2002)

Breitung (B) (2000)

Im, Pesaran and Shin (IPS) (2003)

Two Fisher-type tests (Augumented Dickey-Fuller and Phillips-Perron) as per Maddala and Wu (1999) and Choi (2001)

Hadri (H) (2000).

[2] Aruba, Anguilla, Martinique, St Marteen, US Virgin Islands, Cuba, Monsterrat, Cayman Islands, Turks and Caicos ,British Virgin Islands and Bonaire

Table 1 Panel Unit Tests

Series	Levin, Lin and Chu (LLC) Ho: Unit Root (common unit root process)	Breitung (B) Ho: Unit Root (common unit root process)	Im, Pesaran and Shin (IPS) Ho: Unit Root (individual unit root process)	Augmented Dickey-Fuller Fisher Type (ADF-Fisher) Ho: Unit Root (individual unit root process)	Phillips-Perron Fisher-Type (PP-Fisher) Ho: Unit Root (individual unit root process)	Hadri (H) Ho: Stationarity (common unit root process)
Sav/Gdp	-5.4356*	-1.678	-3.287*	48.967*	43.710*	4.523*
Invt/Gdp	-4.175*	0.514	-3.026*	34.765***	38.750**	3.928*
<(Sav/Gdp)	-16.432*	-2.553*	-9.301*	103.654*	130.543*	1.774**
<(Invt/Gdp)	-6.811*	-2.108**	-5.064*	68.076*	96.576*	2.991*

Notes: *, ** and *** denote rejection of the null at 1%, 5% and 10% respectively. All tests were conducted with individual intercepts and linear trend. For levels and first differences we used lags = 3

All the tests except ADF-Fisher and PP-Fisher shows the series Sav/GDP and Invt/GDP are non-stationary at the 1% level of significance, which are non-stationary at 10% and 5% respectively for the ADF-Fisher and PP-Fisher tests.

After first differencing the series all the variables are stationary at the 1% level except $\lhd Invt/GDP$ using Brietung (5% level) and the $\lhd Sav/GDP$ using Hadri (5% level).

Therefore for the overall panel unit root results strongly show that Sav/GDP and Invt/GDP are integrated of the order of one I(I), and for first difference <Sav/GDP and <Invt/GDP are integrated of the order zero I(0).

Our panel data series of Sav/GDP and Invt/GDP comprise information for 15 Caribbean markets across the English, French, Spanish and Dutch territories. Therefore careful analysis of both the individual country unit root test and panel unit root test need to be conducted for thoroughness. Karlsson and Lothgren (2000) suggested that for greater reliability of panel unit root tests, careful joint analysis of individual and panel series needed to be conducted.

The results of our individual unit root tests (levels and first differences) are displayed in table 2 and 3 below:

Table 2: Unit Root Test Results of Individual Markets (Levels)

Invt/GDP			Sav/GDP	
Markets	ADF test	P-value	ADF test	P-Value
Antigua and Barbuda	-2.095	0.246	-1.987	0.432
Bahamas	-2.001	0.345	-1.854	0.536
Barbados	-2.108	0.267	-1.606	0.632
Dominica	-2.117	0.398	-1.897	0.356
Dominican Republic	-1.978	0.404	-1.853	0.398
Grenada	-2.132	0.376	-2.107	0.321
Guyana	-1.653	0.678	-3.356	0.053
Haiti	-2.987	0.265	-2.653	0.134
Jamaica	-1.402	0.435	-1.754	0.767
Puerto Rico	-1.354	0.456	-2.453	0.097
St.Kitts and Nevis	-2.605	0.126	-2.456	0.121
St.Lucia	-1.986	0.435	-2.113	0.287
St. Vincent and the Grenadines	-2.651	0.134	-1.879	0.653
Suriname	-3.216	0.047	-3.487	0.042
Trinidad and Tobago	-2.765	0.189	-3.002	0.062
Im, Pesaran, Shin (IPS)	-3.026*		3.287*	
Maddala and Wu (MW) – 2 Fisher Type tests	34.765***		48.96*	

Notes: *, ** and *** denote rejection of the null at 1%, 5% and 10% respectively. All tests were conducted with individual intercepts and linear trend. For levels and first differences we used lags = 3

For the series Sav/GDP and Invt/GDP all the markets except Guyana, Suriname and Trinidad & Tobago, are non-stationary of order one I(I).

Table 3 will apply first differences to the Sav/GDP and Invt/GDP series to determine their stationary.

Table 3: Unit Root Test Results of Individual Markets (First Differences)

<(Invt/GDP)			<(Sav/GDP)	
Markets	ADF test	P-value	ADF test	P-Value
Antigua and Barbuda	-3.654	0.023	-3.906	0.0320
Bahamas	-3.754	0.021	-4.145	0.0010
Barbados	-3.676	0.0320	-3.450	0.059
Dominica	-4.231	0.0018	-4.005	0.0015
Dominican Republic	-4.345	0.0004	-3.986	0.020
Grenada	-3.876	0.015	-2.665	0.1009
Guyana	-4.909	0.0003	-4.335	0.0024
Haiti	-5.312	0.0000	-3.909	0.019
Jamaica	-3.790	0.0200	-2.980	0.0950
Puerto Rico	-3.754	0.0210	-3.510	0.054
St.Kitts and Nevis	-4.367	0.0003	-5.009	0.0001
St.Lucia	-4.110	0.0012	-3.890	0.0330
St. Vincent and the Grenadines	-3.987	0.0140	-3.803	0.0375
Suriname	-4.561	0.0003	-4.019	0.0017
Trinidad and Tobago	-4.189	0.0011	-5.433	0.0000
Im, Pesaran, Shin (IPS) Maddala and Wu (MW) – 2 Fisher Type tests	-5.064* 68.076*		-9.301* 103.654*	

Notes: *, ** and *** denote rejection of the null at 1%, 5% and 10% respectively. All tests were conducted with individual intercepts and linear trend. For levels and first differences we used lags = 3

For the series $\triangleleft$(Sav/GDP) and $\triangleleft$(Invt/GDP) all the markets except Barbados, Grenada, Jamaica and Puerto Rico, are stationary of order zero I(0).

Therefore the individual market and panel results confirm that the series Sav/GDP and Invt/GDP are integrated at order one and their first difference are stationary and integrated at order zero.

With the establishment of stationary among the series, the panel and individual markets cointegration results are outlined in table 4. For the panel cointegration tests, we used Larsson et al (2001) (LLL) systems based method which is an extension of the Johansen (1988, 1995) maximum likelihood procedure to help identify multiple cointegration vectors. It has proven to be more reliable for sample sizes below 100 data points (Banerjee et al, 2004). With our analysis of individual market's cointegration we used Johansen maximum likelihood method after selecting the optimal lag lengths (equal to 4, as the cointegrated equations have linear trends) in our vector autoregression model. Johansen method is highly sensitive to small sample sizes and the implied lag structure; however it is adept at identifying multiple cointegrating vectors.

Table 4: Likelihood Based Cointegrated Panel and Individual Market results

Markets	r =0	r =1	β	$Rank(r_i)$
Antigua and Barbuda	27.85	7.02	0.45*	1
Bahamas	33.21	5.32	0.28*	1
Barbados	14.58	3.11	0.31	0
Dominica	31.01	10.23	0.52*	1
Dominican Republic	28.67	7.56	1.05*	1
Grenada	16.75	5.90	0.40	0
Guyana	21.78	8.41	1.04*	1
Haiti	25.33	4.89	1.12*	1
Jamaica	21.10	3.10	1.15	0
Puerto Rico	21.50	7.90	1.37*	0
St. Kitts and Nevis	27.66	5.32	0.54*	1
St. Lucia	27.09	8.65	0.34*	1
St. Vincent and the Grenadines	28.67	10.71	0.61*	1
Suriname	23.89	9.01	0.91*	1
Trinidad and Tobago	23.02	5.94	0.87*	1
Panel tests $E(Z_k)$	$r = 0$ 18.65	$r = 1$ 6.84		
$Z_{\overline{LR}}$	4.84	0.34		

*Significant at the 5% level. Panel test critical level = 1.645.Individual markets 5% critical values are 25.87 and 12.52

For our panel cointegration test we can reject our null hypothesis of a largest rank = 0 as our test statistic $Z_{\overline{LR}}$ is 4.84 greater than the critical value of 1.645, however we cannot reject the null hypothesis of our largest rank = 1, the test statistic of 0.34 is below our critical value of 1.645.

These results show that using Larssson et al (2001) panel model determines a common rank of 1, and our series (Sav/GDP and Invt/GDP) are cointegrated.

For Antigua and Barbuda, Bahamas, Dominica, St Kitts and Nevis, St Lucia, St. Vincent and Grenadines, Suriname and Trinidad and Tobago are cointegrated and have savings retention coefficient less than one, showing that long run fiscal conditions are sustained and capital mobility levels are high. While for Dominican Republic, Haiti and Guyana the series are cointegrated but have a savings retention coefficient greater than one.

These findings suggest that the majority of the markets series are cointegrated and most of countries have savings retention coefficient below one, hence,demonstrating that the Feldstein-Horioka does not hold as a moderate degree of capital mobility existing within the markets.

Conclusions and Implications

Our paper using Larsson et al (2001) panel cointegration procedures on 15 Caribbean markets determine that there is moderate capital mobility among the countries and showing that the Feldstein –Horioka puzzle is not valid. The series used (Sav/GDP and Invt/GDP) were non-stationary at levels and stationary in first differences while the individual market cointegration test conducted using Johansen maximum likelihood procedure showed several markets with a saving retention coefficient below one after cointegration, while a few other markets series were cointegrated but with a coefficient greater than one.

This evidence of moderate degrees of capital mobility is in keeping with growing international trends of capital mobility as savings usually follow a higher rate of return elsewhere.

The free movement of capital among Caribbean countries has implications for augmented savings levels to help finance economic development as well as forcing national governments to pursue greater fiscal discipline. Its biggest drawback however is its potential to promote macroeconomic instability.

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