Evidence of capital mobility among 15 Caribbean countries and the Feldstein-Horioka (F-H) puzzle

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- Summary
  - Paper seeks to explore the connection between saving and investment among 15 Caribbean countries for the period 1960-2008.
  - Empirical results suggest that a moderate degree of capital mobility exists among regional economies – thus implying that Feldstein-Horioka (F-H) (1980) is absent.

- Summary
  - Consistent with the observed macroeconomic performances of these countries.

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Introduction

- Capital mobility plays two critical roles in every economy.
  - 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.
  - It is a means of accessing savings which may be used to promote economic growth and development (Murthy, 2007)

Reason for study

- It is 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.
- The primary focus of the paper is to establish the extent to which these countries are integrated in the world financial markets and the implications it holds for accessing savings even when there is a paucity of domestic savings.

What approach will be used

- Several approaches can be used to measure the degree of capital mobility in developing countries (Rocha, 2000):
  - Savings-investment correlations (Feldstein-Horioka) hypothesis
  - Interest parity conditions
  - Euler's equation tests
  - Consumption smoothing technique

- This paper proposes to use the savings-investment correlations approach to test the relationship between the savings ratio (S/Y) and the investment (I/Y) to determine the degree of capital mobility.

- The methodology adopted by Feldstein – Horioka (1980) use the following model:
  - $(I/Y) = \partial + ß\ (S/Y) + \mu$…to estimate the saving retention coefficient, ß.
  - A large and statistically significant ß would suggest that capital mobility is weak.
  - If there were significant movement in capital, ß should be close to zero as domestic savings would be attracted to higher returns offered in other markets.
  - (F-H) (1980) estimated the ß saving retention at 0.887
    - Puzzling result as with the integration of world markets, the expectation was that there would be a steady flow/movement of capital across countries/regions and a lower ß is expected.

What is different with our study

- This study differs from previous investigations as there is no similar study assessing the impact of savings and investment ratios across 15 Caribbean countries.
- No econometric study has been conducted on a wide-cross section of Caribbean island nations of different cultural influences, nor attempted to analyze the individual country savings retention coefficient.
  - The period focuses on 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.

Literature Review

- The work of Feldstein-Horioka (F-H) has spawned an extensive body of empirical research that straddled the use of three different statistical methodologies.
  - Capiro and Howard (1984), Murphy (1984), Dooley et al (1987), Tesar (1991), and Baxter and Crucini (1993) all adopted the cross sectional technique used by Feldstein-Horioka.
  - Coakley et al (1997), Jansen (2000) and Ho (2002) relied on panel data method to test the F-H hypothesis.
  - De Vita and Abbot (2002) and Sinha and Sinha (2004) focused on time series analysis

- A further review of the literature showed that limited research has been completed for developing countries (Rocha, 2000) and even fewer for Caribbean markets.
- Murthy (2007) work was confine to 4 Caribbean nations and 14 Latin American countries.

Methodology

- Our research will focus on conducting a panel data regression to derive the retention coefficients in the Caribbean using maximum likelihood-based cointegration of Larsson, Lyhagen and Lothgren (LLL) (2001)

- Approach will be 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, the effects each coefficient will have on the region verses the individual market.

- Why use panel data econometrics
  - Panel data analysis 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 panel provide stronger parametric panel and group ADF- statistic tests.

- Our model is:
  - $\Delta(\omega_t) = \Pi\, \omega_{t-1} + \sum \lambda_t \Delta\omega_{t-1} + \delta\alpha_t + \varepsilon_t$

- Where $(\omega) = [(Sav/GDP)_t , (Invt/GDP)_t]$ 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 ε_t is expected to be white noise.

- Empirical Results and Findings
  - We used the following panel unit root 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 (Augmented Dickey-Fuller and Phillips – Perron) as per Maddala and Wu
    - 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.

Panel Unit Root 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 Δ Invt/GDP using Breitung (5% level) and the Δ Sav/GDP using Hadri (5% level).

- Karlsson and Lothgren (2000) suggested that for greater reliability careful joint analysis of individual and panel series need to be conducted.

Unit Root Test Results (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) Maddala and Wu (MW) – 2 Fisher Type tests	-3.026* 34.765***		3.287* 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

Unit Root Test Results (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*	

- Therefore the individual market and panel results confirm that the series Sav/GDP and Invt/GDP are integrated at order one and their difference are stationary and integrated at order zero.
- With the establishment of stationary among the series, the panel and individual markets cointegration results are checked.

- For the panel cointegration tests, we used Larsson et al (2000) systems based method which is an extension of the Johansen (1988, 1995) maximum likelihood procedure to help identify multiple cointegration vectors.
- With our analysis of individual market's cointegration we used Johansen maximum likelihood method after selecting the optimal lag lengths (equal to 4)

Likelihood Based Cointegration

Markets	r=0	r=1	ß	Rank (r)
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	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_{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.
- We estimate each market saving retention coefficient, ß, using vector autoregression (VAR).

- Results:
  - Cointegrated markets with savings retention coefficient < than one.
    - Antigua and Barbuda, Bahamas, Dominica, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname and Trinidad and Tobago.
    - Showing long run conditions are sustained and capital mobility levels are high.
  - Cointegrated markets with savings retention coefficient > than one.
    - Dominican Republic, Haiti, and Guyana.
  - These findings suggest that the majority of the market series are cointegrated and most of the countries have savings retention coefficient below one.
    - Feldstein – Horioka (F-H) does not hold as a moderate degree of capital mobility existing within the markets.