

Economic Review

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Economic Review

Volume XXXVIII, Issue 1

The *Economic Review* provides a bi-annual summary of the major socio-economic issues facing Barbados, selected research conducted by Bank staff and reviews of topical literature from around the world. The *Economic Review* is prepared by the staff of the Research and Economic Analysis Department (READ) of the Central Bank of Barbados.

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Frequently Used Abbreviations

BOP	Balance of Payments
BRICS	Emerging economic group of Brazil, Russia, India, China and South Africa.
CAR	Capital Adequacy Ratio
CIF	Cost Insurance Freight
FDI	Foreign Direct Investment
FX	Foreign Exchange
GDP	Gross Domestic Product
GITR	Global Information Technology Report
ICT	Information and Communications Technology
IMF	International Monetary Fund
NIF	National Insurance Fund
NIS	National Insurance Scheme
NPL	Non-Performing Loan
NRI	Network Readiness Index
WEF	World Economic Forum

A Note on NIS Financing

*By the Debt Unit, Research and Economic Analysis Department**

Abstract

This paper analyses the substantial growth of Barbados' National Insurance Scheme since the 1980s and examines how the fivefold increases in its surpluses have been invested in government securities and other forms of local sovereign debt. The analysis finds that the level of investment in government debt has increased commensurate with higher NIS surpluses, increasing the Fund's exposure to government over that time. The findings suggest that this level of exposure to government debt is mid-way between social security exposure levels observed in a sample of developing and developed countries. Additionally, the rebalancing of NIS' investments has succeeded in reducing the short-term bias in its portfolio in favour of more long-term assets, thereby improving the match between asset and liability maturities. The results also indicate that the percentage of government's outstanding debt held by NIS is virtually the same as it was in the late 1990s.

Introduction

Over the years, the National Insurance Scheme's role as a major financier of Government operations and as an agent of macro-economic stabilisation has become increasingly important. Recent public discourse on the role of the NIS in Government financing has focused principally on two broad questions: How much has the NIS invested in Government and how has this level of investment in Government changed over time?

This paper will address these two questions by examining the evolution of the NIS' portfolio post 1980 and the importance of the NIS as a financier of Government.

Section 1 will briefly outline the history of the NIS and the growth in its reserves. Section 2 will focus on the NIS' investment portfolio and Section 3 will provide a focused review of the contemporary role of NIS as a government financier, while Section 4 will provide some international comparisons.

1. NIS Overview

1.1. Introduction and Development

Formed in 1967 by the Social Security Act 1966 (the Act), the NIS was charged with a mandate to provide six forms of contribution-based social security benefits to Barbadians, namely sickness, maternity, funeral grants, old-age pensions, invalidity and survivor benefits. The NIS' operations are overseen by the National Insurance Board (NIB) which is

* Prepared by the Debt Unit in the Research and Economic Analysis Department of the Central Bank of Barbados.

a corporate, nine-member body, consisting of members appointed from government, the local workers' organisation (s) and the private sector.

Following the initial Act, a series of amendments were made and new legislation drafted to broaden the coverage of the NIS, including the 1971 extension of partial coverage to self-employed individuals, the introduction of a Severance Payment Scheme (under the Severance Payments Act 1973), the introduction of the Unemployment Benefit Scheme in 1981 and the establishment of a Maternity Grant in 1985. For further discussion of the evolution of the NIS benefit scheme, see Kellman, 1996 and New Insight Magazine, Special Edition, 2007.

Following these revisions, the NIS was effectively expanded to four individual funds, all managed by the Scheme, namely the National Insurance Fund¹ (NIF) – by far the largest, the Severance Fund (SF), the Unemployment Fund (UF) and the Sugar Worker's Provident Fund². These funds are financed by two types of revenue, namely compulsory employee and employer contributions and other earnings; the latter of which includes interest earnings on investments, rental income and other miscellaneous earnings. Though these funds are managed separately, for ease of analysis, their financial data will be analysed collectively throughout this section.

1.2. NIS Operations

The growth in the contribution-benefit balance can be viewed as three distinct periods of surpluses (See figure 1), punctuated by brief periods of decline. Between 1982 – the first year of the Unemployment Benefit Scheme – and 1989, relatively small surpluses were recorded (save a small deficit in 1986), as contributions to the NIF overshadowed the benefits paid from of the three funds.

Figure 1: Contribution Revenue-Benefit Expenditure Balances (BDS\$ Millions)



Sources: Central Bank of Barbados Statistical Database and Unaudited NIS Cash Flow Statements

¹ The Insurance Fund administers benefits related to sickness, maternity, maternity grants, employment injury, invalidity, funeral grant, survivors, old age contributory and non-contributory pensions and disablement payments.

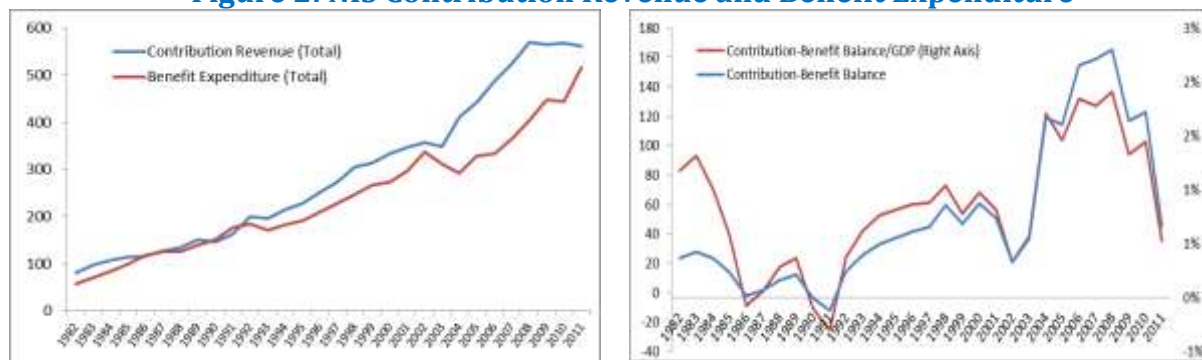
² Given the extremely small size of the Sugar Worker's Provident Fund, it will be excluded from the analysis.

The economic decline the following year and the ensuing austerity measures that reduced employment and wages, sharply lowered contribution revenues to all three funds and simultaneously increased unemployment-related benefit payments. As a result, contribution-benefit deficits were recorded in both 1990 and 1991.

In order to avoid a depletion of the reserves that was likely to result if these deficits had continued, in the second half of 1991 the contribution rate was raised from 1 percent to 5.50 percent of insurable earnings. Simultaneously, there was a reduction in benefit payments to a two-tiered rate of 60 percent of insurable earnings for the first 10 weeks unemployment and 40 percent for the next 16 weeks. Smith (1993) notes that this revision of the contribution and benefit payments structure was ultimately a success as there was a \$30 million increase in the reserves of the UF between end-1991 and end-1992, despite a 6 percentage point increase in unemployment (to 23 percent) and a 12 percent increase in unemployment claims to 20,396 – the highest number on record. By 1992, these successful revisions restored the contribution-benefit surpluses on the UF helping to offset the continued weak performance on the NIF.

The combination of declining unemployment (which reached 12.3 percent by 1998) and a significant increase in public sector wages resultant from retroactive wage payments in 1996, ensured that combined surpluses on the three funds were maintained at an average of \$46M per year between 1994 and 2000 compared to an average of just under \$10M in the corresponding period a decade earlier.

Figure 2: NIS Contribution Revenue and Benefit Expenditure



Source: Central Bank of Barbados Statistical Database and Unaudited NIS Cash Flow Statements

The improved surpluses were also driven in large part by a series of significant changes at the NIF including an increase in the contribution rates of 1.5 percent in 1998. This helped raise contribution revenue significantly, allowing the NIF surpluses to more than offset the gap left by declining UF revenues, occasioned by successive reductions in the unemployment contribution rates to 3.0 percent and 1.5 percent in 1994 and 1998, respectively.

Weak macro-economic conditions in 2001 and 2002 narrowed the contribution-benefit surpluses on the three funds (See Figure 2). In 2003, a comprehensive pension reform

programme commenced, which resulted in the largest increases in contribution-benefit surpluses in the Fund’s history.

In particular, the 1 percent increase in the contribution rates in each of the years 2003 to 2006 and a staggered increase in the retirement age had an *“immediate, positive impact on National Insurance finances”* (Actuarial Report, 2005). Increases to the normal pension age from 65 to 67 in steps of six months every four years, through 2006 to 2018 were also introduced. Additionally, contribution income increases in 2005 were also positively impacted by a 2.9 percent increase in the insurable earnings ceiling. All of these revisions were buoyed by historically low unemployment levels and robust economic growth during this period. The result was an almost tripling of the contribution-benefit balance between 2004 and 2008, to \$142M.

These balances continued to expand until 2009 when the global economic recession created an adverse shock to economic growth, raised unemployment and narrowed the contribution base. The result was that revenue growth slowed from an average of 10 percent per annum between 2003 and 2008 to being flat thereafter. The impact of these weaker earnings was compounded by higher levels of expenditure. In particular, part of the earlier pension reforms involved the partial indexing of retirement benefits to inflation, which reached 9.5 percent in 2011 – the highest level since the 1980s. In addition, during this period, a number of additional pensioners took advantage of voluntary early retirement. Overall, the result was an increase in the rate of growth of expenditure from 6 percent between 2003 and 2008 to 17 percent in 2010, narrowing the surpluses toward the end of the period.

Nonetheless, surpluses persisted over the period and were invested in various instruments, leading to an additional source of revenue for the NIS. This non-contribution income, which comprised principally investment earnings, has grown substantially through the period and since the mid-1990s, has steadily accounted for approximately 25 percent of revenue to the three funds (See figure 3).

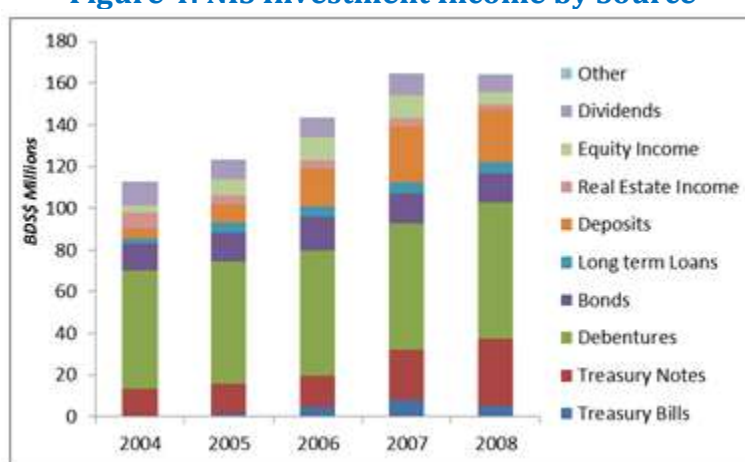
Figure 3: NIS Investment Revenue



Source: Central Bank of Barbados Statistical Database and Unaudited NIS Cash Flow Statements

While detailed disaggregated time-series data is not available for these investment earnings, data from the available Annual Reports (See figure 4) confirm that close to 70 percent of investment income emanates from government securities. Given the growth in both the value of these investments since 2008 and the sustained high yields on long-term instruments in 2010 and 2011, this pattern is likely to have continued through the period. Additionally, financial statements for 2008, the most current year for which disaggregated data is available through the Annual Report of the NIS, indicate that 24 percent of Fund revenue was attributed to investment income, with 63 percent of the latter coming from debentures, Treasury Notes and T-bills. Given the rise in the amount of government-held debt and the weighted average increase in long-term interest rates, investment earnings from government securities are expected to have risen commensurately through 2011.

Figure 4: NIS Investment Income by Source



Source: NIS Annual Reports (2004-2008)

When this investment-related revenue is tallied with contribution revenues and compared to total expenditures, a similar pattern emerges in which surpluses overall have moved from around 1 percent of GDP in the mid-1980s, to averaging 3 percent in the 2000s.

2. NIS Investment

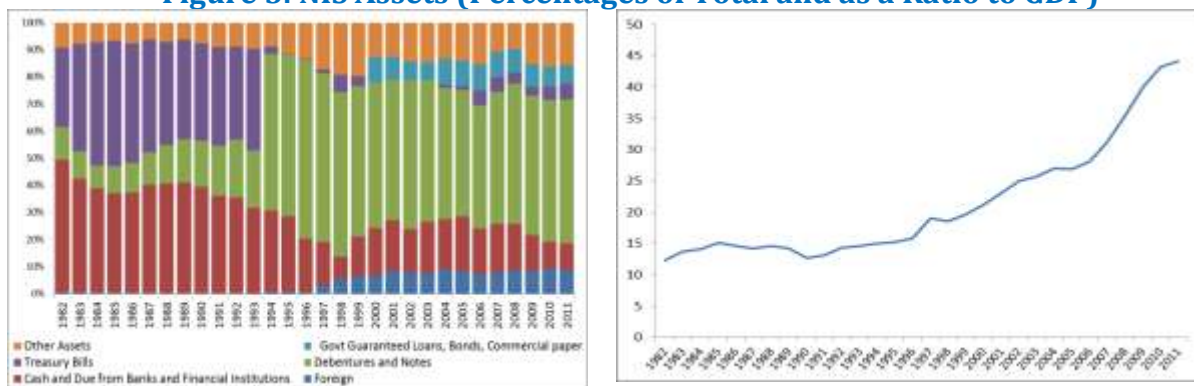
International Social Security Association (ISSA) guidelines for social security³ investment note that investment decisions should be driven by the two principal objectives, namely security – referring to the extent to which investments allow the scheme to meet its commitments in a cost-effective way; and profitability – relating to achieving maximum returns subject to a prudent level of risk. Critically, however, the Guidelines also point to a subsidiary investment objective relating to social and economic utility, in which decisions should take into consideration long-term national objectives that may not be fully reflected

³ While these guidelines speak specifically to Social Security, they can be widely regarded as applicable to broad National Insurance systems such as the NIS, since they focus on long-term viability and provide a very useful framework for prudential investment of national insurance funds.

in the pursuit of a strategy based solely on maximizing returns since, ultimately, “the sustainability of any social security scheme depends on national economic growth” (Page 11).

During the 1980s and the early 1990s, Government securities accounted for around 52 percent of the Funds’ asset portfolio. Of this amount, the bulk – 40 percent - were held in three, six and one-year T-bills. In addition, short-term, non-government assets such as cash and fixed deposits accounted for another 40 percent of the asset base. This high ratio of short-term investments has been attributed to the emphasis of the three funds on providing short-term benefits, including those related to the newly-formed unemployment benefit and maternity grant schemes. As a result, the investment portfolio was forced to remain relatively liquid during this period.

Figure 5: NIS Assets (Percentages of Total and as a Ratio to GDP)

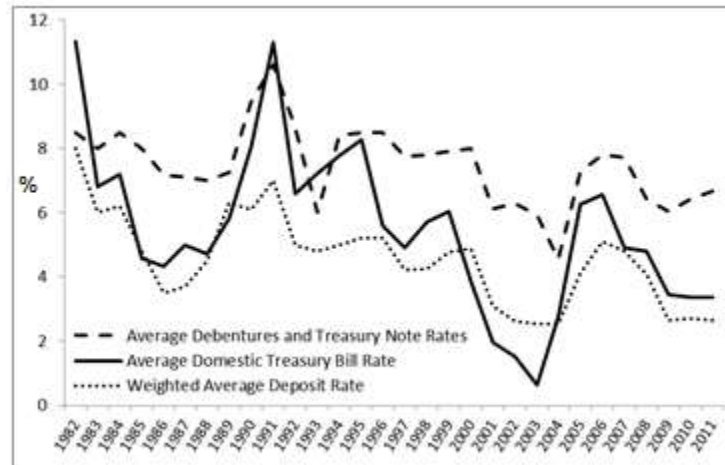


Source: Central Bank of Barbados Statistical Database and Unaudited NIS Cash Flow Statements

This high ratio of short-term assets remained relatively stable through to the end of the decade. However, by the early-1990s, the contribution revisions designed to preserve the long-term strength of the Fund began to yield higher revenues. These inflows were driven primarily by pension-related contributions and therefore represented long-term liabilities, which had to be matched with assets of similar maturity.

An investment strategy was therefore devised that involved the diversification of the portfolio, including a greater emphasis on medium and long-term instruments. This rebalancing also allowed the Fund to take advantage of the comparatively higher rates of return on Debentures and Treasury Notes, relative to both Treasury Bills and bank deposits (See figure 6). As a result, short-term instruments (Treasury Bills, cash and bank deposits), which accounted for around 75 percent of the asset portfolio in 1990, fell dramatically to 33 percent in 1994.

Figure 6 – Nominal Yield on Domestic Government Securities



Source: Central Bank of Barbados Statistical Database

The NIF continued to diversify its portfolio in the following years by making a number of domestic investments in “blue chip” domestic equities. However, given the small size of the domestic equity market and limited trading on the domestic stock market, this form of investment remained relatively small. Additionally, the NIS also began to acquire a number of commercial real estate lots. Combined, these types of investments accounted for around 8 percent of the asset base in 1990 and increased to around 13 percent by 2000.

The other major investment category for the NIF that emerged in the late 1990s and through the 2000s, was foreign investments. The NIB invested in a number of foreign securities, including foreign government bonds, pushing foreign investments up from less than \$1 million in 1990 to \$28.1 million in 1997, representing 3 percent of total assets, to \$292.7 million or 9 percent of the total asset base, by 2010.

As a result of these adjustments, the proportion of Government securities to the total asset base declined steadily during the early 2000s to 48 percent in 2005, before rising again in the latter half of the decade. The overall exposure to Government exceeded observed in the late 1990s as the NIS also invested in other government instruments, including loans guaranteed by Government and the bonds of statutory corporations. This form of investment more than doubled since 2000, rising from \$122 million to \$268 million at the end of 2010. These increases represented around 7 percent of the total asset base of the Fund. ultimately pushing total exposure to government up to around 61% of the overall asset base by 2010.

3. NIS as a Financier of Government

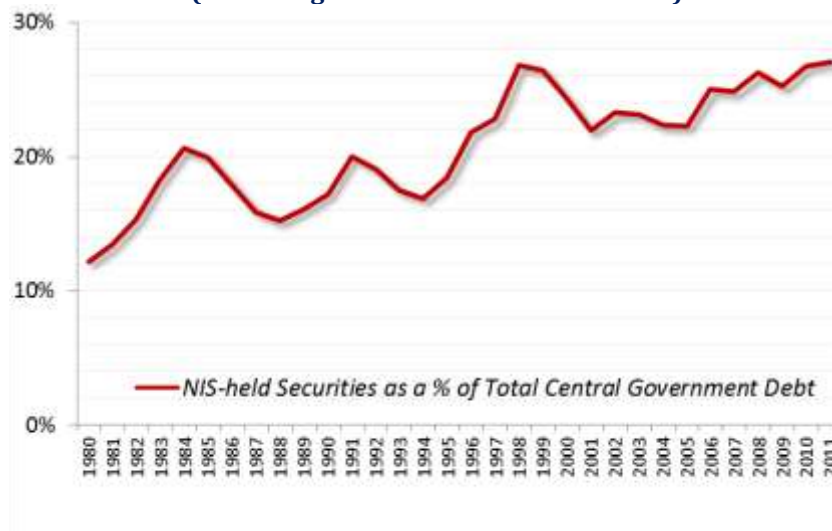
Over the years, the NIS has become the largest single purchaser of domestic Government securities. During the 1980s, as small NIS surpluses began to build, the Fund increasingly invested these in available government paper. By the end of 1991, NIS-held securities accounted for nearly 42 percent of outstanding government securities. While growth in

NIS' surpluses continued to fuel their purchases of these securities into the early 1990s, the fiscal crises during that period resulted in a much faster increase in the overall level of debt. In fact, while NIS-held securities increased by, on average, 10 percent between 1990 and 1993, overall securities rose by double that rate over the same period. As a result, the ratio of NIS-held securities to the total fell to a low of 27 percent by 1994. Nevertheless, as the growth rate in debt slowed and NIS surpluses increased throughout the decade, the ratio climbed again to an average of 37 percent during the 1990s.

Subsequently, the pension reforms of 2003-2006 more than doubled NIS surpluses and provided additional revenue for NIS' investment. The result was a further increase in NIS' holdings of government securities, which further increased the ratio to around 43 percent by end-2011.

As Figure 7 illustrates, when expressed in relation to total debt, NIS' holdings of debentures, Treasury Notes and T-bills followed a similar pattern, rising during the early 1980s to around one-fifth of total debt by 1991. As Government issued more securities as a percentage of total debt during the 1990s and NIS surpluses increasing, the NIS became increasingly important as an investor in government debt. This level of investment peaked in 1998, when NIS-held securities as a percentage of total debt rose to 27 percent. Despite a decline in the early 1990s, the ratio began to climb again in 2006, returning to its peak level by 2011.

**Figure 7: NIS-held Securities
(Percentage of Total Government Debt⁴)**



Source: Central Bank of Barbados Statistical Database

⁴ Total Government Debt relates to all loans, securities and other direct debt obligations of Central Government.

As noted, the rebalancing of the NIS portfolio has reduced the proportion of short-term debt and this reduction is also reflected by the contraction in NIS holdings of total short-term domestic instruments from an average of 28 percent in the early 1990s, to 14 percent between 2006 and 2010. It is useful to note that this scenario has been mutually beneficial from the perspectives of Government and the Scheme since, for the former, it reduces the short-term roll-over risk, and for the latter, it facilitates a closer match between asset and liability maturity.

4. *International Comparison*

In evaluating the investment of the NIS in government securities, it is useful to consider similar investments of other social security schemes. Table 1 presents a comparison of total government securities⁵ held by the social security agency as a ratio of total investments⁶ for a small group of developed and developing countries. Data in this area is difficult to disaggregate, but the small sample suggests that current levels of NIS investment in Government securities put Barbados mid-way among the developed and developing countries.

Table 1: Social Security Investments in Home-Country Government Securities

Country	Investments held in Government Securities (%)
Canada ¹	23
Trinidad ²	24
Bahamas ³	45
Barbados ⁴	68
Cyprus ⁵	93
Singapore ⁶	95
United States ⁷	100

Sources: Social Security Annual Reports

¹ Ratio of marketable and non-marketable Provincial Government Bonds, Government of Canada Bonds, plus index-linked bonds to total investments held by the Canada Pension Plan, 2009

² Ratio of Government Securities to Total Investment Portfolio of the National Insurance Board, 2009

³ Ratio of Bahamas Government US dollar notes and Bahamas Government Registered Stock to Total Investments of the National Insurance Fund, 2011

⁴ Ratio of Government Securities to total investments held by the National Insurance Fund, 2010

⁵ Ratio of non-tradable government deposits to Total Investments held by the Social Insurance Scheme, 2009

⁶ Ratio of Special Issues of Singapore Government securities and Singapore Government Securities to Total Investments (Investments plus investment properties) held by the Central Provident Fund, 2011

⁷ Ratio of Special Bonds and Certificates of Indebtedness to total investments held by the Old-Age and Survivors Insurance Trust Fund, 2012

⁵ While a more useful measure would be total exposure to Government, heavy aggregation of some categories makes it difficult to clearly identify overall exposures. Nevertheless, in most instances, security-holdings represent the bulk of investment in government and analysis of these holdings is indicative of the size of exposure to Government.

⁶ Total investments differs from total assets as the latter includes cash and deposits in the banking system

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The Global Information Technology Report 2012 - Barbados' Assessment

By Vincent Grosvenor*

Introduction

In the most recent Global Information Technology Report (GITR) of 2012, Barbados was ranked 35th in a field of 142 developed and developing nations on the Network Readiness Index (NRI).

The GITR is an annual publication that was unveiled in 2002 by the World Economic Forum (WEF) in partnership with Institut Européen d'Administration des Affaires and has become one of the most respected information and communications technology (ICT) reports of its kind. The GITR series has been used to raise the awareness, at governmental and non-governmental levels, of the role of ICT in economic and societal development.

The key feature within the GITR is the Network Readiness Index (NRI). The NRI measures the degree to which economies across the world leverage ICT for enhanced productivity, development and competitiveness. The series tracks ICT's strengths and weaknesses of the selected nation economies and give some indication of their progress over time. A number of variables have been used in the formulation of the index, and some of these variables have been revised over the years to better represent the constant shift in the ICT landscape.

The 2012 report, presented a detailed analysis of the main drivers and impacts of this increasingly inter-connected world. This focus contributes to the World Economic Forum's recently launched Hyper-connected World Initiative, which seeks to understand the systemic nature of change in a hyper-connected world.

1. Economic Benefits of Information Communication Technology (ICT)

ICT and in particular the convergence of ICT offer a myriad of opportunities for governments, enterprises and consumers and hence economic activity. The GITR of 2012 gave an in-depth treatment of the issues surrounding this shift, driven primarily by consumer appetite and industry demand. It is however, up to societies to restructure their economies in order to take full advantage of this phenomenon.

The WEF has therefore embarked on a useful exercise to quantify and model the relationship between what it sees as the ICT drivers and the economic and social impacts, and to measure countries by what it calls the Network Readiness Index to determine their position on the NRI scale.

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2. Concept of NRI

The variables used in the 2012 report are grouped into 10 broad categories called pillars, from Political and Regulatory Environment to Social Impacts¹. The index is on a score of 1 to 7, with 7 being the highest achievable rating a country can attain.

Various organisations have undertaken the complex task to measure the development of ICT and its impact on economies and societies in general. However, few, if any have found a perfect model that captures the drivers of ICT and the resulting impact in a single index. Arguably, the WEF has emerged with the most comprehensive index that takes into consideration the main stakeholders (individuals, businesses and governments), as well as prevailing regulatory and macroeconomic conditions in formulating a comparative ranking for a large number of countries.

The author is not fully convinced of the degree of robustness of the NRI framework in ascribing causality to economic outcomes. From an econometric perspective, the assumption that the forty-five NRI disaggregated variables that represent the ICT drivers cause changes in the eight economic and social impact variables has not been substantiated. It is also doubtful that, with the expected cross-influence effect among the ICT drivers (dependent variables) and possibly feedback influence of the impact variables on the drivers, a causality effect using the present framework can be statistically proven. However, ICT drivers and the “impacts” are correlated, and to the extent that the coefficient of determination is 0.9 the model has been proven to be a good fit. This revelation, though not mathematically sufficient to establish causation, is a necessary feature which is satisfactory enough for the framework to be used as a policy tool.

3. Barbados’ Historical NRI Performance

As early as 2006, Barbados had done comparatively well, maintaining a position in the top 40 of the NRI scores, surpassing nations in southern Europe such as Spain and Italy, the emerging economic group of BRICS, the entire Caribbean region including Puerto Rico and all of Latin America. Table 1.1 below shows Barbados’ ranks and ratings over the past six years – its best rating and rank was realised in the latest period, 2011-2012.

Noticeably absent from the 2012 report are Barbados’ neighbours with the exception of Trinidad and Tobago (60th), Jamaica (74th), Dominican Republic (87th), Belize (119th) and Haiti (142nd). One can only assume that lack of data from these territories is the reason for their omission, as is the case for a number of excluded nations across the globe.

Interestingly enough, countries in the same economic bloc tend to perform similarly. It may be to Barbados’ advantage therefore to see its neighbours climb the ranks on the NRI list. The Caribbean Telecommunication Union (CTU) is currently driving an initiative to, in its

¹ See Appendix A for a list of the 10 composite variables (pillars) and their disaggregation into the 53 component variables.

words, “raise public awareness and establish strategic programmes to foster innovative and beneficial use of ICT in Caribbean countries for national and regional development”². This initiative is in the form of a roadshow dubbed “Caribbean ICT Roadshow”, and should be in Barbados in September 2012. With initiatives like this, it is hopeful that the region can climb the index ladder together.

Table 1.1: Barbados' Historical NRI Ranks and Ratings

Report Period	Total Nations	Rating	Rank
2011-2012	142	4.6	35
2010-2011	138	4.3	38
2009-2010	133	4.4	35
2008-2009	134	4.4	36
2007-2008	127	4.3	38
2006-2007	122	4.2	40

World Economic Forum (Global IT Reports 2007 - 2012)

4. Analysis of Barbados' 2011-2012 Network Readiness Performance

4.1. Strengths

A review of Barbados' scores in the 10 pillars of the NRI for 2012 gives a clear picture of its strengths and weaknesses. Table 1.2 illustrates this vividly. Barbados ranked an amazing 10th position in the pillar of skills, above the top overall NRI ranked nation of Sweden, which achieved 12th position in skills. In addition, the United States while 8th overall ranked 32nd in skills while the UK (10th overall) ranked 21st in skills.

The four variables that define the skills pillar are incidentally not directly linked to ICT skills, but to the standard of general education and literacy. One of the four variables measures the quality of math and science education, an area where Barbados attained its third highest rank among the 53 variables, second only to the rank of 1st in the variable that quantifies the percentage workforce involved in knowledge-intensive jobs, and the rank of 6th in the variable that gauges the effectiveness of law-making bodies. These three high rankings in the disaggregate variables elevated Barbados' rank in the three associated aggregated pillars – Skills (10), Political and Regulatory Environment (20) and Economic Impacts (26).

In pointing out the strengths, caution must be taken as WEF warned in equating the ubiquity of ICT to its beneficial usage. Often times, ICT policies and initiatives are pursued but little is done to ensure optimum usage and benefit. So though, for example, Barbados

² See CTU's Caribbean Roadshow, available at: www.ctu.int

ranks high in skills, is there enough emphasis being placed on those skills to move the nation along a steeper ICT trajectory?

4.2. Weaknesses

Our greatest deficiency is in the pillar of Affordability in which Barbados is ranked 104th. The three variables used to mould this pillar, with Barbados' rank shown in brackets, are Mobile Cellular Tariffs (94th), Fixed Broadband Internet Tariffs (99th) and Internet & Telephony Competition (110th).

Other areas where Barbados ranked above 90th, and clearly requiring much needed improvement, are Venture Capital Availability (93th), Capacity for Innovation (91th), Government Online Services (104th) and E-Participation (94th).

The report identified other failings that are less egregious but equally deserving of some attention from key stakeholders. Barbados ranked 68th in the variable that test for Intensity of Local Competition and 64th in ICT Impact on new Organisational Models.

Table 1.2: The 10 NRI Pillars and 4 Sub-Indices

Indicator	Rank (out of 142)	Score (1-7)
Network Readiness Index 2012	35	4.6
Environmental Sub Index	29	4.8
1. Political and Regulatory Environment	20	5.1
2. Business and Innovation Environment	35	4.5
Business and Innovation Environment Sub Index	51	5.1
3. Infrastructure and digital content	33	5.1
4. Affordability	102	4
5. Skills	10	6.1
Usage Sub Index	34	4.3
6. Individual usage	24	5.1
7. Business usage	41	3.9
8. Government usage	61	3.9
Impact Sub Index	36	4.3
9. Economic Impacts	26	4.3
10. Social Impacts	44	4.2

Source: World Economic Forum Global IT Report 2012

5. Lessons Learnt in the Barbados Case

The old adage that one should build upon one's strength is a very applicable here. The skills base was identified as Barbados' best performing ICT driver³, so Barbados needs to mobilise the other ICT enablers like Internet, Telephony and Mobile Affordability along with Venture Capital Availability around our main driver, Skills, to create the kind of environment that can enhance our ICT potential.

An approach that tackles these weak areas should include all stakeholders, but the gaps are wider at the business and governmental levels than at the individual level. All of the NRI pillars that describe individuals are ranked in the top 25, while those pillars that describe Business and Government are all ranked above 40. This presents the view that while there are still hurdles to be overcome from an individual standpoint, there remains much work to be done by businesses in areas like the capacity to innovate, and by Government in areas such as online services.

6. Conclusion

There is a plausible perception that a society which invests in ICT will ultimately derive significant economic benefit. Many have inferred a causal relationship between ICT pervasiveness and the economic and social development, but whether ICT causes development or vice versa is unclear. Inherent difficulties in demonstrating causality should, however, not deter stakeholders from pursuing the necessary policies and enabling factors that drive a productive and competitive ICT environment. In this regard, WEF's NRI is a good barometer for the measurement of countries' productive and competitive ICT environment and the disabling issues that nations need to address, if economies and societies are to gain greater economic leverage from ICT.

³ Note that Skills as defined here is a composite variable and is comprised of Quality of Education System, Quality of Math and Science Education, Secondary School Enrollment and Adult Literacy Rate variables.

APPENDIX A

Barbados Networked Readiness Index in Detail

	Rank (out of 142)	Score1 (1-7)
1st pillar: Political and regulatory environment		
1.01 Effectiveness of law-making bodies*	6	5.5
1.02 Laws relating to ICT*	53	4.2
1.03 Judicial independence*	17	5.9
1.04 Efficiency of legal system in settling disputes*	20	4.9
1.05 Efficiency of legal system in challenging regs*	24	4.6
1.06 Intellectual property protection*	24	5.1
1.07 Software piracy rate, % software installed	n/a	n/a
1.08 No. procedures to enforce a contract	n/a	n/a
1.09 No. days to enforce a contract	n/a	n/a
2nd pillar: Business and innovation environment		
2.01 Availability of latest technologies*	27	6.1
2.02 Venture capital availability*	93	2.3
2.03 Total tax rate, % profits	n/a	n/a
2.04 No. days to start a business	n/a	n/a
2.05 No. procedures to start a business	n/a	n/a
2.06 Intensity of local competition*	68	4.9
2.07 Tertiary education gross enrollment rate, %	24	65.9
2.08 Quality of management schools*	26	5.0
2.09 Gov't procurement of advanced tech*	39	4.1
3rd pillar: Infrastructure and digital content		
3.01 Electricity production, kWh/capita	55	3714.5
3.02 Mobile network coverage, % pop.	25	99.9
3.03 Int'l Internet bandwidth, kb/s per user	49	20.6
3.04 Secure Internet servers/million pop.	27	329.3
3.05 Accessibility of digital content*	28	6.0
4th pillar: Affordability		
4.01 Mobile cellular tariffs, PPP \$/min.	94	0.40
4.02 Fixed broadband Internet tariffs, PPP \$/month	99	50.39
4.03 Internet & telephony competition, 0-2 (best)	110	1.20
5th pillar: Skills		
5.01 Quality of educational system*	15	5.1
5.02 Quality of math & science education*	10	5.3
5.03 Secondary education gross enrollment rate, %	28	100.6
5.04 Adult literacy rate, %	15	99.0
6th pillar: Individual usage		
6.01 Mobile phone subscriptions/100 pop.	29	128.1
6.02 Individuals using Internet, %	28	70.2
6.03 Households w/ personal computer, %	39	61.4
6.04 Households w/ Internet access, %	45	51.0
6.05 Broadband Internet subscriptions/100 pop.	31	20.6
6.06 Mobile broadband subscriptions/100 pop.	n/a	n/a
6.07 Use of virtual social networks*	42	5.7
7th pillar: Business usage		
7.01 Firm-level technology absorption*	38	5.4
7.02 Capacity for innovation*	91	2.7
7.03 PCT patents, applications/million pop.	32	11.5
7.04 Extent of business Internet use*	39	5.5
7.05 Extent of staff training*	36	4.4
8th pillar: Government usage		
8.01 Gov't prioritization of ICT*	29	5.4
8.02 Importance of ICT to gov't vision*	45	4.3
8.03 Government Online Service Index, 0-1 (best)	104	0.2
9th pillar: Economic impacts		
9.01 Impact of ICT on new services and products*	49	4.8
9.02 ICT PCT patents, applications/million pop.	34	2.7
9.03 Impact of ICT on new organizational models*	64	4.2
9.04 Knowledge-intensive jobs, % workforce	1	57.6
10th pillar: Social impacts		
10.01 Impact of ICT on access to basic services*	32	5.3
10.02 Internet access in schools*	30	5.5
10.03 ICT use & gov't efficiency*	52	4.5
10.04 E-Participation Index, 0-1 (best)	94	0.1

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APPENDIX B

Rank	Country/Economy	Score	Rank	Country/Economy	Score	Rank	Country/Economy	Score
1	Sweden	5.94	61	Azerbaijan	3.95	121	Suriname	2.99
2	Singapore	5.86	62	Kuwait	3.95	122	Côte d'Ivoire	2.98
3	Finland	5.81	63	Mongolia	3.95	123	Tanzania	2.95
4	Denmark	5.70	64	Slovak Republic	3.94	124	Zimbabwe	2.94
5	Switzerland	5.61	65	Brazil	3.92	125	Cameroon	2.93
6	Netherlands	5.60	66	Macedonia, FYR	3.91	126	Mali	2.93
7	Norway	5.59	67	Romania	3.90	127	Bolivia	2.92
8	United States	5.56	68	Albania	3.89	128	Nepal	2.92
9	Canada	5.51	69	India	3.89	129	Syria	2.85
10	United Kingdom	5.50	70	Bulgaria	3.89	130	Ethiopia	2.85
11	Taiwan, China	5.48	71	Sri Lanka	3.88	131	Nicaragua	2.84
12	Korea, Rep.	5.47	72	South Africa	3.87	132	Timor-Leste	2.84
13	Hong Kong SAR	5.46	73	Colombia	3.87	133	Lesotho	2.78
14	New Zealand	5.36	74	Jamaica	3.86	134	Madagascar	2.73
15	Iceland	5.33	75	Ukraine	3.85	135	Burkina Faso	2.72
16	Germany	5.32	76	Mexico	3.82	136	Swaziland	2.7
17	Australia	5.29	77	Thailand	3.78	137	Burundi	2.57
18	Japan	5.25	78	Moldova	3.78	138	Chad	2.55
19	Austria	5.25	79	Egypt	3.77	139	Mauritania	2.55
20	Israel	5.24	80	Indonesia	3.75	140	Angola	2.49
21	Luxembourg	5.22	81	Cape Verde	3.71	141	Yemen	2.41
22	Belgium	5.13	82	Rwanda	3.7	142	Haiti	2.27
23	France	5.12	83	Vietnam	3.7			
24	Estonia	5.09	84	Bosnia & Herzegovina	3.65			
25	Ireland	5.02	85	Serbia	3.64			
26	Malta	4.91	86	Philippines	3.64			
27	Bahrain	4.90	87	Dominican Republic	3.6			
28	Qatar	4.81	88	Georgia	3.6			
29	Malaysia	4.80	89	Botswana	3.58			
30	United Arab Emirates	4.77	90	Guyana	3.58			
31	Lithuania	4.66	91	Morocco	3.56			
32	Cyprus	4.66	92	Argentina	3.52			
33	Portugal	4.63	93	Kenya	3.51			
34	Saudi Arabia	4.62	94	Armenia	3.49			
35	Barbados	4.61	95	Lebanon	3.49			
36	Puerto Rico	4.59	96	Ecuador	3.46			
37	Slovenia	4.58	97	Ghana	3.44			
38	Spain	4.54	98	Guatemala	3.43			
39	Chile	4.44	99	Honduras	3.43			
40	Oman	4.35	100	Senegal	3.42			
41	Latvia	4.35	101	Gambia, The	3.41			
42	Czech Republic	4.33	102	Pakistan	3.39			
43	Hungary	4.30	103	El Salvador	3.38			
44	Uruguay	4.28	104	Iran, Islamic Rep.	3.36			
45	Croatia	4.22	105	Namibia	3.35			
46	Montenegro	4.22	106	Peru	3.34			
47	Jordan	4.17	107	Venezuela	3.32			
48	Italy	4.17	108	Cambodia	3.32			
49	Poland	4.16	109	Zambia	3.26			
50	Tunisia	4.12	110	Uganda	3.25			
51	China	4.11	111	Paraguay	3.25			
52	Turkey	4.07	112	Nigeria	3.22			
53	Mauritius	4.06	113	Bangladesh	3.2			
54	Brunei Darussalam	4.04	114	Tajikistan	3.19			
55	Kazakhstan	4.03	115	Kyrgyz Republic	3.13			
56	Russian Federation	4.02	116	Malawi	3.05			
57	Panama	4.01	117	Benin	3.05			
58	Costa Rica	4.00	118	Algeria	3.01			
59	Greece	3.99	119	Belize	3.01			
60	Trinidad and Tobago	3.98	120	Mozambique	2.99			

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Definitions:

Hyper-connectedness - an environment where the Internet and its associated services are accessible and immediate, where people and businesses can communicate with each other instantly, and where machines are equally interconnected with each other

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Tracing the Liquidity Effects on Bank Stability in Barbados

By Kester Guy and Shane Lowe*

Abstract

This paper provides a micro-economic approach to evaluating bank stability in the face of adverse liquidity conditions. Specifically, it examines the potential for systemic risk as a result of liquidity shocks on each bank. According to Nier et al., (2008) systemic risk results when the failure of multiple banks imposes significant costs on the entire economy. This assessment is done by tracing the liquidity effect across institutions based on the degree of exposure among commercial banks. In this study, a bank with an after-shock capital adequacy ratio (CAR) less than 8 percent is assumed to require additional capital. In addition, systemic risk rises when the CAR of the entire banking sector converges to the 8 percent threshold.

Overall, the results suggest that banks in Barbados are well capitalised and are able to withstand significant liquidity shocks. In addition, the study found that banks can be ranked in terms of systemic importance. Consequently, the second-round effects that result from systemically important banks tend to have large impacts with significant implications for bank stability.

Keywords: Liquidity, Stress Test, Bank Stability

JEL: G17, G21, G32

Introduction

Bank liquidity has always been a major concern for policymakers. On the one hand, excess liquidity may be a significant contributor to inflation and can hamper the ability of monetary policy (Agénor and El Aynaoui, 2010) while, on the other, liquidity shortages have been associated with failed institutions and can trigger systemic instability. Managing these two extremes is by no means a simple or straight forward task, as several factors, both macro and idiosyncratic, can influence banks' liquidity. In recent years, this subject has received increased attention as policymakers and researchers alike examined and re-examined the dynamics of bank liquidity and its relationship both to macro and micro economic factors. For example, Agénor and El Aynaoui (2010) looked at excess liquidity,

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bank pricing rules, and monetary policy; Khwaja and Mian (2008) studied the impact of bank liquidity shocks in an emerging market; Khemraj (2010) addressed the question, 'what does excess bank liquidity say about the loan market in less developed countries?' and Moore and Maynard (2006) looked at commercial banks' demand for excess liquid assets. These studies represent a small sample of the investigations undertaken in recent times and provide useful insights in addressing some of the critical issues relating to bank liquidity.

A widely used definition of excess liquidity is the involuntary accumulation of liquid reserves. That is, the amounts of reserves in excess of the statutory requirements, and in some cases, beyond what banks hold for precautionary purposes. In managing liquidity risks, banks are not constrained only by the cash on hand and other liquid assets, but are also aware that they can access the interbank market or borrow from the central bank (Agénor et al., 2004). Accordingly, Agénor and El Aynaoui (2010) argued that liquidity determinants may be either structural or cyclical. Understanding the nature of the liquidity constraint and the factors that drive it will aid the policymaker in crafting the appropriate responses.

Liquidity risk is one of the critical issues facing policymakers, as this has the potential to trigger institutional failures through bank runs, the drying up of market liquidity or counterparty speculations about another bank's liquidity conditions. Furthermore, knock-on effects (transmitted through direct bilateral exposures between institutions and in other ways), can generate systemic failures (De Bandt and Hartmann, 2000). While several studies in recent times have included stress test analysis and contagion effects, Willem van den End (2010) maintains liquidity risk scenarios have not been sufficiently addressed. A framework that monitors changes in bank liquidity and assesses the potential for destabilising the financial system is therefore a vital element in the modern-day supervisory toolkit.

This study establishes a framework that is useful in identifying the impact of liquidity on individual banks while tracing the effects across the banking system. Both macro and bank-specific variables were used in an econometric model to determine the drivers of bank liquidity. Extending the model into a forecasting structure and applying simulated shocks to specific explanatory variables provide guidance on the likely path of the liquidity variable under stress for each bank. Further, the liquidity effects based on bank responses were traced through the banking system using interbank network analysis. This analysis provides an early warning system for assessing the systemic risk arising out of liquidity shocks.

The empirical approach seen in Moore and Maynard (2006) was adopted to determine the factors that help to explain liquidity conditions while the resilience to liquidity shocks was determined by the capital ratios of each institution. The CAR serves as an indicator of the bank's ability to absorb losses resulting from either direct liquidity shocks or through interbank contagion. In this study a failed bank was identified as one in which the after-shock CAR is less than the internationally accepted 8 percent benchmark. Furthermore,

systemic risk rises when the CAR of the entire banking sector converges to the 8 percent threshold.

Overall, the results suggest that banks in Barbados are well capitalised and are able to withstand significant liquidity shocks. Moreover, the study found that there is a ranking among banks in terms of systemic importance. Consequently, the second-round effects that result from systemically important banks tend to have large impacts with significant implications for bank stability.

According to the authors' knowledge, literature on the inter-bank exposures for the Caribbean region has been non-existent. By combining the liquidity forecasting approach, a novel framework for assessing the impact of liquidity risk on bank stability was established. The study continues with a discussion on the liquidity observations in Barbados, followed by a brief literature review in section 2. Section 3 discusses the data and methodological approach used, and section 4 discusses the results. Finally, we conclude in section 5 with a summary of our main findings and recommendations.

1. Stylised Facts

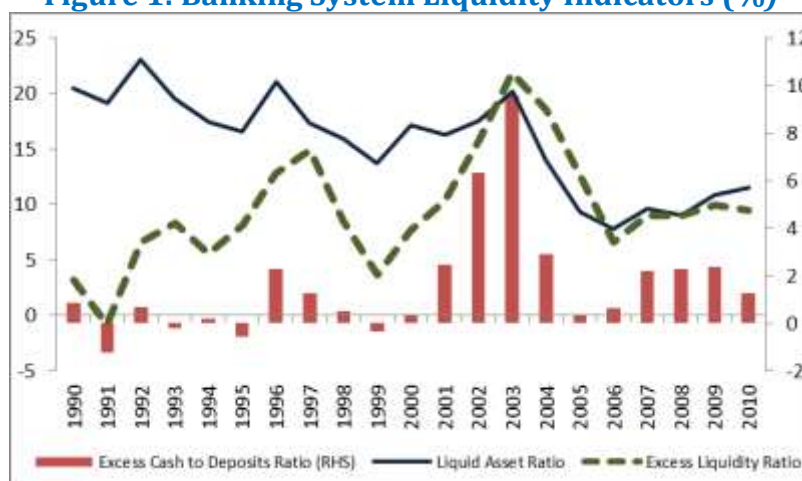
There are several metrics that can be used as a liquidity indicator. Among the commonly used ones in Barbados are the liquid assets ratio, the excess liquidity ratio and the excess cash-to-deposit ratio, each of which provide a unique guide to the policymaker¹. For example, a high or growing excess cash-to-deposit ratio may indicate that banks are likely to adopt aggressive lending policies in the future. At the same time, the policymaker may consider the indicator when pricing short-term treasury instruments. As seen in Figure 1, the liquidity measures appear to show a stronger correlation since 2002, largely reflecting the swings in excess cash. This convergence was also observed during the 2000-01 period when a series of policy adjustments were implemented – for example, downward adjustments on the cash and security requirements for commercial banks. The liquid assets ratio showed very little co-movement with the other liquidity measures prior to 2002-03, but was over 85 percent with each of the variables subsequently. The correlation between excess cash and excess liquidity averaged 70 percent over the entire period.

Historically, commercial banks' liquid assets ratios have been relatively high compared to the other two liquidity measures. Nevertheless, they are all influenced by elements in the real economy and direct policy intervention by the monetary authority. Of particular note is the build-up in deposit growth during the 1994-96 period, fuelled by an expansion in economic activity and large foreign capital inflows. As credit remained sluggish, the

¹ The liquid assets ratio is measured as local currency, deposits with the Central Bank of Barbados and other local commercial banks, plus domestic treasury bills, divided by total assets. The excess liquidity ratio is measured as the excess cash and securities held by commercial banks beyond that required by law, divided by average deposits, while the excess cash ratio represents that excess cash divided by average deposits.

monetary authority adjusted its policy² in order to ease the stringent requirements that stymied credit growth (Samuel and Valderrama, 2006). Excess liquidity eased over the next three years and bottomed out at the end of 1999 aided by further policy intervention. Sustained credit growth had led to immense pressure on the foreign reserves, and upward adjustments to the cash reserve requirement and discount rate were among the strategies implemented to limit the amount of lending in the economy.

Figure 1: Banking System Liquidity Indicators (%)



Source: Central Bank of Barbados

The restrictive policy measures of 1999 were short-lived as the authorities responded to the contractions in economic activity associated with the 9/11 incident. Notwithstanding, liquidity levels grew steadily in the early 2000s on the strength of Government's increased discretionary spending as well as large capital inflows associated with mergers and acquisitions. As interest rates remained low and the overall economy gained momentum, a resurgence in credit demand was evident, and this remained strong through the mid-2000s. At the onset of the financial meltdown, the authorities eased the policy stance on several occasions during the 2007 to 2009 period to encourage economic activity. Subsequently, liquidity across the system edged up slightly, but remained relatively steady over the last two years, even as deposits and credit alike remained flat.

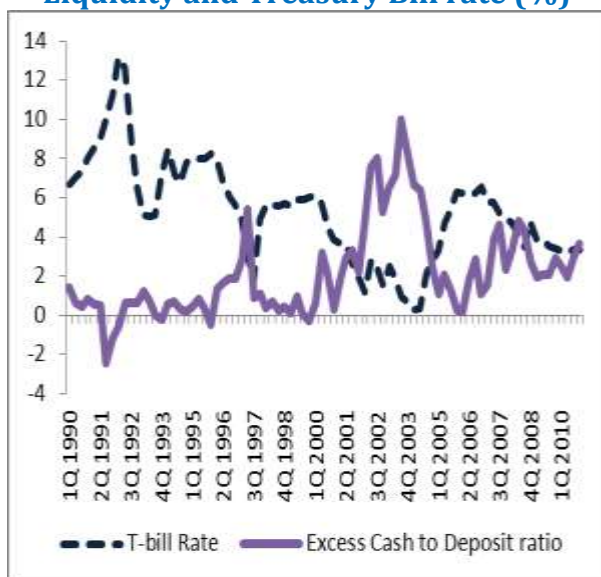
In terms of the association of liquidity with interest rates³, Figure 2 shows a stable negative association between the variables over the past three decades. The association as defined by correlation coefficient is in the region of -75 percent. This relation is consistent with mainstream arguments which suggest that high liquidity should drive down interest rates as institutions compete to earn a return on their excess funds. Inflation, on the other hand, does not show any significant association with liquidity, and many authors agree with

² In May 1997, the Central Bank of Barbados reduced the minimum deposit rate and cash reserve requirements by 1 percentage point and cut the proportion of securities held required by commercial banks from 23 percent to 20 percent. In addition, the Bank withdrew \$85 million of its deposits from the banking system.

³ The T-bill rate was used as it is the best representation of an auction market in Barbados.

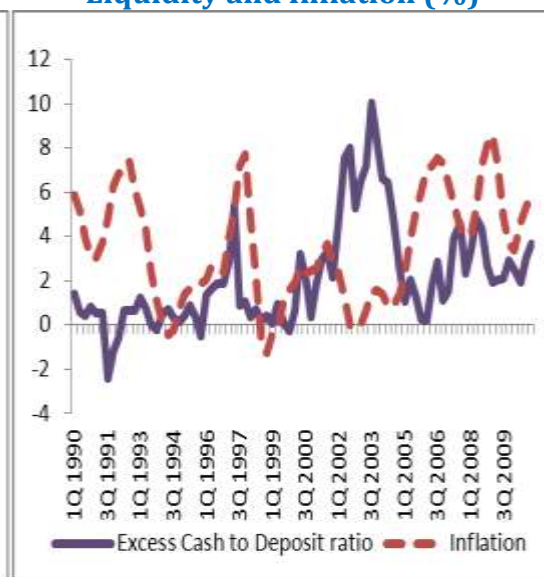
Craigwell and Moore (2010) that inflation in Barbados is largely imported. Despite this finding, some periods of high inflation and low excess liquidity were observed.

Figure 2:
Liquidity and Treasury Bill rate (%)



Source: Central Bank of Barbados

Figure 3:
Liquidity and Inflation (%)



Source: Central Bank of Barbados

2. Literature Review

The literature on modelling banks' liquidity is somewhat extensive, but relatively few studies have focused on small developing countries. Conventional theories of liquidity management and demand have focused on views such as the portfolio management theory where liquid assets are seen as a risk-free component of a bank's portfolio; the concept of liquid assets may be seen as a residual, that is, the sources of funding less credit and investments. Further, liquid assets act as a buffer for banks, guarding against the unpredictability of deposit withdrawals (Alger and Alger, 1999) and helps to explain why banks hold relatively risk-free and low-yielding assets instead of investing in higher yielding securities or credit. The reasons behind this seemingly non-profit making behaviour have implications for policymakers with respect to the effectiveness of monetary and fiscal policy and the overall supply of credit to the economy.

Agenor et al. (2004) provided the starting block for much of the recent literature on modelling excess liquidity. The authors derived a theoretical framework by explicitly modelling banks' excess liquid assets as a function of itself lagged, the reserve requirement, the volatility in the cash-to-deposit ratio and output gap (to capture the precautionary motives of banks), as well as the GDP output gap. Saxegaard (2006) investigated the issue of precautionary versus involuntary build-up in liquid assets due to undeveloped financial markets, and the consequences for the effectiveness of monetary policy.

In many lesser developed countries (LDCs), banks tend to hold large quantities of excess liquidity in their asset portfolios (see also Khemraj 2006 and 2010), explained partially by these two motives. The researcher extended the model used by Agenor et al. (2004) to decompose these two motives of cash accumulation, applying it to banks operating in sub-Saharan African (SSA) countries. Using a non-linear structural VAR model, they augment Agenor's framework with additional explanatory variables, including the volatility of private sector credit and government deposits, as well as further variables to track the flows of funds into and out of the banking system. Saxegaard opted to include the central bank's discount rate as the cost of liquidity and their findings suggest that the build-up in excess liquid assets by banks in their sample was primarily due to the involuntary build-up of funds. The author also made a key observation, that the liquidity build-up represents a structural problem within banking systems. The involuntary build-up of reserves on the other hand, can lead to increased inflationary pressures when the demand for credit picks up and these funds are disbursed. There then is a need for central bank intervention to remove this liquidity, but this may prove futile if monetary transmission is weak.

Maynard and Moore (2006) in modelling excess liquidity in Barbados also augment Agenor et al.'s (2004) demand for liquidity model with a measure of money creation, central bank's net domestic assets, excess cash and excess securities. Khemraj (2006 and 2009) investigated liquidity preferences and determinants in LDCs, focusing primarily on the Caribbean, and Guyana in particular. In his 2006 publication he finds that commercial banks in LDCs view excess liquidity and credit as close substitutes at very high minimum loan rates. Further, he proposes that excess liquidity is a structural result of oligopolistic banking systems and that any monetary policy impact on commercial banks would only be effective at high loan rates. His 2009 article explored why banks would prefer to hold excess funds instead of investing in a profitable foreign asset, finding that for Guyana, commercial banks are less focused on holding cash for precautionary purposes, and are faced by a foreign currency constraint imposed by the Central Bank's desire to accumulate foreign reserves.

Another instructive finding from Agenor et al. (2004) was that in times of stress, banks prefer to ramp-up their precautionary balances rather than lending on the interbank market. Such a practice can exacerbate strains in the financial system and was cited as a factor in the credit crunch of the late 1990s in Eastern Asia. Banks' exposures to each other are also exacerbated in times of stress. Contagion occurs via a number of channels, including common shocks and investor behaviour (Jokipii and Lucey, 2006). Adverse news or events which are perceived to impact directly on commercial banks may lead to runs on banks, presenting challenges for these institutions to meet withdrawals for deposits with available liquid assets. The cost of liquidity would vary from the rate on the interbank market, or the discount rate, or the discounted value associated with having to sell illiquid assets. The ripple effect throughout the banking systems is dependent on the degree of interbank exposures among banks.

Several authors including Allen and Gale (2000), Čihák et al. (2011) and Nier et al. (2008) have illustrated the importance of the structure of a system's interbank linkages in determining the extent of its fragility to shocks. The simple transmission of a shock to one

bank is absorbed, in order of priority, by its capital, creditors (other commercial banks) and finally, if there is any residual, its depositors. In the event that capital is not sufficient to fully absorb any losses, the other commercial banks' holdings are affected, and this initiates the ripple effect of losses on these institutions. Nier et al. found that by varying the size of capital, the size of the interbank market, the degree of connectivity and the concentration within the banking system have significant impacts on the likelihood of a systemic crash. Moreover, limited liquidity and greater discounts on fire sales also increase the chances of a systemic breakdown. Studies such as Espinosa-Vega and Solé (2010), Degryse et al. (2010) and Chan-Lau (2010) also applied these models to cross-border banking risks.

3. Data and Methodology

The econometric approach adopted allowed for evaluating various types of effects across the variables as well as providing for possible heterogeneity in the cross-sections. Such a framework allowed the authors to derive a robust liquidity demand function and assess the accuracy of the model to forecast bank liquidity. Further, the network analysis provided insight into the degree of interbank exposures among banks and identifies the institutions which are systemically significant. Monthly data from 1993 to 2011 was used to estimate and evaluate the model, while balance sheet data as at year-end 2011 was used to simulate the liquidity effects across the sector. The methodology employs three phases: the estimation, the forecasting and evaluation and the network analysis.

3.1. Estimation

A pooled framework was chosen to derive the econometric relationship between the three chosen liquidity measures and eight key macro- and micro-economic variables. The selected regressors and functional relationship was adapted from Agernor et al. (2004), Maynard and Moore (2006) and Khemraj (2009) who all investigated this issue using time series methods. Each liquidity indicator is expressed in general form as:

$$Liquidity_{it} = \beta_1 Liquidity_{it-k} + \beta_2 rr_{t-k} + \beta_3 VolCD_{it-k} + \beta_4 tb_{t-k} + \beta_5 NDA_{t-k} + \beta_6 YYT_{t-k} + \beta_7 VolYYT_{t-k} + \beta_8 VolPSC_{it-k} + \alpha + \varepsilon_{it},$$

representing the pooled homogeneous equation, with the subscripts i , t and k denoting, individual, time and lag length (6 months are chosen initially) respectively. The above equation is also estimated within a pooled heterogeneous framework, in which the coefficient on each variable and the constant α are allowed to vary over time. These two frameworks are then used to forecast the system and bank-specific liquidity ratios, respectively.

The variables included for consideration are defined as follows: Liquidity represents the relevant liquidity indicator used in each equation, while rr is the reserve requirement existing at the time and is expected to have a negative impact on excess liquidity and excess

cash, but a positive impact on the liquid assets ratio as banks are coerced into holding more liquid assets⁴. VolCD and VolPSC capture the volatility in the cash-deposit ratio and private sector credit, respectively as measured by the 3-month rolling standard deviation in the cash-deposit ratio and private sector credit. Increases in these volatilities are expected to push banks to hold more liquid assets as a precautionary motive to meet unpredictable withdrawals in deposits while also satisfying the demand for private sector funding. The Treasury Bill rate (tb) and the central bank's net domestic assets (NDA) are each expected to have positive impacts on the excess liquidity and liquid asset ratios, as higher interest rates should induce banks to hold more short-term securities, while increases in the NDA should lead to money creation and more cash in the vaults of commercial banks. These two variables may have opposite impacts on the excess cash holdings of banks however, as the NDA will again lead to money creation while higher interest rates should lead banks to divert cash to higher-yielding assets. YYYT is the deviation of GDP away from its long-term trend while VolYYYT is the volatility of this deviation, respectively. It is anticipated that as aggregate demand increases in magnitude and volatility, there will be a greater demand for cash in the economy.

3.2. Forecasting Liquidity

Having estimated the dynamic relationships between the liquidity indicators and the eight explanatory variables, in-sample (1993 – 2010) and out-of-sample (2011m1 – 2011m8) forecasts are carried out to ascertain the predictive nature of each model. The p-values of Mincer-Zarnowitz Regressions (Mincer and Zarnowitz, 1969) and mean percentage errors (MPEs) are calculated for the system models for both forecasts, and the heterogeneous model. Since we are more concerned with the policy implications arising from the system's liquidity as opposed to any one bank, we evaluate the p-values of the Mincer-Zarnowitz Regression and the MPEs for the in-sample forecasts in order to test of the model's ability to track each series.

3.3. Network Model for Contagion Analysis

This paper traces the potential risks to Barbadian commercial banks arising from their exposures with other banks within the domestic, regional and global banking system traced. Shocks to one or more banks can lead to contagious effects being felt throughout a system if at least one institution fails. Here we will describe the approach derived from the body of literature on network models which we use to track the transmission of various shocks, derived from the body of literature on network models.

Our model is built on a network of banks, each of which is connected to the others via interbank holdings, whether deposits or loans. The framework we use assumes that a shock to one bank is fed through as losses to the regulatory capital and risk-weighted assets of that institution and a check is made to ascertain whether that bank has failed (breached its 8 percent prudential capital adequacy ratio limit) or been able to fully absorb

⁴ This variable changes to the local cash reserve requirement ratio when estimating the excess cash function.

the shock ⁵. In the event that the former has occurred and the size of the shock is sufficient to eliminate the affected bank's entire capital, all other banks which would have held funds with that institution will lose these holdings in proportion to the size of the residual shock. This translates into losses to these institutions, generating a second round effect where the banks may or may not be able to absorb these losses within their capital. The process continues until the shocks are fully absorbed by the remaining banks, or all banks have failed.

The model also has with it a number of additional parameters which may be adjusted to alter the severity of a shock and provide alternative stress scenarios. The loss-given-default on any shock is initially set at 100 percent, while there are assumptions made about additional contagion effects through investor panic. After a bank fails, depositors may run to withdraw deposits from the remaining institutions, at a rate specified within the model. Initially it is arbitrarily assumed that banks lose 30 percent, 10 percent and 6 percent, respectively of demand, savings and time deposits after the first round of failures, and 20 percent, 8 percent and 4 percent respectively in each subsequent round. To combat this run on deposits, banks pay depositors out of available liquid assets and initially 35 percent of their funds held at head office. However, in the event that this is insufficient to meet the demand, they must begin to sell off non-liquid assets, presumably at a discount in a stressed environment, and this discount is initially assumed to be 50 percent of book value. The discount feeds through as an additional loss to capital and may further intensify the problems faced by banks.

Two main scenarios are used to stress the banking system, namely individual defaults on each commercial bank's three largest exposures ⁶ and secondly, shocks leading to the failure of European, Canadian, American, Caribbean-affiliated and non-affiliated banks with which domestic commercial banks hold deposits. Scenario one represents a situation in which some banks could find themselves given the large exposure which some have to the domestic private sector. This has manifested itself over the past two years as one particular bank has experienced a substantial rise in its gross classified debt on account of loans to just two groups being classified as substandard. Scenario two is particularly relevant given the current uncertainty surrounding a number of banks operating in the USA and Europe in particular as well as the presence of mostly Canadian banks in the domestic sector. This scenario allows us to evaluate the potential impact of failures arising in these countries, as well as problems which may arise that are similar to those initiated by the failure of CL Financial Holdings in Trinidad & Tobago in 2009.

Under each set of scenarios, the assumptions are then twice varied to reflect first 5, and then 10 percentage point increases in the proportion of deposits withdrawn at each stage of the shock transmission.

⁵ Since only 5 of the 6 banks used in the sample submit regulatory capital to their regulator, the Central Bank of Barbados, an estimation of this value was made for the 6th bank, based on its ratio of calculated risk-weighted assets to those of its parent.

⁶ Even though some of these assets are secured by various forms of collateral, we the authors assume a full stress scenario where these securities become impaired.

Table 1 gives a matrix of the interbank holdings of Barbadian commercial banks as at the second quarter of 2011. From the matrix, one can see that only two banks, Banks 2 and 6, hold deposits from other domestic commercial banks. Bank 2 is the most connected within the network, with Bank 6 holding the largest share of deposits, albeit from just one bank. The commercial banks are much more exposed to regional and international institutions, with Canadian and Caribbean affiliated banks holding the largest share of deposits. This finding is not surprising, given that all domestic banks are ultimately owned by Canadian and Caribbean parents.

Table 1: Matrix of Barbadian Commercial Bank Assets Held at Other Banks

	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6
Holding Banks: (BDS\$ '000)						
Bank 1	-	-	-	-	-	-
Bank 2	831	-	15	209	781	-
Bank 3	-	-	-	-	-	-
Bank 4	-	-	-	-	-	-
Bank 5	-	-	-	-	-	-
Bank 6	-	-	-	2184	-	-
Canadian	28164	1148	118696	39807	331092	72
US	39472	16190	55	72457	66509	2542
European	871	857	3358	8324	2332	1814
Caribbean affiliates	7483	1112	215	233102	1483	1209
Caribbean non-affiliates	1938	178	-	648	-	-

Source(s): Central Bank of Barbados and Commercial Banks

4. Results and Analysis

4.1. Estimation results and forecasts

Tests to determine the poolability of the data suggest that any individual fixed effects are likely to be redundant. Thus, the estimation results of our pooled homogeneous equations are shown in Table 2. Results of the heterogeneous estimation are not displayed, because of the cumbersome nature of presentation but can be acquired from the authors upon request. Table 3 shows the relative performance of each forecast.

Table 2: Results Pooled Homogeneous Estimations

Liquid Assets		Excess Liquidity		Excess Cash	
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
Constant	9.432**	Constant	12.630**	Constant	13.024**
Liquidity(-1)	0.730**	Liquidity(-1)	0.652**	Liquidity(-1)	0.362**
Liquidity(-2)	0.132**	Liquidity(-2)	0.188**	Liquidity(-4)	0.137**
Dummy#	9.715**	D(RR)	-0.954**	VolCD	0.811**
VolCD(-3)	-0.076*	VolCD	0.465**	NDA(-1)	-0.007**
VolCD	0.245**	VolCD(-1)	-0.374**	NDA	0.006**
VolYYT(-3)	51.489**	Liquidity(-3)	0.052*	Liquidity(-2)	0.145**
VolPSC	-10.924**	VolYYT(-3)	126.721**	VolCD(-1)	-0.582**
Liquidity(-3)	0.072**	YYT(-6)	-24.343**	YYT(-6)	-13.252**
YYT(-6)	-8.994**	VolPSC	-12.643**	VolYYT(-3)	72.990**
VolPSC(-5)	6.394**	D(TB(-5))	0.415**	Liquidity(-3)	0.129**
VolCD(-1)	-0.135**	D(TB(-1))	-0.309*		
VolCD(-5)	-0.139**	YYT	11.733**		
D(TB(-5))	0.255**	NDA(-1)	-0.005**		
Liquidity(-6)	0.040**	NDA	0.004**		
		Liquidity(-4)	0.058**		
R-squared	0.9038	R-squared	0.8994	R-squared	0.6385
Jarque-Bera	11.96**	Jarque-Bera	5.20*	Jarque-Bera	14.13**
Q-Stat (1 lag)	0.236	Q-Stat (1 lag)	0.468	Q-Stat (1 lag)	0.004
Q-Stat (2 lags)	0.615	Q-Stat (2 lags)	0.91	Q-Stat (2 lags)	0.639

** and * represent significance at 5 percent and 10 percent levels, respectively

added to bring distribution closer to normality

Source(s): Author's calculations

After conducting panel unit root tests and differencing the appropriate variables to achieve the stationarity conditions for each series, our pooled estimations suggest that the selected variables explain a higher proportion of variations in the monthly liquid assets ratio, than in excess liquidity and excess cash ratios. The reserve requirement ratio appears in only the excess liquidity equation and carries the correct sign, suggesting an almost one to one relationship between required reserve and excess reserve ratios. Our precautionary motive variables VolCD and VolPSC give varying results across the three equations. The primarily negative sign on the latter variable across equations suggests that as the demand for credit becomes more volatile, banks' liquidity positions decrease in response to at times higher than expected loan demand. The VolCD variable appears with both negative and positive lags in each equation, although the strongest effect appears to be that of a positive one. This result seems quite plausible as frequent up and downturns in cash will be reflected in liquidity positions and banks will be pushed to increase their general holdings of cash in order to meet any unexpected demands. The Treasury Bill rate appears in the first two equations with primarily positive coefficients, suggesting that banks respond to increases

in this rate by purchasing more securities with maturities one year or less. The coefficients on the NDA suggest that money creation initially increases excess cash and securities holdings of commercial banks and this is met by a subsequent decrease one month later, presumably through increased lending or foreign investment. VolYYT carries its a priori sign under each equation, while YYT's dual coefficients suggest that as aggregate demand picks up in the economy, banks become more liquid, possibly through higher deposits. However, as credit growth catches up with deposits, commercial banks' liquidity positions are reversed as more funds are lent back to the economy.

Turning attention to Table 3, the model diagnostics reveal that for the liquid assets and excess cash regressions, there may be some issues of non-normality, but in all three cases, the models do not suffer from 1st or 2nd order serial correlation.⁷

Table 3: Results of Forecast Evaluations

	Liquid Assets		Excess Liquidity		Excess Cash	
	P-value from Mincer-Zarnowitz Regression	F-stat MPE	P-value from Mincer-Zarnowitz Regression	F-stat MPE	P-value from Mincer-Zarnowitz Regression	F-stat MPE
System (in-sample)	0.0203	1.56%	0	6.69%	0.0069	-0.32%
System (out-of-sample)	0.2546	1.67%	0.8491	-0.33%	0.0602	-23.39%
Bank 1	0.8695	4.03%	0.9776	4.40%	0.978	32.46%
Bank 2	0	1.72%	0.0666	-111.26%	0.9767	-291.74%
Bank 3	0.0248	1.96%	0.962	28.30%	0.9819	-473.44%
Bank 4	0.0967	0.68%	0.1329	12.66%	0	-32.67%
Bank 5	0.5954	2.09%	0.8558	6.80%	0.9188	-16.92%
Bank 6	0.0053	7.87%	0.164	-179.78%	0.1249	103.56%

Source(s): Author's calculations

Forecast evaluations of the three liquidity indicators show that, as shown by the R-squared in the three equations, forecasting the liquid assets ratio is considerably more accurate than the other two forecasts, both for the system and the individual banks. At most, the forecasts overpredict the liquid assets ratio by at most 7.87 percent in the case of Bank 6, whose liquidity, on inspection of all other forecast performance indicators, appears to be less easy to predict in general. The excess cash ratio's forecasting performance appears to be worst of all, reflecting the volatile nature of this ratio and comparatively low R-squared, as excess liquidity performs much better in all but few cases. Overall, Banks 2 and 6 appear to exhibit the more difficult ratios to predict, with Bank 2's performance potentially suffering from a constant ratio over much of late 1991 and the entire period of 1992. Despite this performance, however, the p-values from the Mincer-Zarnowitz regressions indicate that all in-sample forecasts of aggregate liquidity measures are biased and

⁷ Tests at further lags were done and a similar result was found.

inefficient at the 5 percent level of significance, but out-of-sample forecasts are unbiased and efficient. It is also interesting to note that despite the relatively good performance of the liquid assets forecasts, forecasts for this measure appear to be biased and inefficient for 3 out of the 6 banks.

4.2. Network Stress Analysis

Tables 4 and 5 display the results for the two sets of shocks applied to the Barbadian commercial banking system as at 2011 Q2. As is clear, a shock that produces a default in the three largest exposures of each bank always leads to the failure of the affected bank, highlighting both the risks of large exposures as well as the necessity for holding collateral against large credits and investments. However, these shocks, while reducing the capital of the other banks within the system, have very little effect on the remainder of the system because of the relatively small value of interbank holdings among the six institutions, and because the shocks are absorbed after one round. Nevertheless, as we increase the proportion of deposits withdrawn from banks in the other two scenarios of shocks, we see many more failures, with all banks failing in three out of six shocks under a 5 percentage point increase in withdrawals, and all but one under a 10 percentage point increase in deposit outflows. Finally, Banks 2, 3 and 6 appear to be the most systemically important banks in terms of triggering an overall system collapse.

Table 4: Results of Default of Banks' Three Largest Exposures

Shocks	Minimum CAR % of Remaining Banks	Maximum CAR %	Sector CAR %	Number of Banks with CAR < 8%
Baseline	15.35	23.42	18.33	0
Bank 1	10.96	23.42	17.89	1
Bank 2	10.88	23.42	17.51	1
Bank 3	10.96	20.87	15.71	1
Bank 4	10.96	23.42	18.65	1
Bank 5	15.41	23.42	18.83	1
Bank 6	10.96	23.42	17.49	1
Bank 1 (+5%)	10.35	12.42	11.84	3
Bank 2 (+5%)	-	5.79	-	6
Bank 3 (+5%)	-	5.28	-	6
Bank 4 (+5%)	10.52	17.94	14.62	2
Bank 5 (+5%)	12.85	21.77	17.46	1
Bank 6 (+5%)	-	5.79	-	6
Bank 1 (+10%)	-	7.99	-	6
Bank 2 (+10%)	-	7.99	-	6
Bank 3 (+10%)	-	5.73	-	6
Bank 4 (+10%)	-	7.99	-	6
Bank 5 (+10%)	9.28	20.87	15.06	1
Bank 6 (+10%)	-	7.99	-	6

Source(s): Central Bank of Barbados and authors' simulations

With respect to the failure of regional and international banking systems, there appears to be much fewer defaults in the system than in the previous stress scenario, particularly given that the size of banks' domestic large exposures are much more than their funds held in overseas institutions. However, a similar story does present itself as an increase in the rate of withdrawal of deposits during a crisis significantly increases the number of banks failing domestically, with two banks out of five failing under the most extreme assumption of withdrawals. Overall, failures in Canada and failures by the regional affiliates of domestic banks are the two main triggers of systemic risk in Barbados. This is not surprising given the relatively large exposures which our banks have to their parents and affiliates throughout the western hemisphere.

Table 5: Results of Failure of Individual Banking Systems

Shocks	Minimum CAR % of Remaining Banks	Maximum CAR %	Sector CAR %	Number of Banks with CAR < 8%
Baseline	15.35	23.42	18.33	0
Europe	15.04	23.27	18.12	0
Canada	13.64	20.76	16.07	1
USA	9.07	23.42	15.84	0
Caribbean affiliates	10.82	23.41	18.45	1
Caribbean non-affiliates	15.35	23.42	18.3	0
Europe (+5%)	15.04	23.27	18.12	0
Canada (+5%)	11.04	20.76	14.66	1
USA (+5%)	9.07	23.42	15.84	0
Caribbean affiliates (+5%)	10.03	17.66	14.39	2
Caribbean non-affiliates (+5%)	15.35	23.42	18.3	0
Europe (+10%)	15.04	23.27	18.12	0
Canada (+10%)	-	7.39	-	6
USA (+10%)	9.07	23.42	15.84	0
Caribbean affiliates (+10%)	-	7.98	-	6
Caribbean non-affiliates (+10%)	15.35	23.42	18.3	0

Source(s): Central Bank of Barbados and authors' simulations

A number of key findings are suggested. Firstly, investor behaviour and panic can play a key role in magnifying a banking system's problems (a key result reported by Nier et al., 2008) as increases in the proportion of deposits withdrawn placed much greater strain on banks' liquidity positions, which under previous scenarios had appeared much sounder. In fact, because the size of interbank holdings among domestic entities is relatively small, this exposure played little part in prolonging the crisis at hand. Hence, maintaining adequate liquidity, and subsequently preventing unprofitable fire sales can be essential to mitigating a prolonged crisis.

This relates to our second finding, namely that a prolonged crisis, as witnessed by numerous rounds of defaults, increases the probability of a major failure of the entire

banking system. As the number of rounds of defaults increases from just one or two, the chances of all six banks' capital falling below their prudential limit increases exponentially.

In addition, the model is very beneficial in allowing researchers and policymakers to track the transmission of a shock from its trigger until it is finally absorbed. The results from our simulations have revealed that although Banks 2, 3 and 6 are systemically most important in triggering a crisis, due to their holdings of other banks' deposits, Bank 5 is actually the most likely to trigger additional rounds of default under both sets of scenarios. This is partially explained by the Bank 5's slightly lower capital adequacy and liquid assets ratios. This bank is also heavily exposed to the Canadian banking system and all this combines to increase its probability of default relative to its competitors. Nevertheless, it must be noted that the scenarios used are all extremely stressful and all of the banks investigated appear to be sufficiently liquid and very well capitalised against major shocks to the system, including failures to the US and European banking systems and severe investor panic.

5. Conclusion

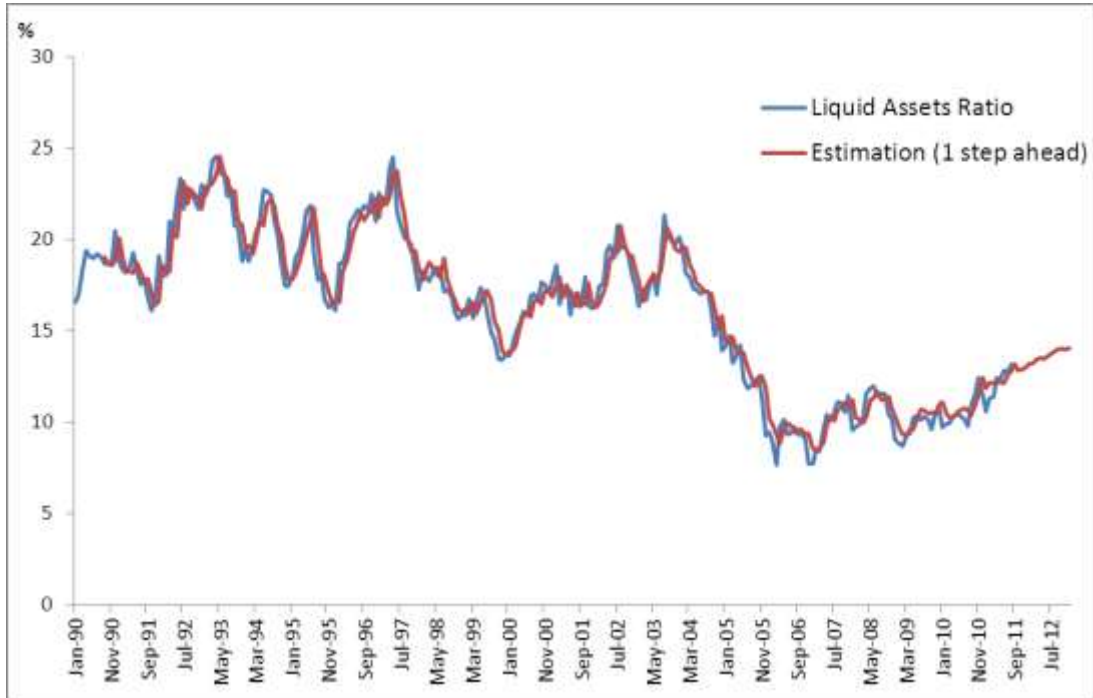
This study provides a useful framework for monitoring systemic as well as individual bank liquidity. We adopted a simple macroeconomic model that allows a formal analytical exploration of the implications of liquidity shocks across institutions and traces the impact on banks' capital. This stress test framework assesses the risks to the Barbadian banking system based on the inter-bank exposures among institutions.

The results suggest that a high level of persistence exists across the liquidity measures. Volatility in cash-to-deposit and changes in the business cycle are also important factors among the three measures of liquidity. Volatility in private sector credit appears to impact the liquid asset ratio and excess liquidity variables only, while the net domestic asset variable is an important factor for excess liquidity and excess cash variables. In addition, the predictive capacity of the model is stable and satisfactory.

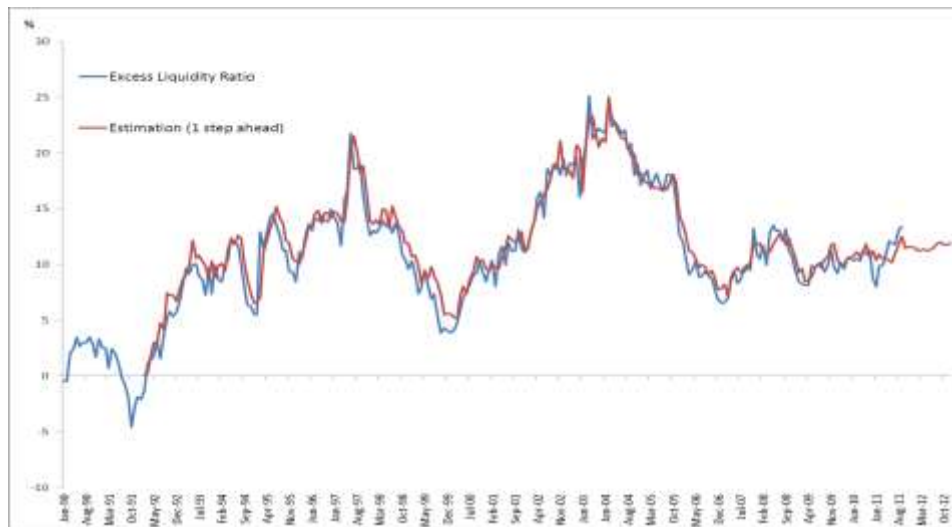
Commercial banks in Barbados are currently well capitalised and are able to withstand significant shocks. According to the stress test analysis, a sizeable credit default would only compromise the capital of the institution in which it occurred. Other institutions are able to absorb losses that may arise through contagion. However, by compounding the stress test simulations with runs on deposits we observe that there are three banks of great systemic importance, each of which has the potential to trigger a collapse in the system. Further, exposures to Canadian banks and Caribbean affiliates are the only exposures which, if compromised in conjunction with a severe run on banks' domestic deposits, would lead to a failure of the local banking system. This study reveals that Barbadian banks are sufficiently insulated from the current financial crises of Europe and the USA, but are closely connected to their parents, all of whom are either Canadian or Caribbean.

Appendices

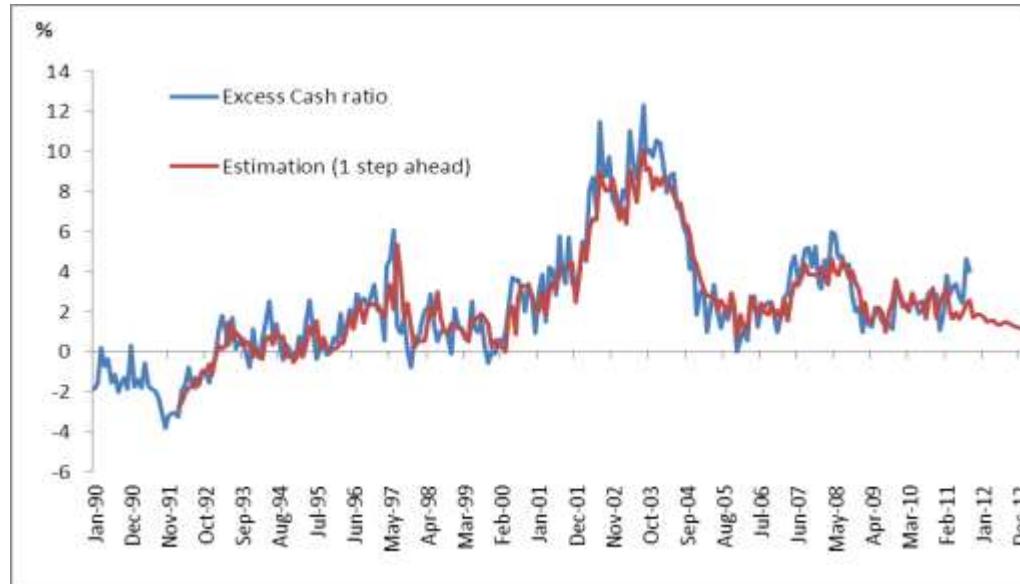
Appendix 1: Liquid Assets Ratio In-Sample, Out-of-Sample and Ex-post Forecasts



Appendix 2: Excess Liquidity Ratio In-Sample, Out-of-Sample and Ex-post Forecasts



Appendix 3: Excess Cash Ratio In-Sample, Out-of-Sample and Ex-post Forecasts



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What Prompts Central Bank Intervention in the Barbadian Foreign Exchange Market?

By Mahalia Jackman*

Abstract

The Central Bank of Barbados often intervenes – buys or sells from the foreign exchange (FX) reserves – to ensure the daily clearing of the FX market. This paper estimates an FX intervention function for Barbados using a dynamic complementary log-log model. Three general findings emerged: (i) dynamics play an important role in the Central Bank's intervention function, meaning that the probability that an intervention takes place today is conditional upon an intervention taking place at least one day prior. This most likely reflects the fact that deficits/surpluses on the FX market tend to be persistent, resulting in intervention over a consecutive number of days; (ii) there appears to be some differences in the response of Central Bank interventions to the other key variables. Particularly, seasonal fluctuations in tourism and interest rate spreads are likely to impact the probability of a sale intervention, but don't seem to affect the likelihood of a purchase intervention. Moreover, an influx of real estate flows is likely to increase the probability that a purchase intervention takes place, but might have limited impact on the marginal propensity of a sale intervention. Finally, (iii) 'oil price shocks' is the only exogenous variable which appears to impact both sale and purchase interventions.

Keywords: Foreign exchange, intervention and fixed exchange rate

JEL: F31, E58 and N26

Introduction

Intervention in the foreign exchange (FX) market occurs when a monetary authority buys or sells foreign dollars, normally against its own currency. Central banks usually intervene in order to calm disorderly market conditions, fix exchange rate misalignments, stabilise erratic short-term exchange rate fluctuations, or quell the excess demand/supply of FX. It follows that the motivation, frequency and size of interventions vary considerably across exchange rate regimes.

Under a floating regime, the size and timing of interventions are critical policy decisions. Specifically, the magnitude of the intervention is assumed to be proportional to the resulting change in the exchange rate, while the timing determines whether or not the shock is fully absorbed by market players¹. But, in an economy with a fixed exchange rate –

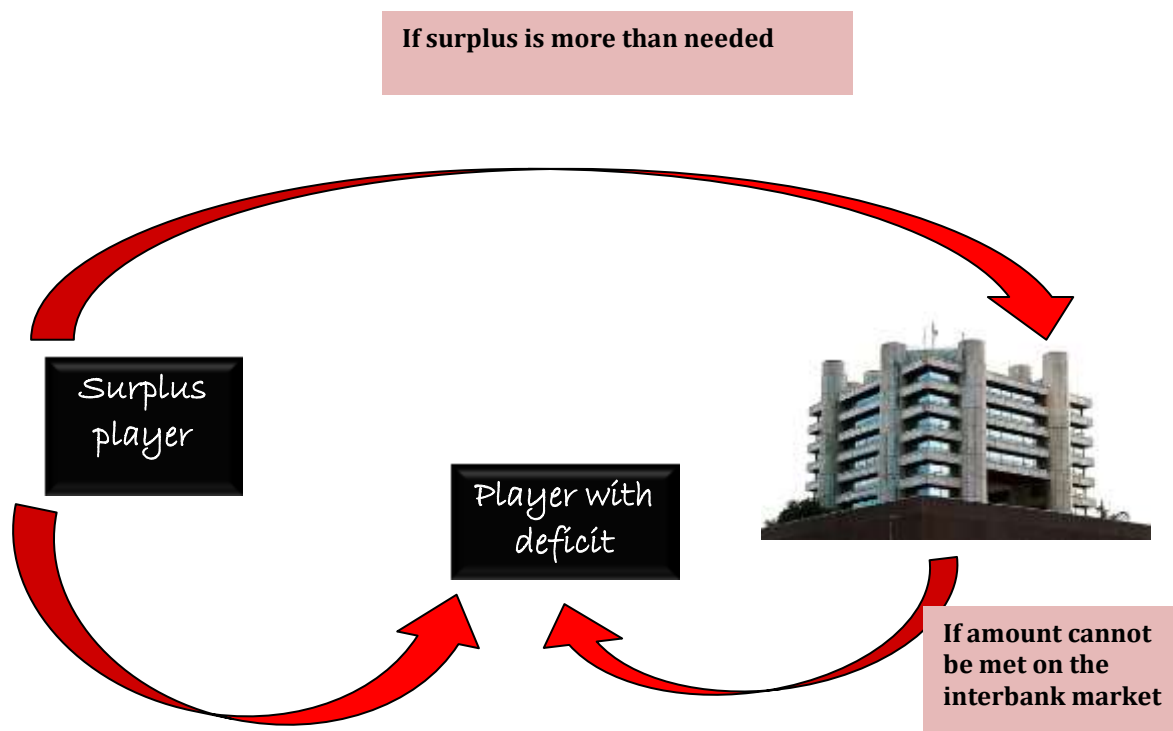
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¹ Theoretically, the more surprising the intervention, the more likely market players will be caught off guard. If intervention is unexpected, market players may not be able to fully absorb the shock and so, intervention is more effective.

such as Barbados – it is the FX demand and supply conditions that dictate both the timing and amount of intervention. Hence, intervention in a pegged economy tends to be endogenous.

Figure 1 depicts a simplified model of the intervention process in Barbados². The focus here (as well as the rest of the paper) is on the interaction between the Central Bank and authorised FX dealers. Typically, if any FX dealer has more FX than it needs, it offers to sell the surplus on the market. Dealers who are short that day, or expect to experience a shortage over the next couple of days, buy from the surplus player. If the short dealers don't need the full amount on offer, the excess surplus is sold to the Central Bank. Alternatively, if the offered amount by surplus players is insufficient, the dealers whose needs cannot be met on the interbank market are accommodated by the Central Bank. In a nutshell, the Central Bank acts as the last resort for sales and purchases of FX, and only intervenes in periods of excess deficits or surpluses.

Figure 1: FX Intervention in Barbados



This then raises the question – “what are the causes of FX deficits/surpluses in the Barbados FX market?” In this paper, the author seeks to unravel some of the factors that force Central Bank involvement in the Barbados FX market. The study employs daily data, and in so doing, better captures the frequency and pattern of FX intervention with respect

² FX interventions in Barbados are not sterilised.

to balancing demand and supply in the market. The disadvantage of this approach is the vanishing relationship between interventions and some “economic fundamentals” which are usually measured on a monthly or quarterly basis (see Almekinders and Eijfinfer, 1994).

The rest of this paper is organised as follows: in Section 1, an analysis of the features of central bank intervention is presented. Section 2 evaluates some factors believed to be driving intervention, while section 3 presents and evaluates a quantitative model of FX intervention for Barbados. Finally, some concluding remarks are offered in section 4.

1. Features of FX Interventions in Barbados

1.1. Measuring FX Interventions

A popular proxy of intervention is the change in the stock of international reserves. However, the use of this variable for Barbados can be very misleading, since changes in reserves often reflect, *inter alia*, withdrawals/inflows of funds from multilateral organisations (for instance, the Caribbean Development Bank or the Inter-American Development Bank), government repayments and inflows from government loans. Thus, official intervention in this paper is defined as the total foreign currencies traded by the Central Bank on the interbank FX market.

But, even this approach has its shortcomings. Specifically, FX dealers in Barbados are currently subjected to two surrender requirements (see Worrell et al, 2011):

- I. FX dealers in Barbados are required to sell 25 percent of the proceeds of foreign currency loans undertaken on behalf of private sector customers and 100 percent of the proceeds of government related loans to the Central Bank (effective 2005).
- II. Dealers are required to sell 5 percent of their gross purchases of FX from their customers to the Central Bank (effective 2011).

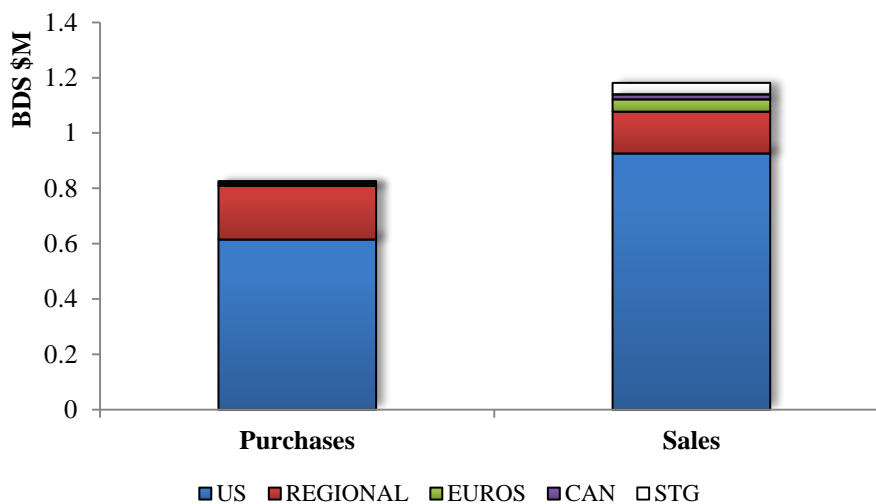
In this study, the author excludes purchases relating to these FX policies from the definition of “buy interventions” as they may not necessarily reflect intervention driven by supply/demand conditions, i.e. a sale to the Central Bank due to a surplus of FX on the market. Thus defined, the remainder of this section focuses on the prominent features of FX interventions over the period 2003-2011.

1.2. Size, Frequency and Structure of FX Interventions in Barbados

Daily FX interventions carried out by the Central Bank are mostly denoted in US dollars (See figure 2) – which can be expected given that the aim is to defend the BDS\$2 to US\$1 peg. Trailing behind are trades of regional currencies, i.e. transactions in Belize, Eastern Caribbean, Guyanese, Jamaican or Trinidad and Tobago dollars. A close look at the data

reveals that the majority of transactions in regional currencies are related to trade in goods. Indeed, the majority of Barbados' visible trade is with CARICOM countries. Intra-regional financial and capital transactions also occur, but are not quite as common; and most of these tend to take place in US dollars. Finally, there are occasional sales of Canadian dollars (CAN), Sterling pounds (STG) and Euros, which tend to be largely related to the importation of goods and proceeds of property sales. As shown in Figure 2, purchases of these currencies are rare, accounting for less than 3 percent of daily FX transactions on average.

Figure 1: Intervention by Currency – Daily Average: 2003-2011



Source: Central Bank of Barbados

Table 1 describes the empirical distribution of the intervention data over the sample period. The table highlights that Central Bank FX interventions are heavily skewed, and exhibit larger kurtosis than the normal distribution. In fact, the Jarque-Bera statistic unambiguously rejects the null hypothesis of normality for both sale and purchase interventions.

There seems to be a preponderance of days of zero activity. Out of 2,348 trading days, sale interventions take on a zero value in 260 business days. The case of purchase interventions is even more dramatic, registering 495 days with no activity. The dollar amounts of FX interventions tend to be small, at least in comparison to the more advanced economies (see for instance Kim and Sheen, 2002; Frenkel and Stadtman, 2001); the average sale intervention for the full sample being \$1.2 million and the average purchase value is just \$0.8 million. Moreover, on nearly 70 percent of active days, the intensity of sale interventions are less than \$1 million, while about 67 percent of purchase interventions stood in the modest range of \$0 to \$1 million. Nonetheless, there are episodes of large scale interventions, with the largest sale and purchase interventions to date valued at \$34 million and \$96.4 million, respectively.

Table 1: Empirical Distribution of Interventions – January 2003 to December 2011

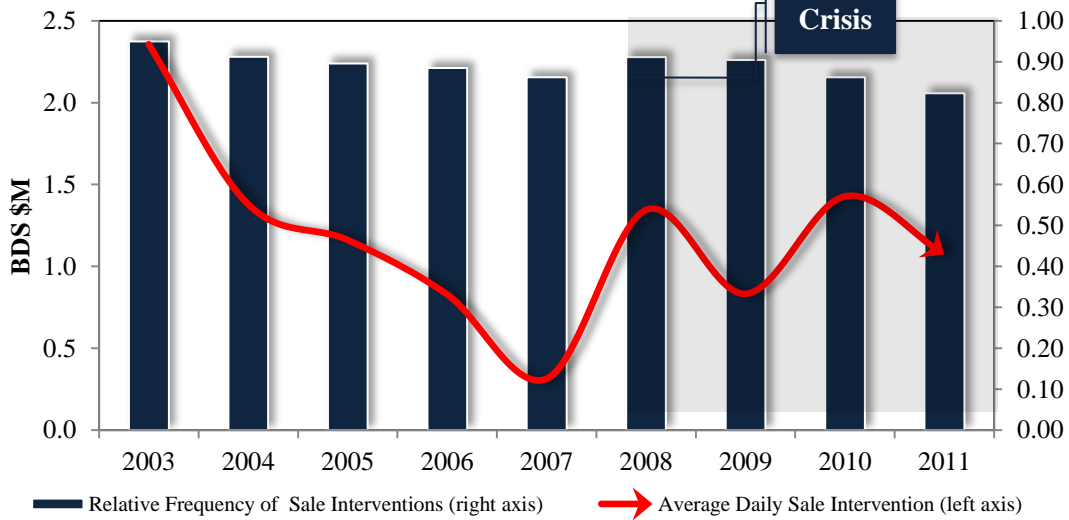
Sale Interventions			Purchase Interventions		
<i>Intervention Value (BDS \$M)</i>	<i>Frequency</i>	<i>Cumulative (%)</i>	<i>Intervention Value (BDS \$M)</i>	<i>Frequency</i>	<i>Cumulative (%)</i>
0	260	11.1	0	495	21.1
(0.0 – 0.5]	1489	74.5	(0.0 – 0.5]	1381	79.9
(0.5 – 1.0]	150	80.9	(0.5 – 1.0]	182	87.6
(1.0 – 1.5]	71	83.9	(1.0 – 1.5]	52	89.9
(1.5 – 2.0]	49	86.0	(1.5 – 2.0]	36	91.4
(2.0 – 2.5]	44	87.9	(2.0 – 2.5]	42	93.2
(2.5 – 3.0]	36	89.4	(2.5 – 3.0]	37	94.8
(3.0 – 3.5]	33	90.8	(3.0 – 3.5]	18	95.5
(3.5 – 4.0]	20	91.7	(3.5 – 4.0]	6	95.8
(4.0 – 4.5]	16	92.3	(4.0 – 4.5]	12	96.3
(4.5 – 5.0]	14	92.9	(4.5 – 5.0]	3	96.4
> 5.0	166	100.0	> 5.0	84	100.0
Mean	<i>Sales</i> \$1.2M		<i>Purchases</i> \$0.8M		
Maximum	\$34.0M		\$96.4M		
Jarque-Bera (p-value)	73179.02 [0.0]		8401276 [0.0]		
Skewness	4.5		13.9		
Kurtosis	28.8		294.7		

Source: Central Bank of Barbados and author's calculations

Interestingly, the intervention size and frequency was not uniform over the sample period. This is shown in Figures 3 and 4, which plot the average daily intervention value and the relative frequency of interventions (defined as percentage of trading days with intervention activity). Between 2003 and 2007, both the frequency and size of sale interventions were on a downward trajectory, with the frequency of sales intervention moving from 0.95 in 2004 to 0.86 in 2007. The size of daily sales (on average) also fell, moving from \$2.4 million to a low of \$0.3 million. But, it should be noted that the year 2007 is a large outlier here. Specifically, the observed decline in FX obtained from the Central Bank may have been due to the influx of foreign flows in relation to Cricket World Cup 2007 as well as the inflows due to the purchase of local BS&T shares by Neal & Massy. As shown in Figure 4, this led to resurgence in sales of FX to the Central Bank. In fact, over the time period, 2007 is the only year in which the difference between average daily purchases and sales was positive.

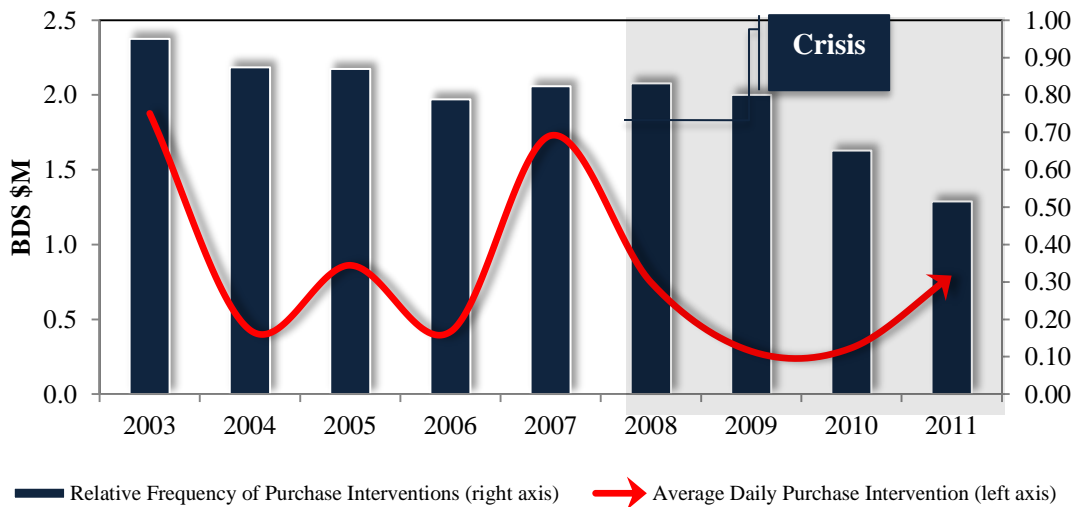
Beyond 2007, i.e. since the onset of the crisis, both the size and frequency of purchase interventions (net of the surrender requirements) have been on the decline. This was somewhat expected, as some of the key features of the crisis were declining travel receipts and diminished capital and financial inflows. However, in 2011, the average daily purchase intervention rebounded, as there was an influx of flows relating to the sale of Barbados Light and Power shares to Emera. At the same time, the size of sale interventions rose, returning to 2004-2006 levels. Interestingly, the percentage of days with activity remained low, as Central Bank mainly received large discrete demands for FX.

Figure 3: Size and Relative Frequency of Sale Interventions



Source: Central Bank of Barbados and author's calculations

Figure 4: Size and Relative Frequency of Purchase Interventions



Source: Central Bank of Barbados and author's calculations

2. Factors Influencing FX Intervention in Barbados

As mentioned in the introduction, in a fixed rate regime, it is the supply and demand conditions on the FX market that prompt central bank intervention. Thus, the Central Bank ensures the daily clearing of the market by buying and selling from its international reserves. This section examines some of the factors that may prompt intervention.

The market clearing condition may be written as:

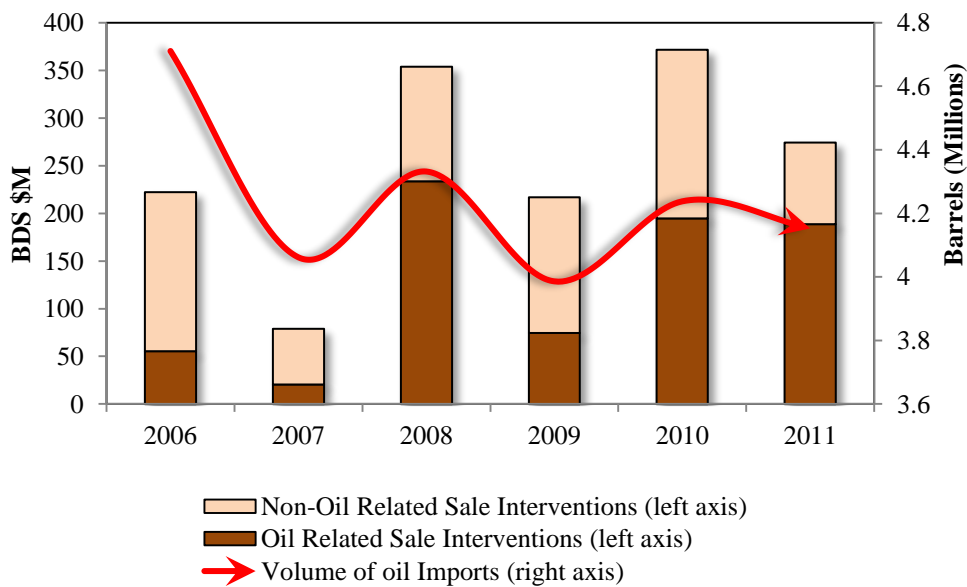
$$Intervention_t = CA_t + \Delta K_t \tag{1}$$

where *Intervention* denotes the foreign currency flows generating from central bank intervention in the market, *CA* represents flows generated by current account transactions and ΔK is the net flow demand for domestic currency through the capital and financial account of the balance of payments.

Traditionally, the current account is assumed to be a function of measures of price competitiveness such as the real exchange rate (Sarno & Taylor, 2001). But Barbados accounts for such a small volume of trade in its import and export markets that it has very little influence in determining the prices of the products it trades (Witter, Briguglio, & Bhuglah, 2002) – in other words, Barbados can be described as a price taker. Limited price control and small shares imply that the balance on the current account tends to be externally determined. At present, the current account balance is determined by the price of international oil and tourism flows.

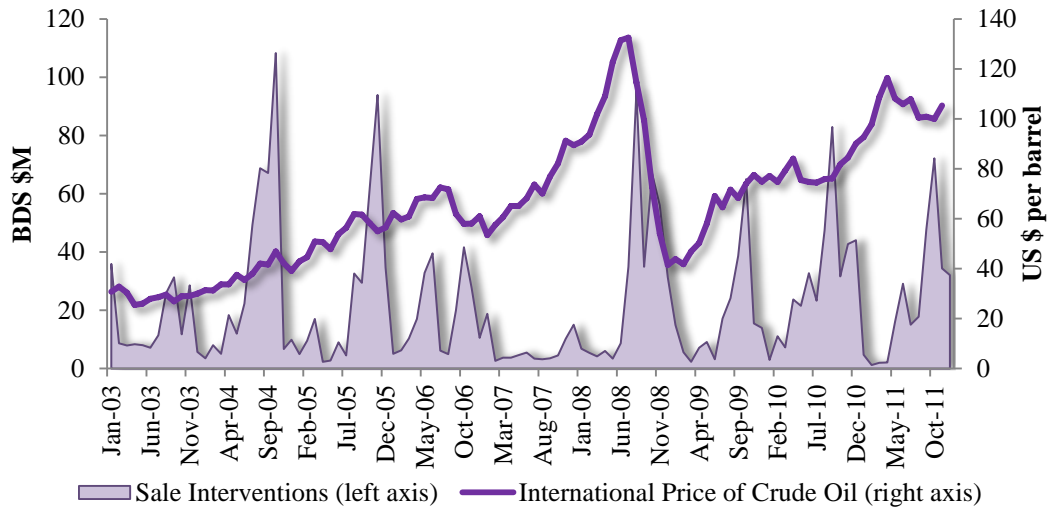
Barbados, like several other Caribbean states, is a net importer of oil. As noted by Moore (2011), oil-related imports currently account for over 20 percent of total imports, and so, stands as the largest component of imports. As a price taker, the escalating price of oil in recent years has inflated the country’s import bill, and by extension, led to a significant deterioration in the external current account. As a result, the Central Bank has had to intervene to provide FX to cover oil-related payments. It is estimated that between 2006 and 2011, nearly 50 percent of Central Bank FX sales were for oil related imports. Given that the volume of oil imports has generally been on the decline since 2006 (See figure 5), it seems as though this development was driven by hikes in the international price of oil. Based on Figure 6, there seems to be some correlation between shocks to the price of oil and sale interventions.

Figure 5: Volume of Oil Imports and Sale Interventions



Source: Central Bank of Barbados

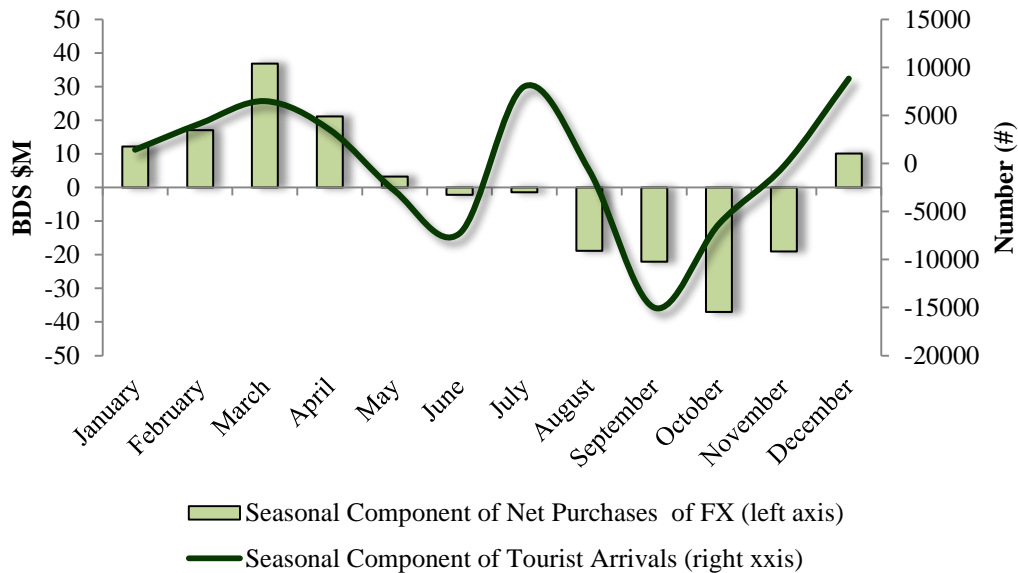
Figure 6: International Oil Prices and Sale Interventions



Source: Central Bank of Barbados and the International Monetary Fund

On the export side, tourism receipts are the country’s main source of external finance, accounting for nearly 50 percent of total foreign exchange earnings. In fact, recent work by Lorde et al., (2010) suggests that current account deficits in Barbados would be unsustainable without tourism receipts. Given the island’s high dependence on tourism, it is not surprising that the buoyancy of FX intervention in Barbados is highly seasonal and generally moves in tandem with the seasonal fluctuations in tourist arrivals (See figure 7)³.

Figure 7: Seasonal Fluctuations in Net Purchases of FX and Tourist Arrivals



Source: Central Bank of Barbados and author’s calculations

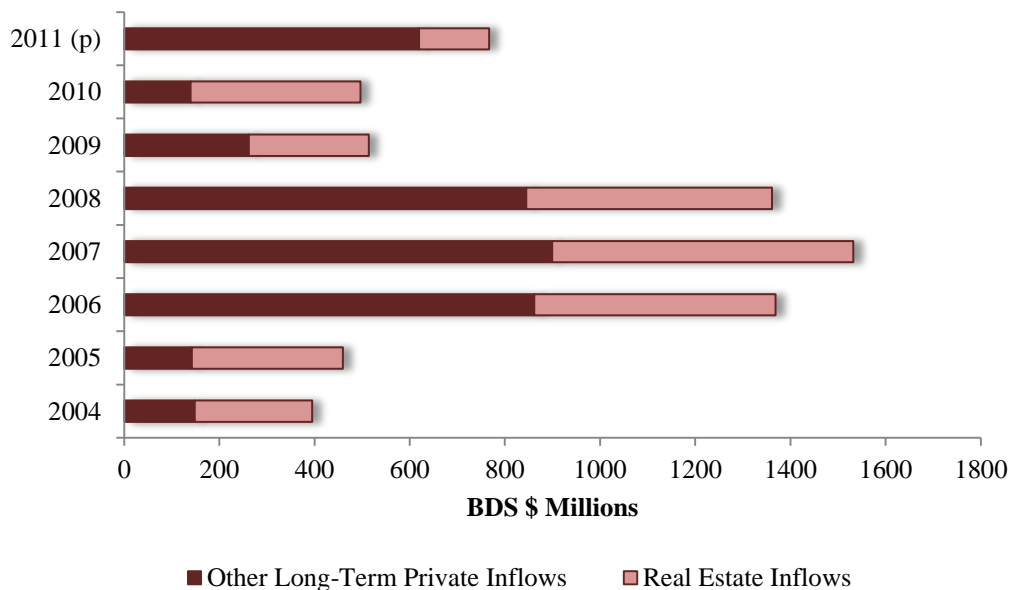
³ The seasonal components presented in Figure 7 were extracted using the univariate structural time series model of Harvey (1989).

The analysis thus far has focused on how factors driving the current account influence FX intervention. But, what about ΔK ? At the daily frequency, the change in net demand for capital inflows is the main driver of fluctuations in a central bank's net purchase of foreign currencies. In the absence of sufficient capital inflows, the deficit on the external current account can only be financed through intervention, whereas an abundance of capital flows creates a surplus of FX in the system that ordinarily would be purchased by the central bank.

In general, a model of ΔK can be derived within the framework of speculative dynamics (Sarno & Taylor, 2001). Under these models, the net demand for foreign currency should be related to factors such as the differential between domestic and foreign interest rates. Indeed, work by Worrell et al (2008) and Craigwell et al (2011) suggest that once allowance is made for market frictions and large discrete events, net purchases of FX by the Central Bank responded to interest differentials in a way that was consistent with the uncovered interest parity condition – i.e. net purchases of FX were positively related to the interest rate spread⁴.

Another factor influencing ΔK , but less likely to be influenced by the interest rate spread dynamics, is real estate flows. As can be seen in Figure 8, these flows make up a significant portion of long-term private capital inflows, and should, by extension, influence central bank intervention (See figure 9).

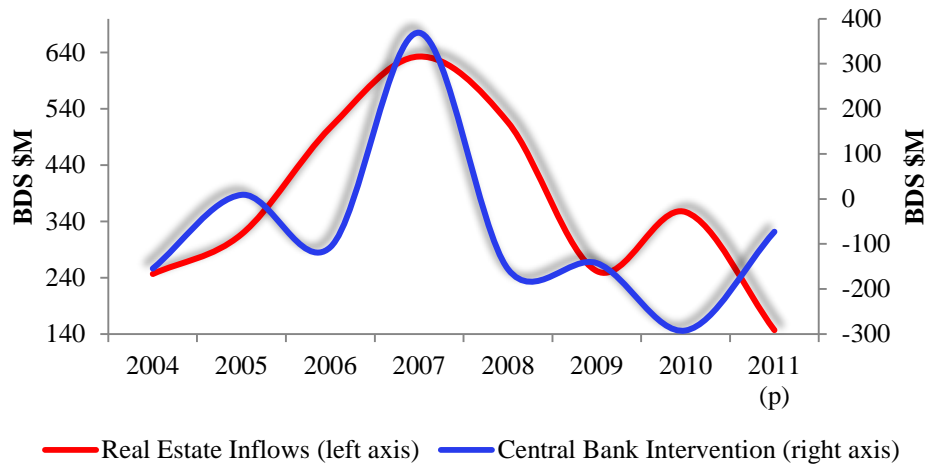
Figure 8: Long-Term Private Capital Inflows



Source: Central Bank of Barbados

⁴ These studies define the interest rate spread as the difference between the Barbados 3-month Treasury bill rate and that of the US.

Figure 9: Real Estate Flows and Central Bank Intervention



Source: Central Bank of Barbados

3. Modelling FX Intervention in Barbados

In this section, a quantitative model of FX intervention is given. Based on the analysis presented in Section 2, the author assumes that FX intervention in Barbados can be modelled as a function of oil price shocks, tourism, interest rate spreads and real estate inflows. But, as noted by Jackman (2012), deficits/surpluses on the Barbados FX market tend to be persistent, i.e. once an intervention is carried out, another intervention is likely to take place in the following day. Thus, some autoregressive terms are also included in the model.

Purchase and sale interventions are modelled individually. Separate models of purchase and sale interventions allow us to better capture the region of inaction and the potential asymmetric response of purchase and sale interventions to the dependent variables (Herrera & Özbay, 2005). The estimated model takes the following form:

$$I_t^{purchase} = \gamma_0 + \delta_i(L)I_t^{purchase} + \gamma X_t + v_t \quad (2)$$

$$I_t^{sale} = \beta_0 + \alpha_i(L)I_t^{sale} + \beta X_t + \varepsilon_t \quad (3)$$

The variable $I_t^{purchase}$ represents a purchase of foreign currency by the Central Bank (exclusive of purchases made in relation to the surrender requirements); I_t^{sale} represents a sale of foreign currency, L is the lag operator and $[v_t, \varepsilon_t]$ are error terms. X_t is a matrix of control variables such that $X_t = (T_t, i_t^{spread}, K_t^{real\ estate}, \sigma_t^{oil})$ where T is the tourism variable, i^{spread} is the interest differential between Barbados and the US; $K^{real\ estate}$ represents real estate flows; and, σ_t^{oil} represents oil price shocks.

3.1. Estimation Technique

The econometric modelling of daily intervention series has been widely discussed in the academic literature. As shown in Table 1, the data can be described as a ‘zero-inflated process’ – i.e. several observations have a zero value. To overcome this problem, studies often consider intervention to be generated from a mixture of three probability distributions with non-overlapping sample distributions (Kim & Sheen, 2002), i.e. three types of events – positive intervention, negative intervention and zero intervention. This then implies that estimations based on simple OLS regression techniques may be severely biased.

To address this, some authors generate a binary choice dependent variable corresponding to the intervention/no intervention outcomes of sale and purchase interventions, and then model the probability of each type of intervention using either probit or logit models (see for instance Ballie and Osterber, 1997; Frankel and Stadtman, 2001; Kim and Sheen, 2002). Following this approach, the variable $I_t^{purchase}$ takes the value of one if there is a purchase of foreign currency– and zero otherwise – and I_t^{sale} is a dummy variable that takes the value of one if there is a sale of foreign currency, and zero otherwise.

But, an issue with using probit/logit estimation is that their density functions are assumed to be symmetric about zero. However, as discussed in Section 1, the intervention data is heavily skewed. Thus, use of probit/logit models may represent a misspecification and can lead to biased inferences about the marginal effect of changes in any of the independent variables. As such, this paper utilises a complementary log-log model. Unlike the probit and logit models, the log-log function allows for asymmetry, and is derived from the assumption that the error distribution (or distribution of the latent variable) follows a standard extreme value distribution. Thus, the model is useful in cases where the probability of an event is very small or very large, as is the case of the intervention variables.

3.2. Data Description

The foreign exchange intervention information used in this paper is the total currencies (i.e. U.S. dollars, Canadian dollars, sterling pounds, Euros and regional currencies) traded with FX dealers. As in Worrell et al (2008) and Craigwell et al (2011), the tourism variable is a discrete variable used to differentiate between the peak period of tourism and the low period; the interest rate spread is defined as the difference between the Barbados 3-month Treasury Bill rate and that of the US. The volatility of oil prices is used as a proxy for oil price shocks. In general, a GARCH (1, 1) model with a general error distribution gave the best approximation of the conditional volatility of oil prices. Data on the US Treasury Bill rate is taken from the US Department of the Treasury, while observations on oil prices are obtained from the US Energy Information Administration; all other information is taken from Central Bank data files. The frequency of the data is daily, spanning the period January, 2003 to December, 2011.

3.3. Estimated Results

Maximum likelihood estimates of the dynamic complementary log-log models are presented in Tables 2 (purchase interventions) and 3 (sale interventions).

Table 2: Determinants of Purchase Interventions

	Observed Coefficient	Average Marginal Effect	Robust Standard Errors	P-Value
$I_t^{purchase}(-1)$	0.336	0.107	0.065	0.000
$I_t^{purchase}(-2)$	0.271	0.086	0.065	0.000
T_t	0.011	0.004	0.052	0.828
i_t^{spread}	0.384	0.122	0.275	0.162
$K_t^{real\ estate}$	$2.51e^{-08}$	$7.93e^{-09}$	$1.05e^{-08}$	0.017
σ_t^{oil}	-0.012	-0.004	0.007	0.096

Table 3: Determinants of Sale Interventions

	Observed Coefficient	Average Marginal Effect	Robust Standard Errors	P-Value
$I_t^{sale}(-1)$	0.281	0.065	0.084	0.001
T_t	-0.113	-0.027	0.054	0.037
i_t^{spread}	-0.087	-0.021	0.021	0.000
$K_t^{real\ estate}$	$-6.62e^{-08}$	$-1.56e^{-10}$	$6.74e^{-09}$	0.922
σ_t^{oil}	0.021	0.005	0.009	0.013

From these results, three general observations can be made:

- I. *Dynamics play an important role in the Central Bank of Barbados' FX intervention function.* Lags of the dependent variable in both purchase and sale equations are positive and statistically significant, implying that the probability that an intervention takes place today is conditional upon an intervention taking place at least one day prior. Ito and Yabu (2007) associate the dynamic correlation of interventions with the presence of political costs associated with the process of designing an optimal intervention policy. This usually occurs if a central bank has to negotiate interventions with a third party. Once an agreement is reached, interventions can be carried out over a number of days. Herrera and Özbay (2005) posit that temporal correlation can also arise if the objective of the central bank is to minimise an intertemporal loss function that is non-time separable – i.e., if the central bank wants to minimise the impact of current disorder in the FX market, but also past realisations of distortions. But, as mentioned in the introduction, the Central Bank (or any other party for that matter) does not determine the timing or amount of intervention– it is the market that dictates FX intervention. Thus, these aforementioned theories are not fully applicable to Barbados. Rather, the apparent positive autocorrelation in the FX intervention function most likely reflects the fact that deficits/surpluses

on either the capital or current account tend to persist over a number of days. These pressures tend to be exerted on the peg over a consecutive number of days leading to some persistence in interventions. Interestingly, purchase interventions tend to be more persistent than sale interventions – for the purchase intervention specification, a lag length of two is found to be most useful, while one lag is sufficient for the sale intervention estimation.

- II. *There are differences in the response of Central Bank purchase and sale interventions to FX supply and demand conditions – highlighting the importance of modelling “buy” and “sell” interventions separately.* Interestingly, the estimated results seem to suggest that seasonal fluctuations in tourism do not systematically influence purchase interventions (at least at the conventional levels of testing), but affects sale interventions. Specifically, during the peak tourist season, the Central Bank is less likely to conduct a sale intervention than during the off-peak season. This hints that the influx of tourists in specific months reduces FX dealers’ dependence on Central Bank and points to the importance of tourism receipts in achieving external balance and maintaining adequate reserves. A similar story emerges for interest rate spreads – higher interest rate spreads may reduce the probability of sale intervention, but has no impact on the marginal propensity of a purchase intervention. Finally, the coefficient on the real estate variable is positive and significant in the purchase intervention specification – signalling that an influx of real estate flows could increase the likelihood of the Central Bank purchasing FX from the interbank market – but has a limited impact on sale interventions.

- III. *The impact of oil price shocks is significant and wide-spread.* An interesting observation is that oil price volatility is the only exogenous variable which is statistically significant in both estimations. As shown in Table 3, greater oil price volatility increases the possibility of a sale intervention, which is in line with Figure 6. At the same time, the shock reduces the chance of a purchase intervention. From this, oil prices can be said to have the greatest impact on FX intervention as it affects both “buy” and “sell” interventions; on both ends, hikes in oil prices result in a loss in reserves. Against this backdrop, the recent push to create a green economy and reduce the dependence on fossil fuels seems to be justified. In 2011, the Government outlined a renewable energy programme and discussed several initiatives to encourage the use of energy efficient machinery and processes. More than this, there are plans on stream to retrofit all state-owned buildings to make them more energy efficient. These efforts are forecasted to bring down the cumulative cost of oil imports by about 25 percent and total electricity cost by US\$200 million over the next 20 years. The shift from fossil fuels to renewable forms of energy could be very beneficial. Specifically, it can help shield Barbados – to some extent – against future hikes in oil prices. As such, this should significantly reduce the import bill and by extension, limit international reserve losses.

The estimated model can be used to form expectations for Central Bank intervention in Barbados. Specifically, if the estimated model holds true, what are the implications for Central Bank intervention in 2012? Table 4 below summarises projections for oil prices, tourism receipts, interest rate spreads and real estate inflows.

Table 4: Expectations for Oil Prices, Tourism Receipts, Interest Rate Spreads and Real Estate Inflows

	2012 ^{forecast}	Source
Average Price of Crude Oil	Increase	IMF World Economic Outlook (April, 2012)
Tourism Receipts	Increase	World Travel and Tourism Council Database (as at April 2012)
Interest Rate Spread	Largely Unchanged	Author's Expectations
Real Estate Inflows	Steady Inflows	Key market players

According to the April 2012 edition of the IMF's World Economic Outlook, the average price of crude oil is forecasted to increase from US\$104.01 in 2011 to US\$114.70 in 2012, largely based on geopolitical risks, which are unlikely to subside soon. As shown in Section 2, positive oil price shocks were a leading cause of sale interventions between 2008 and 2011. Based on the evidence presented in Tables 3 and 4, if oil prices continue to rise, one would then expect that the probability of oil-related sale interventions will also increase, and that purchase interventions might be negatively affected.

Projections for travel receipts are a bit more favourable. As at April, 2012, estimates from the World Travel and Tourism Council (WTTC) indicated that visitor exports for Barbados could rise. While the econometric model only looked at how seasonal fluctuations in tourism affect sale interventions, it can be inferred that in general, a rise in tourist expenditure significantly reduces sale interventions. So, with an uptick in tourist expenditure, there may be less dependence on the Central Bank by authorised dealers to meet their FX needs.

The forecast for interest spreads is a bit more complex. However, the author expects that the accommodative monetary stance held by the Federal Reserve and the Central Bank in 2011 should continue in 2012 – specifically, no significant changes in interest spread are currently expected. Thus, the estimated impact of interest rates spreads on sale interventions in 2012 should be marginal. Finally, based largely on discussions with key real estate agents in the countries, the outlook for real estate inflows to Barbados is stable – which increases the likelihood of purchase interventions this year.

4. Concluding Remarks

The FX market in Barbados can be described as a “small, fixed price market”. As such, the Central Bank does not determine the timing or the amount of intervention, but simply intervenes to ensure the daily clearing of the market. This paper evaluates FX intervention in Barbados. It applies a dynamic complementary log-log model to determine the factors which prompt central bank intervention in the Barbados FX market.

Results indicate that past interventions are very useful in predicting current intervention, which the author attributes to the fact that imbalances in the FX market tend to persist over a number of days. Also, it is found that modelling “sell” and “buy” interventions individually allows us to make useful interpretations that have not (to the best of the author’s knowledge) been made before for Barbados – i.e. the potential asymmetric response of purchase and sale interventions to the independent variables. Specifically, the empirical evidence suggests that seasonal fluctuations in tourism and interest rate spreads influence the probability of a sale intervention, but don’t seem to affect the likelihood of a purchase intervention. Moreover, real estate flows tend to increase the probability that a purchase intervention takes place, but has a limited impact on the marginal propensity of a sale intervention. This may suggest that studies based on “net” behaviour can conceal differences in intervention behaviour.

The paper also looked at the implications of the model for Central Bank intervention in 2012. Based on the estimated model, oil-related FX interventions should increase in this year, as oil prices are currently forecasted to continue to rise in 2012 (see IMF’s World Economic Outlook released in April, 2012). Current expectations are that interest rate spreads should remain relatively unchanged. Hence, changes in sale interventions brought about by movements in the interest rate spread should be negligible. While the model only looked at how seasonal fluctuations impact FX interventions, it can be inferred that the amount of tourism receipts received in Barbados significantly impacts on sales interventions. As at April 2012, the WTTC projects a rise in tourism receipts for Barbados. This could bring about some ease in sale interventions. Finally, current forecasts are that real estate related inflows should be stable in 2012, and this should increase the chances of a purchase intervention. However, it should be noted that these predictions for intervention are more indicative than conclusive as they are largely conditional on (1) the accuracy of the model⁵; and (2) the projections for oil prices, tourism receipts, interest rate spreads and real estate flow materialising⁶.

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⁵ A model, being an approximation of a certain reality, will always have some degree of misspecification or inaccuracy. The question then is how serious the misspecification or inaccuracy.

⁶ The classic truism applies here: even the best forecasts fail.

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Stabilisation Policy with a Fixed but Market-determined Exchange Rate

By DeLisle Worrell*

Abstract

This paper describes how fiscal policy is used in Barbados to manage the demand for foreign exchange and ensure that the Central Bank is always stocked with adequate foreign exchange reserves to supply the needs of the interbank market. This enables the Central Bank to maintain an unchanged exchange rate through intervention on the interbank market. Sustaining the peg in this way lends credibility to Government economic policy and provides strong incentives to save and invest in the local economy.

Introduction

The experience of the English-speaking Caribbean since the 1970s confirms that, for small open economies closely tied to the United States of America (US), maintaining the value of domestic currency in terms of US dollars is important for the development of the economy and the improvement of standards of living. The economies that score highest in the United Nations Development Programme's (UNDP's) Human Development Index (HDI) are diverse in terms of size of populations and land mass, the principal source of economic activity, the extent of diversity of their exports, and their natural resource endowment. They are all countries with an exchange rate that has remained unchanged in terms of US dollars since it was first linked to the dollar. The thing that most distinguishes these otherwise dissimilar countries is the fact that the US dollar value of the local currency has never changed, since the peg was first established.

The value of the currency in an open economy is determined by inflows and outflows of finance, which respond to changes in domestic interest rates, relative to rates in the US for similar investments. Private firms and financial institutions anchor interest rates on the trends in US dollar benchmark rates, adding a suitable differential for perceived country risk. Financial flows are determined mainly by domestic investment opportunities and by the credibility of domestic economic policy. Where the private sector is satisfied that government policy is appropriate to the economic circumstances, there is no incentive to switch between domestic and foreign finance, but where governments have lost credibility, there has been a large outflow of finance because of a fear that policy error will lead to a depreciation of the exchange rate. In these circumstances, prudent financial controllers in the multinational companies and banks that characterise Caribbean economies have chosen to move funds abroad as a precautionary measure. However, when all

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multinationals took this precautionary action, depreciation became a self-fulfilling prophecy.

These inflows and outflows on the financial account of the balance of payments make monetary policy ineffective. In economies where international transactions are relatively small compared to the domestic financial markets, central banks tighten monetary policy by raising interest rates or imposing higher reserve requirements. However, in countries like Barbados where international financial transactions are a very large part of the market, these policies have the perverse effect of attracting finance from abroad.¹

This paper shows how, in the absence of an effective interest rate tool, fiscal policy may be used to stabilise the small open economy. The balance of external payments and receipts is the best measure of the stability of the open economies of the Caribbean, because of the very high import content of all production and consumption. Any excess of aggregate demand over the supply of goods and services immediately spills over into an additional demand for foreign exchange that, if it persists, will erode the reserves of foreign exchange at the central bank. There is little that Caribbean economies can do to significantly increase the inflow of foreign exchange in the short run, so adjustment policies must focus on a reduction in the demand for foreign exchange. This may be achieved through a cut in government spending or an increase in tax rates, both resulting in a smaller fiscal deficit to be financed, and reduced aggregate spending in the economy. This framework involves joint policy making between the central bank, which projects the balance of external payments, and the fiscal authorities, that must calibrate policies to manage aggregate demand. Together the fiscal authorities and the bank monitor the evolution of the fiscal, the balance of payments, the real economy and finance, to determine when corrections need to be made, and to effect them in a timely fashion.

1. Fundamentals

Barbados' experience suggests that an effective framework for economic policy making in the small open economy may be based on the following foundations:

- I. Stabilisation anchored on the exchange rate; and
- II. An exchange rate that is market determined.

The exchange rate is maintained unchanged by balancing demand and supply of foreign exchange, using fiscal policy. Because fiscal takes time to bite, policy changes need to be made well in advance, with the help of a reliable early warning indicator of the demand and supply of foreign exchange. Such an indicator is available, in the form of Central Bank's foreign exchange reserves, which increase when the supply of foreign exchange is in excess of demand, and fall when supply is insufficient.

¹ *The ineffectiveness of monetary policy tools in Caribbean economies is fully ventilated in Worrell (1996).*

2. The Exchange Rate Anchor

All economies and all markets need an anchor to guide the expectations and plans of market agents. It is the indicator that tells firms whether they can expect growth in the demand for the kind of product or service they sell, and informs workers of the upcoming job prospects. A number of such indicators are commonly used, including the growth of gross domestic product (GDP), the unemployment rate, the rate of inflation, and a stock market index, among others. However, in a small open economy, the indicator that is uppermost in the mind of every economic agent is the exchange rate. Maintaining the value of the local currency, in terms of whatever is the dominant currency in the small economy's geographical region, is the best that can be done to create a favourable climate for savings and investment in the economy.²

No one deliberately chooses an environment of greater uncertainty over one of less uncertainty. Failure to sustain the value of the domestic currency results in greater uncertainty about all domestic prices in the very open economy, because all production and all consumption have a very high import content, directly or indirectly. Therefore, those very open economies which fail to maintain the value of their currencies expose domestic economic agents to an extra source of uncertainty, i.e. that an exchange rate depreciation will inflate domestic prices. This extra uncertainty is a disincentive to saving and a deterrent to investment. In the floating rate regime the value of savings held in domestic financial instruments is subject to unpredictable changes that, in the experience of the Caribbean, are very strongly biased towards depreciation. Investment of all kinds also becomes more problematic, if done in local currency. Investment in real property may eventually catch up with changes in the value of the currency, but that process takes a long time. Anyone who invests in the production of goods and services faces an additional source of doubt about the prices of their inputs and outputs. The additional uncertainty puts countries that do not have an exchange rate anchor at a disadvantage, compared with countries that can sustain the value of their currency.

This is why the exchange rate anchor is so highly valued in the small open economy. The ability to maintain the value of the currency lends credibility to the policies of countries that succeed in doing so, while countries that have been unable to sustain currency values find it hard to gain credibility, even for economic policies that are equally well considered. The exchange rate anchor facilitates saving and investment in domestic currency; in the absence of this anchor the economy is usually characterised by the holding of financial assets in foreign currency in preference to domestic currency, sub-optimal levels of investment in domestic currency and in the local economy, and, in extreme cases, a preference for the use of foreign currency over local money for the conduct of transactions.³

² There is a well-established body of work on the adverse effects of exchange rate volatility on investment. See the survey by Pindyck (1991).

³ These phenomena are well-documented, for example in Worrell & Bourne (1989).

3. The Market-determined Peg⁴

The value of the Barbados currency is maintained through passive intervention by the Central Bank in the interbank market for foreign exchange. Every day, as foreign exchange dealers purchase and sell foreign exchange to the general public, they may augment their supplies as needed by purchasing from another dealer that may have a surplus of foreign exchange. If no other dealer has a sufficient surplus, the Central Bank stands ready to sell the required amount, at our fixed exchange rate. The resources made available to the Central Bank to accomplish this come in the form of a requirement for all dealers to surrender to the Central Bank 5 percent of the value of their purchases of foreign exchange, as well as the voluntary sale of amounts of foreign exchange in excess of banks' own needs.

How can we make sure that there is enough of an inflow of foreign exchange to ensure that the Central Bank is always in a position to meet the dealers' requirements? Though tempting to suggest that the surrender requirement be raised if there is not a sufficient inflow, that would aggravate the foreign exchange shortage, and dealers would need to repurchase the additional amount surrendered to the Central Bank. The only way to correct for an excessive demand for the Central Bank's foreign reserves is to take measures that will reduce the general public's demand for foreign exchange from foreign exchange dealers, such that purchases of foreign exchange are brought down in line with foreign currency receipts and inflows.

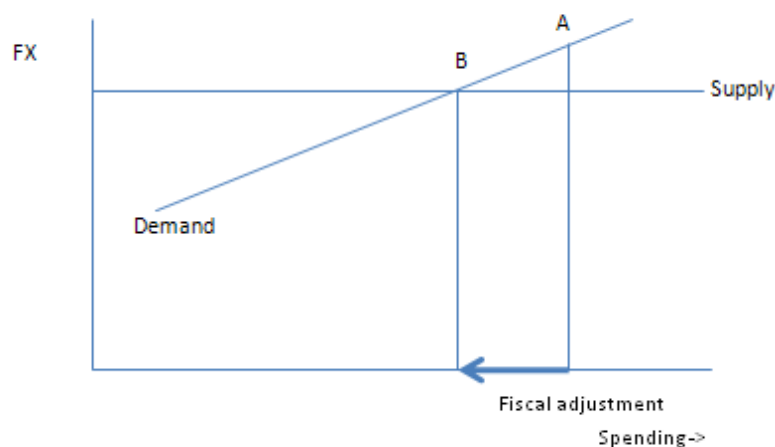
4. Reducing the Demand for Foreign Exchange Using Fiscal Policy

The demand and supply of foreign exchange are balanced by adjusting aggregate expenditure, because in the near term the amount of foreign exchange earnings and other inflows are given. Demand for foreign exchange must therefore be adjusted to ensure that it does not exceed the expected supply of foreign exchange. To do this total expenditure must be managed, because all expenditure in Barbados has a foreign exchange component whether direct or indirect.

Aggregate expenditure is adjusted through the fiscal balance, either through an increase in tax revenues or a reduction in government spending. An increase in tax rates or the tax base – for example by eliminating or reducing exemptions from taxation - reduces spending power. A reduction in spending has a direct effect on spending on goods and services, and indirect effects that work through reduced spending on wages and transfers to households. In either case, a lower fiscal deficit allows for a reduction in Central Bank lending to government and a contraction of finance in the economy.

⁴ The foreign currency market in Barbados may be described as a "fixed price" market, in the terminology of Sir John Hicks, as opposed to the "flex price" market, which most people have in mind. The persistence of the "flex price" model is surprising, since most goods and services in the modern market economy are sold at fixed prices.

Figure 1: How we Balance the Demand and Supply of Foreign Exchange (FX)



This process of balancing the demand and supply of foreign exchange through fiscal policy is represented in Figure 1. The total spending in the economy is measured on the horizontal axis, and the resulting demand for foreign exchange on the vertical axis. As earlier mentioned, the supply of foreign exchange is at a given level in the short run, indicated by the horizontal line, while the demand for foreign exchange increases as spending power increases. In Figure 1 start from a position (Point A) where spending power is so high that the demand exceeds the supply of foreign exchange. The appropriate policy response is to reduce spending power by the amount indicated, through fiscal contraction that reduces the Central Bank's financing sufficiently to eliminate the excess demand for foreign exchange (Point B).

Fiscal Policy must be determined in anticipation, because it takes time for fiscal actions to be taken, and to have full effect. There must be sufficient time allocated, after the foreign exchange shortage is identified, to decide on and implement the appropriate measures. In addition, an allowance must be made for adjustment lags in the economy, before the effects of the fiscal measures appear in terms of reduced foreign exchange demand. In practice, this means that policy decisions should be taken about six months before the full effect of the measures can be expected to show up as a reduction in foreign exchange demand.⁵

5. The Policy Framework for Stabilising the Economy

The tools and institutional mechanisms needed to maintain a balance between the demand and supply of foreign exchange are:

⁵ Adequate foreign reserves provide a cushion in the interim while fiscal measures take effect. In addition, some short-term measures such as credit controls may help for a little while, as explained in Worrell (1996).

- A baseline forecast of the supply and demand for foreign exchange, against which the actual experience may be monitored;
- A daily monitoring system which tracks the supply and demand for foreign exchange, and compares the actual with the forecast; and
- Regular reviews at which decisions are made on corrective action, if necessary.

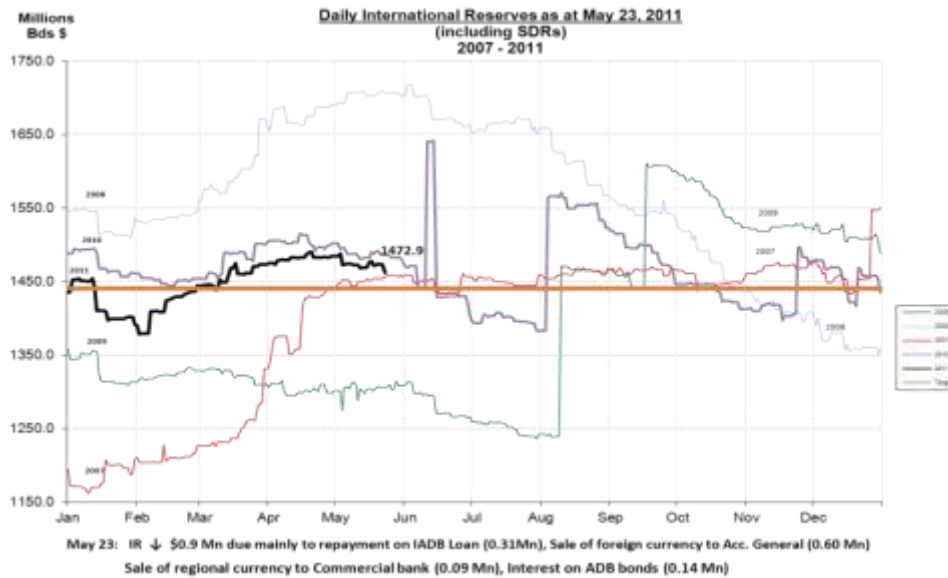
6. The Baseline Forecast

At the beginning of every year, the Central Bank of Barbados produces a forecast of all the major sectors of the economy, including the balance of payments and the demand and supply of foreign exchange. The forecast is derived using a sufficiently detailed model of the economy, including the producing sectors, employment, inflation, government revenues, expenditures and financing, banking and finance, and the balance of payments. All available information is fed into the model about expected investment and capital inflows, international commodity prices, growth and inflation in the countries where Barbados earns most of its foreign exchange, and the fiscal stance. This forecast provides an expected value of demand and supply for foreign exchange, from which is derived a year-end target for the foreign reserves of the Central Bank. If foreign inflows are expected to exceed outflows the target will be higher than the previous year-end, and conversely if outflows are greater than inflows. If the forecast drain on foreign reserves is considered too large, a decision needs to be taken at the January meeting of the economic authorities (explained below) to tighten fiscal policy at the time of the submission of the Estimates of Expenditure in March. It is important to begin the year with a forecast year-end level of foreign reserves that is adequate to defend the rate of exchange in the event of any unexpected shock to the economy.

7. The Daily Monitoring System

Each day the Barbados Government's economic team, headed by the Minister of Finance and the Governor of the Central Bank, receives an update on the Central Bank's foreign reserves. Figure 2, that presents the information that was circulated to the economic team for May 23, 2011, shows the five years 2007 to 2011, each year as a separate line. It also includes the target for year 2011, as a thick orange line.

Figure 2



At a glance, one may compare current performance with performance at the same time in previous years, and observe the seasonal patterns. Moreover, by mentally removing the spikes in the lines for previous years (they represent loans and large investment inflows), one may guesstimate where the foreign reserves will end the year, in the absence of similar inflows. This is a powerful tool for informing policy decisions.

8. Policy Review and Correction

The economic policy team meets on the first Friday of every month for a comprehensive review of economic performance, using the most recent indicators, domestic, regional and international. The meeting analyses all deviations from the economic forecasts, for growth, inflation, employment, government revenues and expenditures, tourism, international business, foreign investment, finance, etc., and tries to get to the bottom of them. Were they as a result of faster or slower growth in the US, UK or elsewhere, higher or lower commodity prices, uncertainty in international financial markets, or other factors over which small open economies have no control? Was it that Barbados' performance was weaker than anticipated even though the external environment was no worse than expected, and is there a need to change the parameters of the economic model accordingly? Were there domestic events that contributed to the unexpected outcomes?

The analysis and the answers to these questions, guide the economic policy team as to the appropriate response. If the revised projection for year-end foreign reserves remains on target or better, no policy change may be needed, and the only decisions may be to investigate some aspect of the economy in greater detail, or to recalibrate some feature of the economic model used for the forecast. However, should the revised foreign reserves forecast indicate an unacceptably large deterioration of the year-end position, relative to

the target, the meeting considers what policy options should be explored for tightening fiscal policy, and within what time frame. Alternatively, if there is additional foreign debt service capacity, the best option might be to borrow on the international financial market.

9. Factors Affecting Policy Choices

Should the foreign exchange position be such as to indicate the need for a reduction in spending in the country in order to achieve the target level of reserves, the factors that inform the choice of policy include:

- The existing burden of taxation, and recent changes;
- The scope for containing government spending on supplies, maintenance, replacements and depreciation, without impairing the quality of services;
- The wages bill and how well it may be contained;
- The need to sustain the social safety net, and to protect the most vulnerable citizens;
- The need to push ahead with public investment that adds to the country's foreign exchange earning potential, directly or indirectly;
- The potential for raising revenue from the sale of services of Government or public corporations, including by raising prices or tariffs;
- The scope for reducing Government's subsidies to corporations and institutions it owns, without reducing the quality of services they provide;
- The availability of Government assets for sale; and
- Government's skill in accelerating projects that have the potential to attract foreign investment, which augments the inflow of foreign exchange.

A great deal of detailed sectoral information should be brought to bear, to inform decisions based on the factors just mentioned. Much of the analysis that provides such information is ongoing, at the Central Bank and in the Ministry of Finance, Economic Affairs and elsewhere in the public service. Some of that research is published in the Central Bank's Economic Review, which is now a wholly electronic journal, appearing on the Central Bank's website twice a year. Other research in regional and international journals is also a source of useful background information and analysis. In order to take account of the uncertainty that results from the use of forecasts and incomplete information, our policymakers typically employ alternatives, a baseline, a pessimistic and an optimistic scenario.

It is worth emphasizing that policy is made under uncertainty. It is unrealistic to expect that things will turn out as projected, even if the policies are implemented as planned. Furthermore, circumstances may turn out differently than was expected, and some aspects of the planned policy may no longer be appropriate targeted. In addition, information is never truly complete, in any aspect of the process. Because the world is uncertain, forecasts will very seldom be 100 percent "accurate", but the usefulness of forecasts is not in their accuracy. Rather the forecast provides a benchmark against which the present may be

evaluated as it evolves each day, and it may therefore be used to give early warning of changing circumstances and a need to re-evaluate the situation.

10. Concluding Remarks

The economic policymakers' concerns are twofold: to stabilise the economy, and to facilitate the growth of GDP. There is some overlap between growth and stabilisation: instability is associated with intensified uncertainty, low investment and poor growth prospects, and expansion in tourism and export activity contributes both to growth and stabilisation. However, by and large the toolkits that are most effective for economic stabilisation are rather different from those that are specifically targeted at accelerating growth, and the time frames are different. The growth-oriented policies that are implemented today will bear fruit only in 3 to 5 years or more. Today's stabilisation policies must produce results before the year is out. Elsewhere the author has spoken to the policies that may contribute to the growth of the Barbadian economy, through investment in tourism, international business and financial services, agriculture and agro-industry and alternative energy production (see *The Four Pillars of a Forward-looking Foreign Exchange-driven Growth Strategy for Barbados*)⁶. This essay has been concerned with the tools and framework for decision-making that are specifically targeted at stabilising the economy.

On the evidence that just shared, an effective way to stabilise the economies of small countries that are as open to financial transactions as are the countries of CARICOM, is to anchor on the exchange rate. Maintenance of the value of domestic currency in terms of US dollars is so highly valued that an unchanging exchange rate is the most visible and most powerful signal that the Government can send of its commitment to fiscal prudence. The peg is a powerful signal precisely because it cannot be maintained by fiat, or by any rationing of the inflow or outflow of foreign exchange. Instead it must be secured through central bank intervention on the interbank market for foreign exchange. The only difference between intervention with a pegged rate and with a flexible rate is that in the former case, the central bank commits to buy and sell at rates that will not change. The central bank can only make that commitment credible if it maintains sufficient foreign exchange reserves at all times. However, securing an adequate supply of foreign exchange to top up reserves as needed is beyond the capacity of a central bank to influence. The reserves get topped up whenever foreign currency receipts exceed payments, for example at the height of the tourist season. It is the fiscal stance, not central bank policy, which must ensure that demand for foreign currency during the low season will not exceed the store that was built up in the high season. For this reason, an institutional framework of joint policy making by Government and the central bank is important for the successful implementation of stabilisation policy. The essential tools the authorities have at their disposal are:

⁶ See *"The Four Pillars of a Forward-looking Foreign Exchange-driven Growth Strategy for Barbados,"* available at <http://www.centralbank.org.bb/WEBCEBB.nsf/vwNews/736D16B42D0DDCE90425798F006F24AE?OpenDocument>.

- An economic forecast model from which to derive a forecast of external balances and a target for foreign exchange reserves;
- A continuous monitoring system;
- A regular review by policymakers, where decisions on corrective action are taken; and
- An effective communications system, to share with the public the challenges to economic stability, and the measures that are being taken to address them.

The framework and procedures described in this essay are arguably the most effective for stabilising the small very open economy. However, many countries have successfully maintained an unchanged exchange parity with the US dollar for decades, in the absence of most of these tools and institutional arrangements. How they were able to do so warrants further study. What is very clear, however, is that the conventional approach to economic stabilisation, based on inflation targeting or money supply targeting, is ineffective in economies that are open to financial flows. In contrast, a policy that pegs the exchange rate and targets foreign exchange reserves, via the management of aggregate demand and the demand for foreign exchange, has scored a very high success rate.

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On the Forecast of Barbados' Nominal Gross Domestic Product

By *Carlton Walkes**

Abstract

This paper proposes a new method of forecasting Barbados' nominal gross domestic product (GDP). The empirical results suggests, that nominal GDP is a function of real GDP, world oil prices and the wage rate of the economy. The common measures of forecast accuracy indicate that the model possesses good forecasting properties.

JEL Classifications: C12; C22; E17

Key words: Nominal GDP; Barbados; Forecast

1. Introduction

Nominal Gross Domestic Product (GDP) is the total expenditure on an economy's output of goods and services during a specific period of time, at prices currently prevailing in that economy. This economic aggregate is the most widely used measure of economic activity and it is also used to compare the size of one economy relative to another. That said, a number of nominal economic variables (such as the fiscal balance, public debt and the external current account balance), are analysed as a percentage of nominal GDP. These ratios are very informative because they enable economists to examine a particular issue in relation to the size of the economy.

However, nominal GDP is not the best measure of economic progress, since it can be influenced either by movements in the volume of goods and services traded, or price changes. Real GDP, on the other hand, holds the price effect constant by fixing prices to those of a specified base year. Therefore, real GDP is a better gauge of economic progress because it responds only to real economic activity and is not inflated by the mere increase of prices.

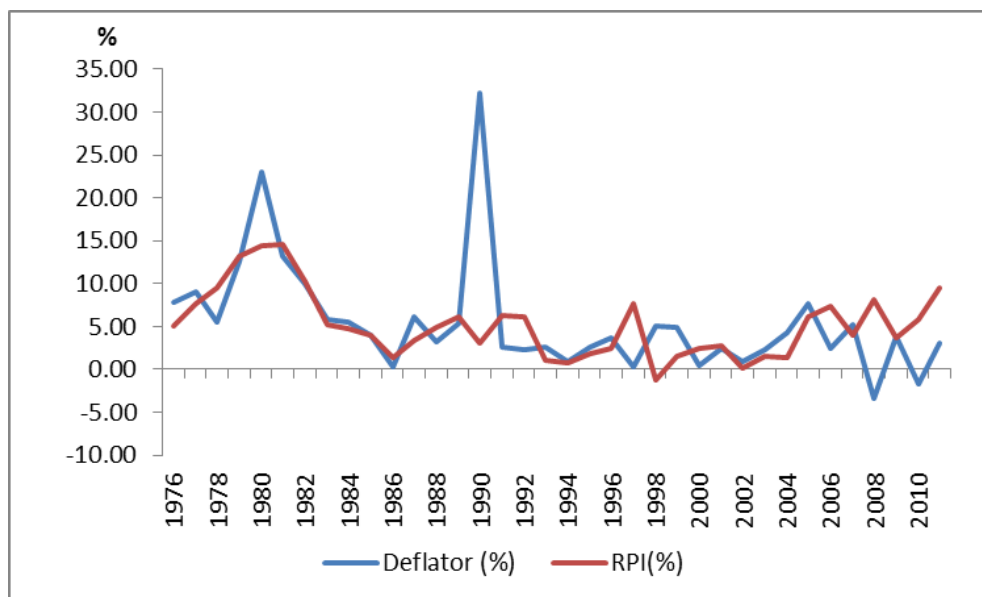
The ratio of nominal to real GDP is known as the GDP deflator or the GDP implicit price deflator. By definition, the GDP deflator captures the price component of nominal GDP and so, is an indicator of the level of prices of domestically produced goods. At present, the Central Bank of Barbados forecasts nominal GDP based on projected growth of real GDP

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and the GDP deflator. The projections for the deflator guided by the forecasted inflation rate as measured by the retail price index (RPI). Figure 1 shows the percentage change in the GDP deflator and the RPI for the period 1976 to 2011. It is clear from the graph that these two measures of inflation tend to diverge from time to time, especially during the latter portion of the review period. The enormous spike corresponding to 1990 in the GDP deflator growth series is caused by a revision of Barbados' GDP current price series from factor cost to the 1993 System of National Accounts (SNA) the relevant basic price valuation. Interestingly, correlation analysis reveals that during 1976 to 1989 the relationship between the two measures of inflation produced a correlation coefficient of 0.86 but this strong positive correlation reversed after 1990, evidenced by a correlation coefficient of -0.32 over the 1991 to 2010 period.

A negative relationship between the percentage change in the deflator and a price index like the RPI is relatively uncommon among countries around the world (Bhalla et al., 2011, March). Due to the emergence of this relationship between the two measures of inflation in Barbados, projections for nominal GDP are often times very different from the actual data. This in turn affects the forecast accuracy of the aforementioned GDP ratios. For these reasons, this research seeks to establish a better method of forecasting nominal GDP.

Figure 1: The Percentage Change in the GDP Deflator and RPI



Source: Barbados Statistical Service

The remainder of this paper is organised as follows: section 2 reports the data sources, the econometric approach and results; and section 3 concludes the work.

2. Data, Methodology and Results

2.1. Data

This research employs annual data spanning the period 1975 to 2008. The dependent variable of this study is nominal GDP and data for this variable was sourced from the Barbados Statistical Service (BSS). In 2009, the Caribbean Regional Technical Assistance Centre (CARTAC) spearheaded a national accounts mission to the BSS, aimed at revising Barbados' GDP current price series. Coming out of the mission, from 1990 onward, GDP at factor cost was revised to GDP at basic prices in accordance with 1993 SNA standards. As a result, the nominal GDP series is made up of both GDP at basic prices and GDP at factor cost. GDP valued at basic prices are higher than the factor cost valuation. To take account of this structural change in the dependent variable, a shift dummy which takes a value of one from 1990 to 2008 and zero elsewhere will be included in the econometric analysis.

The remaining independent variables are real GDP, world oil prices and the wage index. Data on real GDP and the wage index were both obtained from the Central Bank of Barbados. The oil price variable is represented by the West Texas Intermediate crude oil spot average, sourced from Bloomberg. All variables are expressed in logarithmic form.

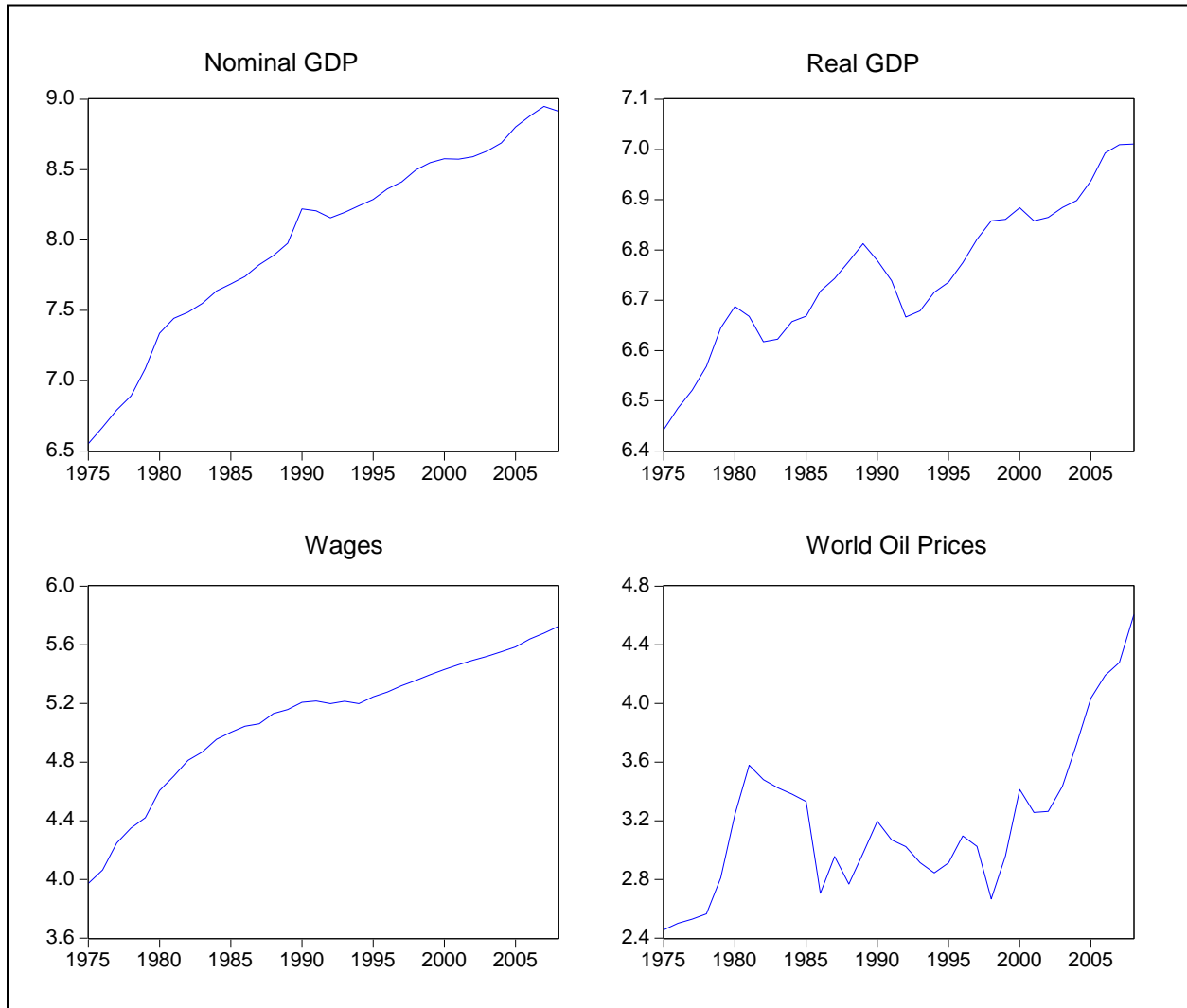
2.2. Econometric Approach

2.2.1. Unit Root Tests

As a first step, the author examines the stationarity properties of the variables using the Augmented Dickey-Fuller (ADF) and KPSS unit root tests. The test statistic for the ADF is based on the null hypothesis that the series contain a unit root, which means there is a high probability of falsely rejecting the null hypothesis when the data generation process is close to a stationary process (Blough, 1992; Harris, 1995). Therefore, the study also employs the KPSS test by Kwiatkowski et al.(1992), where the null hypothesis specifies the series as a stationary process.

Figure 2 reveals that nominal GDP, real GDP and wage index are trending upward, while the oil price variable follows a more erratic pattern. For accuracy, a linear trend is included in the unit root tests for these three variables.

Figure 2: Variable Plots, 1975 – 2008



**Sources: Nominal GDP - Barbados Statistical Service
Real GDP - Central Bank of Barbados
Wage rate - Central Bank of Barbados
World oil prices - Bloomberg**

The results of the two unit root tests are presented in Table 1. Both the ADF and the KPSS tests suggest that real GDP is trend stationary and world oil prices are integrated of order one $I(1)$. However, the tests produce mixed results for nominal GDP and the wage index. The ADF test indicates that nominal GDP and the wage index are $I(1)$, while the KPSS test suggests that the variables are integrated of order two $I(2)$. Given that $I(2)$ variables are very rare among economic variables, the unit root test that accounts for structural breaks by Lanne et al. (2002) and Saikkonen and Lutkepohl (2002) is applied to the two variables to verify the order of integration. The test first estimates the deterministic component of the series by generalised least squares under the null hypothesis that the series contain a unit root. Afterwards, the deterministic term is subtracted from the original series. In the

next step, an ADF-type test is applied to the transformed series. The critical values for this test are reported in Lanne et al. (2002).

Table 1: Unit Root Tests Results

Variables	ADF Test		KPSS	
	Levels	1st Diff	Levels	1st Diff
Nominal GDP	-2.2800	-3.5187**	0.1883**	0.5257**
Real GDP	-3.9420**	-3.9266***	0.0861	-
Wages	-2.7027	-2.6843*	0.1710**	0.4644**
World oil prices	-0.1729	-4.8826***	0.4404*	0.2189

Note: ***, ** and * indicates significance at the 1, 5 and 10 percent level of testing, respectively.

Table 2 shows that the structural break identified for nominal GDP corresponds to 1990, which is a result of the revaluation of the GDP current price series. On the other hand, the break in the wage index series is attributed to the foreign currency crisis that led to an 8 percent cut in the salaries of civil servants in 1992 (see Blackman, 1997: pp. 22). The unit root test for series with structural breaks confirms that nominal GDP and the wage index are I(1).

Table 2: Unit Root Test for Series with Structural Breaks

Variables	Level	1st Difference	Break Date	Decision
Nominal GDP	2.6099	-2.8001*	1990	I(1)
Wages	-0.9642	-4.225***	1992	I(1)

Note: ***, ** and * indicates significance at the 1, 5 and 10 percent level of testing, respectively.

2.2.2. The Forecast Model

For the econometric model, all the time series variables are in first differences so as to obviate problems that may arise from using non-stationary variables such as non-standard distributions of t-ratios and spurious results. The study estimates a supply-side equation using Ordinary Least Squares (OLS) techniques:

$$\Delta Y_t = \alpha + \beta_1 \Delta Q_t + \beta_2 \Delta OP_t + \beta_3 \Delta W_t + \beta_4 D_s + u_t \quad (1)$$

where Y is nominal GDP; Q is real GDP; OP represents world oil prices; W is the wage index; D_s is the shift dummy that controls for the structural change in the dependent variable and u is a well-behaved error term.

Real GDP is expected to have a strong positive impact on nominal GDP as it is essentially the quantity component of nominal GDP. Given that Barbados is a small open economy, an

increase in world oil prices should translate into higher domestic prices, which would then lead to an increase in nominal GDP. However, oil prices alone are not sufficient to fully account for the price element of nominal GDP because the volatile nature of oil prices does not reflect the general movement of prices in Barbados. Wages, on the other hand, are less volatile than oil prices and the price level of an economy tends to be largely determined by the wage rate. Downes et al. (1991) provide strong evidence which identifies changes in the wage rate as a major contributor to inflation in Barbados. Further, publicly available income statements of companies operating in Barbados reveal that wages and salaries account for about 40 percent of total operating expenses. As such, the author expects a positive relationship between nominal GDP and the wage rate.

The regression estimates are reported in Table 3. It should be noted that the initial estimation had a problem of non-normality of residuals. To arrest this problem, a pulse dummy, D_p , is included in the model to account for a large spike in ΔY_t corresponding to the first year of the revised GDP valuation, 1990. The results show that the model is well-specified as the diagnostic tests do not reveal any problems with autocorrelation, heteroscedasticity or non-normal distribution of residuals. All of the independent variables are statistically significant and have their *a priori* expected coefficient signs. Testament to the model's good performance, the $\overline{R^2}$ indicates that roughly 78 percent of the variation in ΔY_t is explained by the independent variables when the degrees of freedom are taken into account. Growth in real economic activity as measured by ΔQ_t has the largest marginal impact on the dependent variable, followed by growth in wages and changes in world oil prices. The shift and pulse dummies are shown to be statistically significant.

Table 3: Estimation Results

$\Delta Y_t = 0.036 + 0.886\Delta Q_t + 0.055\Delta OP_t + 0.476\Delta W_t - 0.027D_s + 0.231D_p + \hat{u}_t$					
(2.268***)	(5.020***)	(2.240**)	(2.974***)	(-1.869*)	(7.048***)
Diagnostic Tests					
$R^2 = 0.817 \quad \overline{R^2} = 0.783 \quad \text{Joint} - F(5, 33) = 24.111***$					
$\text{LM} - F(2, 25) = 0.186 \quad \text{Het} - F(5, 27) = 1.527 \quad \text{Norm} - \chi^2(2) = 3.990$					

Notes: t-statistics of regressors are shown in parentheses. ***, ** and * indicates significance at the 1, 5 and 10 percent level of testing, respectively. R^2 is the coefficient of determination, $\overline{R^2}$ is the coefficient of determination adjusted for degrees of freedom, Joint is the F-statistics for the joint significance of the explanatory variables. LM is the Lagrange Multiplier test for p-th order residual autocorrelation and HET is the Breusch-Pagan-Godfrey heteroscedasticity test. Finally, Norm is the test for normality of the residuals based on the Jarque-Bera test statistic.

Forecasts of nominal GDP are generated from the estimated regression model shown in Table 3. As a whole, the model exhibits decent forecasting potential since the Theil inequality coefficient - which is one of the better indicators for gauging forecasting accuracy according to Mamingi (2005: pp. 240) - is almost zero in both the in-sample and out-of-sample forecast (see Table 4). However, the in-sample forecast appears to have a greater degree of bias and variance than the out-of-sample forecast as evidenced the greater value of the bias proportion and variance proportion for the in-sample forecast.

The out-of-sample forecast horizon extends to 2013. Therefore, projections of the independent variables are required for the years 2012 and 2013. The forecast for real GDP was obtained from the Central Bank of Barbados' internal outlook model, which forecasts each sector of the Barbadian economy based on structural models that incorporate the assumptions of the Bank's economists. As for oil prices, projections of the West Texas Intermediate crude oil spot price was sourced from the U.S. Energy Information Administration's website: <http://www.eia.gov>. For the past two years, wage growth in Barbados has been subdued by the dismal economic environment. Based on the IMF's April 2012 *World Economic Outlook* projection of a weak recovery among major advanced economies, the lackluster performance of the Barbadian economy is likely to persist over the next 18 months. As such, a two-year moving average is used to forecast growth in wages.

Table 4: Forecast Evaluation

	In-Sample Forecast	Out-of-Sample Forecast
	1976 – 2008	2009 – 2011
Root Mean Squared Error	1976 – 2008	2009 – 2011
Mean Absolute Error	240.520	332.560
Mean Absolute Percentage Error	177.519	314.081
Theil Inequality Coefficient	4.424	4.298
Bias Proportion	0.029	0.022
Variance Proportion	0.498	0.212
Covariance	0.262	0.118

Table 5 presents the forecasts of nominal GDP over the period 2009 - 2013 and compares it to the actual data. The information presented in this table shows that the forecasted values of nominal GDP are not notably different from the actual GDP data. Nominal GDP is forecasted to grow by 2.5 percent and 3.0 percent in 2012 and 2013, respectively.

Table 5: Ex-Ante and Ex-Post Projected Nominal GDP (BDS \$), 2009 – 2013

Date	Forecast	Actual	Theil Inequality Coefficient
2009	\$7215.2M	\$7456.9M	-0.0165
2010	\$7485.6M	\$7253.6M	0.0157
2011	\$7726.8M	\$7258.3M	0.0313
2012	\$7919.9M		
2013	\$8157.7M		

3. Conclusion

The Central Bank of Barbados currently forecasts nominal GDP based on the projected growth of real GDP and the GDP deflator. The problem with this approach lies in the fact that projections for the deflator are set exactly in line with forecasted inflation rate as measured by the retail price index (RPI) and over the last 20 years a negative relationship emerged between these two measures of inflation. As a consequence, the present methodology of forecasting nominal GDP requires significant improvement.

To this end, the author estimates an OLS regression model to forecast nominal GDP. The results show a positive link between real GDP, the wage rate and world oil prices. The model exhibits good forecasting properties as indicated by the out-of-sample forecast evaluations.

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Book and Literature Reviews

The Future of Finance: A New Model for Banking & Investment

Moorad Choudhry & Gino Landuyt, published by John Wiley & Sons, Inc., Hoboken, New Jersey (2010)

A Review by Peter Grosvenor*

Written in 2010, after the dust of the financial market crash of 2007 and the banking crisis of 2008 had settled, this book provides a comprehensive analysis of the factors that led to that crisis and how those factors interacted. The authors, Choudhry and Landuyt are experienced practitioners at the highest level in the investment banking and treasury management fields. Following their causal analysis of the crisis they provide practical recommendations for a revised approach to banking and principles of investment, which they believe, should form part of a logical, unbiased review of strategy by both banks and investors. They argue that if followed, their recommendations will help to produce a more sustainable level of economic prosperity.

The Foreword by well-known Finance Professor at Yale University, Frank J. Fabozzi, acknowledged the historic continuum of economic and financial crashes since the 1700s. He however proceeded to highlight the peculiarities of the crisis of 2007 – 2009 that set it apart from its unfortunate forerunners. These included:

1. The technology-based global environment in which the crisis occurred and the almost instantaneous transmission of events.
2. ‘There was no set pattern... no initial shock followed by recovery; rather, economies and markets were beset by a series of shocks, each of greater impact than the last’, culminating in the large scale bailouts of the United States and European Governments to save their banking sectors.
3. It differed from previous market corrections in that for a time, there appeared to be no end in sight for it, hence the government intervention.

Fabozzi then provided a synopsis of the debates that transpired, much of which offered little value added. He referred to Galbraith’s seminal work on the 1929 stock market crash, published some 25 years later and posited the view that in like manner, the lessons of the 2007 – 2009 crisis will take some time to formulate and digest, as much of the published material to that point suffered from being written in haste. He used that point to contrast those earlier published works with this book. He described this book as benefitting from a longer term perspective of the causal factors behind the crash which resulted in value and tractability of its policy recommendations.

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The book is prefaced with an exposition of how the 2007 – 2009 crisis brought the spoiler of reality into the realm of incomplete theory. The incomplete theory being that modern portfolio theory and portfolio diversification apply at all times and would work successfully in both a bull market and a bearish environment. The crisis laid bare all investors and asset classes, including banks, hedge funds, volatility traders, private equity, long/short investors and traditional long-only fund managers. There was no safe haven, as every major asset class suffered losses and diversification across these different asset classes proved counter-effective.

The crisis forced investors to accept that diversification and the efficient portfolio theory do not apply at all times. Even Modern Portfolio Theory (MPT), the cornerstone of modern finance, failed in 2007 – 2008. The practice of diversification to spread risk, in that bear market destroyed value instead of creating it, as it increased the existing risk exposures for no further reward.

The simple lesson is that in a bear market, or any period of negative sentiment, all asset prices and markets decline; and in times of crisis, correlation between asset classes is practically unity. With no uncorrelated assets, it is practically impossible to have a diversified portfolio.

Even diversification on the basis of geography by the banks, in an effort to spread and diversify risk had a negative impact. The authors noted that this strategy only magnified the risk across economies so that when the credit crunch came it hit them everywhere. They mentioned one global giant, the HSBC Group, that weathered the crisis well, but attributed this to *“its conservative liquidity management policy and strong capital base”*.

The authors proposed two policy recommendations:

1. Restructure the business model to assets and regions in which the practitioners had genuine understanding and expertise.
2. For banks to secure long-term liquidity to allow for times of market corrections and illiquidity. Also to avoid overleveraging on the capital base.

They closed their preface with a statement that provides sobering advice to financial market practitioners and regulators as follows:

“Crashes of one sort or another are an integral part of the free-market economy. Rather than trying to prevent them or, worse still, thinking that they can be avoided or legislated away, it behooves financial market practitioners and regulators to place themselves and the firms in which they work in a position where they suffer least from the impact of crashes when they do occur.”

In their introduction Choudhry and Landuyt recalled historic examples to reinforce that financial markets have always been plagued by crashes or bubbles of one sort or another. They then traced the roots of some of the more recent crises and bailouts and identified their genesis.

This included the identification of the large capital inflows that along with other factors led to the Latin American debt crisis of the late 1980 for the US banking system. In the recent crisis, large capital inflows to the US, this time from Asia and China, were again considered a major causal factor. The authors believe that the crisis of 2007 – 2009 was a long time in the making, with this and other factors all coming together. The other factors included:

- The stability of the market led to large infusions of cash from external investors which led to cheaper credit, increases in asset prices and the development of a housing boom.
- The peculiar feature of the financial services industry, where rising asset prices leads to higher demand for those assets. Unlike other industries where demand declines as prices rise.
- The stability, cheap credit and asset growth with markets reaching ever higher highs led to more confidence and increased the level of risk taking. Risk aversion declined and investors started to take on greater risk and made bigger bets.
- The excessive leverage of major financial institutions including Lehman Brothers.

Part One of the book provided a more detailed and expansive assessment of the factors that contributed to the crash that were alluded to in the introduction. Chapter by chapter treatments are provided of the following:

- Globalisation, Emerging Markets and the Savings Glut
- The Rise of Derivatives and Systemic Risk
- The Too-Big-to-Fail Bank, Moral Hazard, and Macroprudential Regulation
- Corporate Governance and Remuneration in the Banking Industry
- Bank Capital Safeguards: Additional Capital Buffers and Reverse Convertibles
- Economic Theories under Attack.

Each of these subject areas were explained and supported by relevant data (tables and charts), that facilitate the understanding of readers. The authors explain the historical development of these contributory factors, the arguments for and against some of the related practices and the related risks, many of which were still in existence at the time of writing. They provided recommendations for better policies to reduce the exposures and minimise the impact of future bank failures and crises.

As they progressed to their analysis and comparisons of the economic and financial market theories, more effort is required by readers to wrap their minds around the sometimes complex and contradictory “ground breaking” theories. Chapter 5 appears more suited for academics, but looking at these theories through the lens of the 2007-2009 Crisis, really brings them to life.

These theories included:

- Modigliani and Miller’s capital cost model
- The Modern Portfolio Theory (MPT) of Markowitz
- The Efficient Market Hypothesis of Eugene Fama

- Autoregressive Conditional Heteroskedasticity/Generalised AutoRegressive Conditional Heteroskedasticity, better known in economic circles as the ARCH/GARCH methodology for analysis and forecasting financial time series

The crisis provided a real-life test of these theories, and some of them did not fare well. This chapter should be of great interest to students and practitioners of finance and economics and Central Bankers, as it provides some “rubber meets the road” real-life assessments of theories of economics and financial markets still taught in universities today. Some of these schools of thought fell prey to the 2007–2009 crisis.

In Part two of this book the authors turn their attention from the causal elements of the financial crash of 2007 – 2009, to new more resilient models for banking and investment. After showing that a significant number of the causal factors were building over a period of time, Choudhry and Landuyt were of the view that it would require both concerted, direct action and another period of time for these factors to be unwound in order for them not to remain a potential cause for a future crashes. Aside from these, they noted other factors that had always plagued the financial markets, including poor loan origination standards and human nature that feeds on, and drives asset bubbles.

Given their position that financial crashes seemed to be inherent in the economic system, they provided recommendations for banks and investors to adopt in order to mitigate the impact of the next crash. While acknowledging that these recommendations were not complete or exhaustive, they reasoned that they should be adopted as part of a logical, dispassionate review of strategy by both banks and investors.

Before setting out their guidelines Choudhry and Landuyt provided assessments of certain critical factors. These included:

- The investment landscape after the crisis.
- Government debt and demographic concerns
- The new economic environment
- Inflation problems and solutions
- Equity versus credit
- Sovereign Bonds
- Currencies and the changing geopolitical landscape
- The commodity factor
- Exchange-traded funds as a flexible asset class

They found that:

- The crash had a major impact on investor thinking and behaviour. This included a new investment paradigm that concentrated on asset rotation of four major asset classes (1. interest rates and inflation, 2. currencies, 3. commodities and 4. emerging markets).
- The US and European Governments’ rescue of the banks further deteriorated the already worsening public finances, and that along with their aging populations, is expected to influence the performance of certain major asset classes.

Looking ahead they proposed that:

- The amount of public debt of developed countries will have an impact on sovereign fixed income investments.
- Certain countries that were facing severe challenges in keeping their funding levels under control will see this have a negative impact on their outstanding government bonds.
- Substantial public deficits and aging populations will increase inflation risks; and this risk will remain for certain countries due to a combination of a tighter labour market and wage pressures.
- This inflationary environment should lead to commodities performing well, and natural resources will become an important asset class to consider.
- Further growth in the global population will put further pressure on the supply of certain agricultural products, which will create further inflationary issues.

The authors then included all of these factors in their investment portfolio model, the actual percentage breakdowns for which, they left to be subject to individual investor preference, circumstances and risk/reward profile. Notwithstanding that, they felt that the following asset classes should be common to everyone's portfolio:

- Government bonds (focusing on countries with healthy public finances)
- Inflation-linked structures (to protect against inflation)
- Commodities
- Emerging markets/BRIC country-linked assets (for higher growth prospects)
- Currencies
- Exchange Traded Funds

As the next step to their investment portfolio model the authors provided the tools that investment practitioners will need to successfully manage this new portfolio. Choudhry essentially returned to the area for which he is probably best known. In a very succinct but effective manner they provided what they considered to be the essential principles and best practice framework of bank asset-liability management, and the main tenets of bank liquidity management.

They argued that the events of 2007-2009 reinforced the importance of sound asset liability management practice in banks. Additionally, they made the case that a bank's asset-liability committee (ALCO) should be set up as an effective management entity at every bank, empowered to ensure correct business practice for asset liability management.

Choudhry and Landuyt closed out their book by recommending "*a sustainable Bank Business Model*". The contents of their proposal should find favour with regulators across most if not all jurisdictions. With a healthy focus on bank strategy, leverage, risk management, capital structure and corporate governance, they were able to put the essential role of the board of directors and senior management into perspective. They posited that the board of directors and senior management should accept that the bank they run is a pivotal part of society, and in the post-crisis era, will be closely regulated. Also,

that their contribution to the stability of the market is as important an objective for a board, as achieving shareholders' return-on-equity.

This work of Moorad Choudhry and Gino Landuyt provides much food for thought for regulators, economists and financial practitioners. It helps readers to better understand how otherwise favourable factors like economic and market stability, high levels of liquidity, cheap credit and strong asset growth, along with globalisation can foster the development of a financial crisis on an unprecedented scale. It also provides insights into the less favourable factors that played a contributory role.

I certainly recommend it.

The Black Swan: The Impact of the Highly Improbable

Nassim Nicholas Taleb, New York, Random House (2007, 2010)

A Review by DeLisle Worrell*

The world economic and financial crisis of 2008 brought to a head long-festering self-doubts within the economics profession, as well as criticisms from outside the ranks of professional economists. This has led to an outpouring of critical writing, but sadly the overwhelming volume has been apologist, explaining events (after the fact) as examples of exceptions to the equilibrium market model (external diseconomies, public goods, “herd behaviour” and the like). That line of “explanation”, exemplified by titles such as *Freakonomics* and *The Economic Naturalist*, tells us nothing about how events might have been ordered otherwise, how to address the current conjuncture more successfully, or how to avoid the next crisis.

The Black Swan is the second really insightful and helpful analysis I have recently read; the first, reviewed in the March 2011 issue of the Central Bank of Barbados Economic Review, was *The Origin of Wealth*. That book proposed and elaborated on an evolutionary theory of economics which acknowledges the advances in scientific knowledge of the last century or more, which economics has studiously ignored. The book currently under review exposes the fact that most empirical work in economics is without scientific foundation, and if taken at face value, leads to error. Once we accept this reality, Taleb argues, we may find acceptable ways of coping with the true uncertainty that is the inescapable reality of human understanding.

The fundamental fallacy of economic statistics and econometrics

The estimation methods now commonly in use all assume that we know the underlying distribution of observations, and that it is Gaussian, whereas in fact we know with some certainty that the distribution of events is not Gaussian, though we cannot know what it is. Because “we need data to obtain a probability distribution to gauge knowledge of the future behaviour of the distribution from its past results, and [because], at the same time, we need a probability distribution to gauge data sufficiency and whether or not it is predictive of the future, we face a severe regress loop.” (Page 251) In short, we need data to discover the distribution, but we need to know the distribution to know what data to collect to discover it. Since we don’t and can’t know the distribution, all our inferences are speculation.

We need to know the distribution of observations, because “given a set of observations, plenty of statistical distributions can correspond to the exact same realisations – each would extrapolate differently. ...Under nonlinearities, the family of possible models/parameterisation explode in numbers.” (Page 353) We need to know the underlying distribution to be able to project forward from actual observations. Taleb cites a commonplace example to illustrate: if we choose a small number of observations it is easy to infer that a series is linear, when in fact it is quadratic.

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What is more, trying to guesstimate the distribution doesn't help. *"Sampling error is too large for any statistical inference about how non-Gaussian something is, meaning that if you miss a single number [my italics], you miss the whole thing."* (Page 355) A useful way to visualise the problem, cited in the book, is the puzzle of the melting ice. If you observe the ice, you may have a notion of the puddle that will be formed when it melts. But in real life we observe only the puddle, so we have no idea what the ice cube looked like, or even whether the pool of water is indeed the result of melting ice in the first place.

Taleb provides a graphic picture of the non-Gaussian world of business: *"Let's say a project is expected to terminate in 79 days ... On the 79th day, if the project is not finished, it will be expected to take another 25 days ... But on the 90th day, if the project is still not complete, it should have about 58 days to go. On the 100th, ... 89 days ... On the 119th, ... 149 days. On day 600 ... 1,590 days. ... the longer you wait, the longer you will be expected to wait."* (Page 159)

Taleb is at pains to point out that, even though this is the inescapable reality, we are not condemned to blunder witlessly into the future. We can make informed guesses about the future, though we should not delude ourselves into believing we can determine their probability of occurrence. What matters is not so much the probability of occurrence, but the consequences, should the projected event occur. The informed, careful decision maker identifies ahead of time those outcomes which are especially dangerous, because of their consequences, and pays most careful attention to developments which seem to lead in those directions. Taleb says he does not advise against crossing the street, just that we do not cross while blindfolded.

History is always reconstructed

We think that there are established facts of history, but students of history know better, because we (I count myself among that number) have seen innumerable examples of reconstructions of the history we learned in school, most of which turns out to have been filtered through a biased lens. Taleb offers even richer insight into the malleability of history. What those who write history recall and record is a limited and biased selection from all the events which actually took place. The bias is not deliberate, but it is inescapable. *"Because your memory is limited and filtered, you will be inclined to remember those data that subsequently match the facts."* (Page 12) The most obvious examples of this are the sages who turn up after any big disaster, claiming to have predicted it. They may have said that something like what happened was likely, but they were at the time competing for media time with hundreds of others, far more credible in the eyes of the public, who were saying other things. After the fact we tend to forget about those who got it wrong, and how credible and convincing we thought them to be at the time. Taleb cites a "Triplet of opacity" which conspires to produce a misinterpretation of history: the world is more complicated than people realise; we can assess matters only after the fact, when we know what "clues" have proven important; we overvalue "facts", especially when they are stated by "authoritative and learned" people.

About memory Taleb says: “... we will tend to remember more easily facts from our past that fit a narrative, while we tend to forget those that do not appear to play a causal role .. This simple inability to remember, not the true sequence of events but a reconstructed one, will make history seem in hindsight to be far more explainable than it actually was – or is.” (Page 70)

“... you remember the last time you remembered the event and without realizing it, change the story at every subsequent remembrance ...

“While we believe that memory is fixed, constant ...” (Page 71)

We commonly misuse the rules of inference

Taleb argues that it is commonplace to draw unwarranted inferences from the things we observe, even when our observations are reasonably accurate. For example, if we have no evidence of the likelihood of a Black Swan, that does not constitute evidence that there is no likelihood of a Black Swan; i.e. no evidence is not to say there is no likelihood, merely that we don't have the evidence. Right up to the day before Thanksgiving, he points out, the turkey has no evidence other than that he will be fattened and cosseted every day. But on the morning of Thanksgiving Day, he discovers the likelihood of his demise is 100 percent.

Even though you will seldom get an academic paper published if all you can say is that there is no evidence of something, in real life that can be very valuable information. For example, “.. if you seek certainty about whether the patient has cancer, not certainty about whether he is healthy, then you might be satisfied with negative inference.” (Page 56) The noted philosopher Karl Popper is credited with promoting the idea of “the “open” society that relies on skepticism as its *modus operandi*, refusing and resisting definitive truths.” (Page 57) I consider myself a follower of Popper: we may, on the basis of careful investigation, hope to discover that a proposition is false. You cannot ever know whether it is true.

Some limits to cognition

Taleb cites a natural tendency of humans to over-interpret and a preference for “compact stories over raw truths.” (Page 63) When we write a story – or history, a story we presume to be true – we do not recount everything that occurred in the period leading up to the main event. Instead we select those occurrences which we judge to be pertinent to explaining the outcome of interest, and omit all the other irrelevant circumstances. The reason we have so many biographies of famous people, and so many different interpretations of history, is that each writer makes a different judgment about what is important.

Moreover, our recall of the facts is biased by our theory of what caused the event of interest. We remember most vividly the details that are rendered important by our after-the-fact explanation of the event. As a result, if we start with the wrong premise, we tend to find supporting evidence. “It takes considerable effort to see facts (and remember them) while withholding judgment and resisting explanations.” (Page 64)

These are all natural tendencies in humans, and they are generally useful to us. Information is costly for us to obtain, costly to store and costly to manipulate and retrieve. Compression

is essential for the performance of conscious work, so we compress, simplify and pretend the world is less random than it is. Taleb argues that both science and art are products of our need *“to reduce dimensions and inflict some order on things.”* (Page 69)

Being wrong with precision

Taleb exposes another human trait – the need for concreteness, for explanations of everything. He says: *“... for psychological comfort some people would rather use a map of the Pyrenees while lost in the Alps than use nothing at all. They do not do so explicitly, but ... they would prefer a defective forecast to nothing.”* (Page 367) The media is guilty of exploiting this trait in all of us: *“... a cause is proposed to make you swallow the news and make matters more concrete. ... the media go to great lengths to make the process “thorough” ... (it is as if they wanted to be wrong with infinite precision instead of accepting being approximately right, like a fable writer).”* (Page 74) He adds that academics do the same *“but dress it up in formal language.”* (Page 75) They are motivated to do so because *“... we live in a society where the reward mechanism is based on the illusion of the regular ...”* (Page 85) In contrast, genuine insight about the world arrives by an entirely different route: *“... you may think about a problem for a year and learn nothing; then ... something will come to you in a flash.”* (Page 88)

We come to the wrong conclusions if we neglect the silent evidence

Taleb illustrates the “silent evidence” with the following parable: *“More than 2000 years ago the Roman orator ... Cicero presented the following story. One Diagoras, a nonbeliever in the gods, was shown painted tablets bearing the portraits of some worshippers who prayed, then survived a subsequent shipwreck. The implication was that praying protects you from drowning. Diagoras asked, “Where are the pictures of those who prayed, yet drowned?” The drowned worshippers, being dead, would have a lot of trouble advertising their experiences from the bottom of the sea. This can fool the casual observer into believing in miracles.”* (Page 100)

“The neglect of silent evidence is endemic to the way we study comparative talent ... [it results in] the winner take all effect ...” Taleb cites the 19th century novelist Honore de Balzac whose success is attributed to his superior “realism”, “sensitivity”, etc.; the problem is that we do not know how many of Balzac’s long forgotten contemporaries also wrote with similar realism and sensitivity. *“My point ... is not that Balzac is untalented, but that he is less uniquely talented than we think” because we have lost the records of the thousands of writers now completely vanished from our consciousness.”* (Page 103)

“The graveyard of failed persons will be full of people who shared the [same] traits [as] .. the population of millionaires ... What truly separates the two is for the most part.. luck.” (Page 106)

Our education does not equip us well to deal with life

We make *“ .. [a] serious mistake about human nature: the belief that we are built to understand nature and our own nature, and that our actions are, and have always been, the result of our own choices.”* (Page 117) This belief, an unstated assumption of most education, is without foundation. In fact, *“ ... classroom knowledge may get in the way of*

understanding what is going on in real life”, for which you need “... enormous curiosity about the texture of reality. ... the attributes of the uncertainty we face in real life have little connection to the sterile ones we encounter in exams and games ... In real life you do not know the odds ... and the sources of uncertainty are not defined.” (Page 127)

The growth of our knowledge is *“threatened by greater increases in confidence”* which lead to *“an increase in confusion, ignorance and conceit.”* (Page 138) *“... we overestimate what we know, and underestimate uncertainty, by compressing the range of possible uncertain states (i.e. by reducing the space of the unknown).”* (Page 140) Taleb goes on to say: *“... our ideas are sticky: once we produce a theory, we are not likely to change our minds ... When you develop your opinions on the basis of weak evidence, you will have difficulty in interpreting subsequent information that contradicts these opinions, even if this new information is obviously more accurate ... the more detailed knowledge one gets of empirical reality, the more one will see the noise (i.e. the anecdote) and mistake it for actual information.”* (Page 144)

For all of these reasons, we should beware of blindly following expert advice. *“The problem with experts is that they do not know what they do not know. Lack of knowledge and delusion about the quality of knowledge come together ...”* (Page 147) Taleb is critical of economists, and rightly so, since most of empirical economics is based on the Gaussian fallacy. Taleb says what all central bank policymakers know to be true: economists’ predictions are *“not good enough to help with serious decisions.”* They are too iffy. The error rate in forecasts by stockbrokers, government deficit forecasts, bank forecasts are all *“so large that it [the error] is far more significant than the projection itself!”* (Page 162) What is more, sophisticated methods are no better than simple ones. Taleb comments, *“Economics is perhaps the subject that currently has the highest number of philistine scholars – scholarship without erudition ...”* (Page 156)

Taleb’s criticism of economists resonates with me: *“... optimization set back social science by reducing it from the intellectual and reflective discipline that it was becoming, to .. a second rate engineering problem for those [with] .. physics envy. In other words, an intellectual fraud.”* (Page 184) *“Tragically, before the proliferation of empirically blind idiot savants, interesting work had been done by true thinkers, the likes of J M Keynes, Frederick Hayek, and the great Benoit Mandelbrot, all of whom were displaced because they moved economics away from the precision of second-rate physics. ... One great underestimated thinker is G L S Shackle ...”* (Page 185)

We do not know how to plan

Almost everyone seems to believe that you should make a plan and stick to it, but that is usually the path of folly. Instead, a plan should be used as a reference table, against which economic indicators are evaluated as time evolves. It is what informs us that changes may be necessary in order to achieve the plan’s objectives. *“Plans fail because of ... the neglect of sources of uncertainty outside the plan itself”* (page 157), sources of uncertainty such as an ailing mother in Minnesota, a broken engagement, strikes, bad weather, electricity shortages, etc. *“We cannot truly plan, because we do not understand the future – but this is*

not necessarily bad news. We could plan while bearing in mind such [the above] limitations.” (Page 157)

Taleb explains our limitations: *“The notion of a future mixed with chance, not a deterministic evolution of your perception of the past, is a mental operation our mind cannot perform. ... when we think of tomorrow we do not frame it in terms of what we thought about yesterday on the day before yesterday.”* We are also not good at projecting ourselves into others’ reality: *“Go to the primate section of the Bronx Zoo where you can see our close relatives in the primate family ... You can also see ... tourists laughing at the caricature of humans the lower primates represent. Now imagine being a member of a higher level species ... far more sophisticated than the human primates. You would certainly laugh at the people laughing at the nonhuman primates. Clearly, to those people amused by apes, the idea of a being who would look down on them the way they look down on the apes cannot immediately come to their minds – if it did ... [t]hey would stop laughing.”* (Page 193)

Decision making and free markets

Decision making in our societies is too often hamstrung by the desire for certainty about outcomes, something which is obviously unattainable. However, even those who accept that decisions are taken under uncertainty too often insist on knowing the margin of error in their forecasts. But because we cannot know the true distribution of observations, we merely delude ourselves when we calculate a margin of error based on the Gaussian distribution. All is not lost, however. *“... in order to make a decision you need to focus on the consequences (which you can know) rather than the probability (which you can’t know).”* Decision making is always a process of trial and error. The effectiveness of free markets derives from the circumstance that *“... free markets ... allow the trial-and-error process [of] ... “stochastic tinkering” on the part of competing individuals who fall for the narrative fallacy – but are effectively collectively partaking of a grand project.”* (Page 211) In other words, you don’t have to be superman, because even if you fail to surmount the fallacy of mistaking the story for fact, and all the other market participants make a similar mistake, you can still make progress if you are willing to adapt to circumstances as they unfold in the marketplace. It helps that for many rare events *“it is not easy to compute their probability, but it is easy to get a general idea about the possibility of their occurrence.”* (Page 213) Moreover, chance is the catalyst: *“Capitalism is, among other things, the revitalisation of the world thanks to the opportunity to be lucky. ... Luck is far more egalitarian than even intelligence”* (Page 222)

On wisdom

Taleb states that *“... the best teachers of wisdom are naturally the oldest, because they may have picked up invisible tricks and heuristics ... that helped them to survive in a world more complex than the one we think we understand.”* (Page 310) For example, they have learned that *“Our psychology conspires: people like to go to a precise destination, rather than face some degree of uncertainty, even if beneficial.”* (Page 319) And so, to achieve his desired result the policymaker must sometimes use a precise reference point, even if there is no economic justification for precision.

The economic and financial crisis that erupted in 2008

In an appendix chapter, written after the crisis, Taleb states “... *the crisis of 2008 ... [was] the result of fragility of systems built in ignorance – and denial – of the notion of Black Swan events.*” (Page 321) He continues “... *since there is nothing new about the crisis of 2008, we will not learn from it and we will make the same mistake in the future. ... the current administration is populated by those who are bringing model error into industrial proportion.*” (Page 322) Taleb notes that “... *Alan Greenspan ... went to Congress to explain that the banking crisis ... could not have been foreseen “because it had never happened before”.* Not a single member of Congress was intelligent enough to shout “... *you have never died before, ... not even once; does that make you immortal?*” (Page 342)

Not surprisingly, Taleb is dismissive of the methodology of financial analysis: “... *“stress tests” [take] the worst possible past deviation ... to project the worst possible future deviation, not thinking that they would have failed to account for that past deviation if they had used the same method on the day before the occurrence of that ... event.*” (Page 343) Taleb is dismissive of value-at-risk methodologies and says that “*A scholar who applies [modern portfolio theory] resembles Locke’s definition of a madman: someone “reasoning correctly from erroneous premises.*” (Page 288)

Taleb argues that “*Few understand that there is generally no such thing as a reachable long run except as a mathematical concept to solve equations; to assume a long run in a complex system, you need also to assume that nothing new will emerge. In addition, you may have a perfect model of the world, stripped of any uncertainty concerning the analytics of representation ... but ... a ... minutely small uncertainty, at the level of the slightest parameter, might, because of nonlinearities, percolate into a huge uncertainty at the level of the output of the model.*” (Page 345)

Concluding remarks

Here is a book chock-a-block with home truths, truths which economists need to acknowledge, if they are to find solutions to an ailing international economy. In truth, the remedies are known and they are at hand; the only thing that stands in the way of their adoption is guidelines and benchmarks that are based on nothing more than convention masquerading as economic “fact”. The 60 percent debt-to-GDP “sustainability” ratio, the “12 weeks of imports” foreign reserves target, the Basel 8 percent capital adequacy ratio, and many other norms are all based on very dubious foundations. Taleb is pleading for us to accept this as the reality, and free ourselves to violate these norms, when circumstances clearly demand it.



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