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CWC 2007: FORECASTING THE INCREASE IN DEMAND FOR BANKNOTES IN THE ECCU

by

Emefa Sewordor

Leah Sahely

Rosbert Humphrey

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EMEFA SEWORDOR

LEAH SAHELY

ROSBERT HUMPHREY

ABSTRACT:

This paper develops an alternative approach to forecasting demand for banknotes that captures the effect of the Cricket World Cup 2007, to inform the Currency Management Department's ordering decision for the three-year period January 2007 to December 2009. The main aim of the forecasts is to improve upon the Currency Management Department's projections of banknote demand, in light of the fact that the department's current method indicates shortfalls in the Bank's supply of banknotes through to the end of December 2007. The Department is then faced with a situation where it has to order a new batch of notes in order to avert the shortage.

The forecasts show that the cricket event would represent a significant enough shock to the demand for currency to warrant an increase in the Currency Management Department's estimates used to inform its ordering policy. The results indicate that there is a need for adjusting the Currency Management's estimates upwards for each banknote denomination in the ECCU with the exception of the five dollar note. The most likely explanation for the exception posed in the case of the five dollar note is that the Currency Management Department's 15 per cent adjustment represents overcompensation for the increased level of activity expected during the CWC period.

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1. INTRODUCTION AND MOTIVATION

The Cricket World Cup 2007 motivated the authors to revisit the issue of banknotes and coin demand forecasting. The Currency Management Department (CMD) was mandated to assess the impact of CWC 2007 on currency demand with the assistance of the Technical Unit, Research Department (RD). The CMD's current method for ordering notes and coins is based on the average monthly usage (plus 10%-15% for any exceptions) from January 2001 to present for each of the ECCU member states.

The existing system employed by CMD shows some deficiencies in that the Bank has been faced with shortages in the past. The ability to correctly forecast the demand for banknotes and coins, and to plan the ordering and supply by the Bank's tenders could avoid shortages of notes and coins during this mega-sporting event.

The RD is venturing into new territory with this study and has sought to gain insight from the experiences of other central banks around the world. Neither the Bank of Jamaica nor the Central Bank of Trinidad and Tobago uses any formal econometric/modeling techniques to address the issue of currency demand and forecasting. Their forecasts are based on historical trends. With regards to addressing the potential effect of the CWC, these countries are expecting visitors to make extensive use of electronic means of payment and hence do not find it necessary to make major adjustments to their regular demand forecasts. The authors contacted the German Central Bank, the Bundesbank, to seek information on how they planned for the FIFA World Cup games in June 2006 and found that they made no special arrangements in respect of the issuing of additional banknotes. Their intention was to analyse the impact of the championship on the cash situation ex post, having adopted a "wait and see" position.

The main objective of this paper is to develop an alternative approach to forecasting demand for banknotes that captures the effect of the CWC 2007, to inform the CMD's ordering decision for the period January 2007 to December 2009.

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The remainder of this paper is laid out as follows: section 2 presents the background to the note; section 3 analyzes trends in the data on currency and its substitutes; section 4 outlines the methodology employed in making the forecasts; section 5 discusses the results and section 6 concludes with recommendations.

2. BACKGROUND

At present, the monetary issuance consists of bills in the denominations of five, ten, twenty, fifty and one hundred dollars. The dataset examined in this study consists of volumes of notes issued on a monthly basis from February 1996 to July 2006, for each denomination of banknotes in each of the territories.[1] The dataset suffers from a deficiency in that there are some months in which there was no issuance of new notes which implies that some data points take on the value zero.

The current CMD approach to determining how much of the denominations of banknotes to order, as commercial banks' requests are received, has experienced problems in the past. The stock ordered is expected to last for three years as orders should not be made until that time has passed. However, historical data reveals that orders for specific denominations have had to be made within those three years, on more than one occasion, to avoid the situation where the ECCB was unable to meet demand. Orders are placed six months in advance of when they are needed, as that is the length of the lead-time for the ordering process, so it is imperative that the Bank be able to accurately forecast demand in order to be efficient in its delivery of notes.

The current stock, which was originally anticipated to last until December 2007, is already expected to fall short of demand for some denominations in seven of the eight member

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[1] The paper focused only on banknotes issued due to the unavailability of data on coins issued.

territories[2]. St Vincent and the Grenadines is expected to experience a shortfall in all five banknote denominations, Anguilla in two denominations, Antigua and Barbuda in three denominations, Dominica in two denominations, Grenada in four denominations, St Kitts and Nevis in one denomination and Saint Lucia in three denominations (see *Appendix I* for details). Further, the Bank now has to consider if it has to order additional currency because of the CWC 2007 event, which will be hosted in four of its member territories (Antigua and Barbuda, Grenada, St Kitts and Nevis and Saint Lucia). St Vincent and the Grenadines is also expected to host warm-up matches and the other member countries (Anguilla and Dominica) may experience some spill-off effects.

Whether or not there is indeed a need for ordering more than the usual stock of banknotes and coins depends in large measure on projections for the level of economic activity that is to take place as a result of the cricket event. Current projections for GDP (the most common measure of economic activity) seem to indicate a significant increase in activity in the period preceding (due mainly to major construction projects related to the hosting of the CWC) and during the CWC 2007.

Given the anticipated increase in tourist arrivals for the CWC in 2007, the demand for currency is expected to rise. Visitor arrivals have never increased by more than 8500 visitors in one month for any one particular ECCU member territory. The number of visitors expected in those countries hosting the matches range from 6000 in St Vincent and the Grenadines to 17000 in Saint Lucia (*Appendix II*). However, the period during which this influx of visitors is expected is only a few weeks in early 2007 as the matches are scheduled for the months of March and April. Therefore, the length of time for economic activity is limited to a short window that again might indicate that the demand for cash may not increase very much.

At present within the ECCU, there are five main international currencies that are accepted by the commercial banks, namely, the euro, the Swiss franc, the US dollar, the British pound and

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[2] Projections as at March 2006

the Canadian dollar. Also, it is common throughout the ECCU for economic agents other than the commercial banks to accept US dollars in transactions but they still provide change in EC dollars. The CMD is considering a proposal specifically for the CWC that, if approved, would expand the list of currencies accepted at the commercial banks during the event. These additional currencies would then be accepted by the commercial banks in exchange for EC dollar banknotes but would not necessarily be sold by the commercial banks. If such a scheme develops then the anticipated increase in demand for the EC dollar discussed earlier would still pertain and would need to be met by the ECCB.

To further confound the forecasting process is the added complication of determining how the commercial banks might choose to meet any exceptional demand. Insurance considerations limit the banks in how much they request, in terms of banknotes, from the Central Bank. A bank's insurance policy may cover up to a certain portion of the banknotes stored in the bank's vault and to exceed that value will mean that the bank is incurring a risk. In some cases, rather than incurring the costs associated with making requests for additional banknotes from the Central Bank, the banks may meet additional demand by re-circulating notes from their stock of deposits.

Other developments in the issuing of banknotes stem from unforeseen events and circumstances that represent a shock to the monetary system. A case in point is the reconstruction efforts in Grenada in the wake of hurricane Ivan in 2004. Due to the feverish pace of construction activity in the last two years, Grenada has been a huge source of demand for banknotes, particularly the twenty and one hundred dollar notes. In such a case, in making its forecasts about future demand, the CMD would have bumped its projections for Grenada by a scale amount that is larger than their usual 10 per cent for "exceptions" mentioned above.

Notwithstanding the arguments suggesting there might be mitigating circumstances that would reduce the cause for concern regarding the effect of CWC on banknotes demand, there is sufficient reason to support the position for developing alternative forecasts in light of the fact that the CMD is expecting a shortfall in normal circumstances, not to mention the cricket event.

3. TRENDS IN THE DATA

The total amount of currency in circulation has been on an upward trend in each territory since 1990 (*Appendix III)*. Additionally there has been an upward trend in the demand for cash over the period 1990 to 2005, as determined by the currency in circulation per capita ratio. However, since 2000 there has been a faster increase in private business demand deposits relative to currency in circulation for the ECCU. The ratio of currency to demand deposits declined from over 94 per cent in 1990, to 75 per cent in 1994, to 47 per cent in 2004. This movement possibly indicates a general shift towards cashless payments[3] and away from cash. Again, the decrease in the ratio is not surprising as the introduction of credit cards, the number of chequing accounts and traveller's cheques leads to a substitution of these instruments for cash in an expanding number of transactions. Further, holding currency in large amounts is risky; it can be lost, destroyed, or stolen.

The dynamic nature of the instruments for cashless payment originates from the continuous innovation in this area. The dominant use of certain instruments in a certain country is determined by legal, business and technological conditions, as well as by the historical development of the payment systems in the country. Cheque payments are largely used in most of the ECCU member countries, constituting over 66 per cent of total cashless payments in the ECCU in 2005. However, Antigua and Barbuda, Grenada, Saint Lucia and St Vincent and the Grenadines are using fewer cheque payments and more paperless transfers than the other member countries (*Appendix IV*). The variation in usage of individual instruments for cashless payment by country can be explained by the absence of diversification of the market supply of payment instruments.

With the recent strides that have been made in the ECCU with regards to cashless payment systems, it may be the case that visitors to the region during the CWC would avail themselves of the opportunity to make payments via these methods, thereby reducing their reliance on

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[3] Cashless payments usually include paper-based payments and electronic payments. It may be classified as check payments, direct funds transfer and payments cards

cash. On the other hand, there are other considerations that may render this argument null. With greater access to payment cards such as credit cards and debit cards comes easier access to cash through the use of ATMs. It is also important to examine the types of economic activity that the visitors for CWC are expected to engage in. It is expected that most visitors would use payment cards to pay for accommodation at hotels and even for restaurant expenses. It is the economic activities that are engaged in outside of the hotel and restaurant sphere which might require cash but these are likely to constitute a small proportion of the total expenses incurred by the visitors.

4. METHODOLOGY

The two methodologies employed in this paper are time series forecasting, specifically exponential smoothing and ARIMA, as well as a scaling method that makes adjustments for the CWC by applying two standard deviations to the data to represent the shock effect of the event.

I. Time Series Forecasting - Exponential Smoothing and ARIMA

This paper employs Exponential Smoothing and Auto-Regressive Integrated Moving Average (ARIMA) time series forecasting methods to fit the historical ECCU data on banknotes issued. The modeling techniques do not make use of any particular economic theory but rely on the underlying patterns in past and current data in order to generate forecasts.

Exponential Smoothing is a forecasting technique that applies unequal weights to past data, with greater significance being placed on more recent data. Two exponential smoothing methods are utilized in the study. The first method is the Holt-Winters Additive method and the second is the Simple Seasonal method.

In order to make clear and precise recommendations to the CMD as to how much of each denomination of banknotes to order for each territory, the forecasting techniques were applied to each banknote series for each territory. Thus, the underlying model for each banknote series, for the individual countries, was identified separately. Identification is the process

whereby the parameters of the model are ascertained to capture the underlying processes in the data.

The exponential smoothing methods are similar to the ARIMA methods. These various models were assessed using criteria which included evaluation of the mean absolute percent error and the mean square error, both of which measure how much the original series varies from the predicted series.

II. Scaling Method

In order to produce forecasts that adjust for the impact that CWC is expected to have on the economies of the ECCU territories, the projected baseline volumes of notes to be issued during the months of February to April 2007 were adjusted by applying a two standard-deviation shock. These three months are singled out because the Cricket matches themselves are to take place in March and April while visitors are expected to begin arriving prior to March. In addition, in the months leading up to the matches, some last minute preparations are expected to generate additional economic activity.

The method involved the following steps:

1. Calculating the average volume issued, on a monthly basis, of each banknote series in each territory (with the exception of Montserrat[4]) using data covering the period February 1996 to April 2006. This was done for each of the months from February to April 2007.

2. The monthly averages for February to April were then positively shocked by two standard deviations to generate the forecasts for the February to April 2007 portion of the forecast period.

3. For the remaining 'regular' thirty-two months in the forecast period, the paper used the time series monthly forecast figures.

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[4] Montserrat is not expected to experience spill-off effects from CWC due to lack of capacity and ongoing volcanic activity, in particular.

4. Finally, to estimate the total demand for all thirty-six months, the February to April 2007 forecasts were added to the forecasts for the remaining thirty-two months, that is, the results from steps 2 and 3 were added together.

5. RESULTS

The results from the above models, for each banknote denomination are reported in *Appendices V to VII*. *Appendix V* presents the CMD's adjusted forecasts alongside the shock-adjusted time series forecasts generated by the statistical/scaling method (in the rows named "RD Projection"). The CMD rows show the volume of banknotes that the department estimates would be needed in order to avoid a shortfall for the next 3-year ordering period. However, these do not explicitly take the CWC into account. The estimates were derived by the CMD method highlighted above with the adjustment for "exception" being 15 per cent. This 15 per cent scaling is across the board, that is, it is applied to each denomination in every territory and does not specifically isolate the CWC period. *Appendix VI* offers a comparison between the original CMD projections without any scaling and the time series forecasts before the two standard deviation adjustment was made to the months February to April 2007. *Appendix VII* lays out the ARIMA and exponential smoothing models which generated the time series forecasts for the banknotes.

In *Appendix V* the results for Anguilla show that the CMD estimates one box each for the fifty and one hundred dollar notes whereas the time series forecasts estimate that the stock projected to exist at 31 December 2006, will be adequate in meeting demand from the commercial banks until December 2009. The data from February 1996 to July 2006 show that, in **Anguilla**, the fifty and one hundred dollar notes are the least issued denominations with issues over that period totaling 223,000 and 304,000 notes respectively while the highly demanded twenty dollar note has a total issue of 540,000. Thus, historically, Anguilla has not needed many notes in the two denominations singled out and as such, a 15 per cent upward adjustment in the estimates by CMD was not warranted. An examination of Appendix VI shows that without any adjustment for CWC, the time series forecast for the twenty dollar note is above the CMD

projection which possibly indicates that the use of the 'regular' CMD method, without adjustment, could have led to a shortfall in Anguilla.

The results for **Antigua and Barbuda** notes, excluding the five dollar note, show that the CMD's pre-adjustment estimates would likely have fallen short as they are all below the time series forecasts (Appendix VI). Appendix V shows that the adjusted CMD estimates continue to fall short of the time series projections. However, in both tables, the results for the 5 dollar note are peculiar in that they show the CMD projections outstripping the time series forecasts. Upon further examination, the coefficient of variation indicates a high level of variability in the Antigua five dollar note series from January 2001 to July 2006 implying that the high average monthly usage figure, which is based on data for that period, is not very reliable in capturing the trends in that series. The abnormally high average is likely overstating the demand for the denomination and as such has resulted in the high CMD projections.

The argument presented above about the 15 per cent adjustment for the fifty and one hundred dollar notes in Anguilla also applies to the case of the adjusted five and twenty dollar notes in **Dominica**. In Appendix VI however, the unadjusted CMD projection for ten dollar notes is also above the time series forecast by two boxes. The CMD estimate only captures the high usage for this Dominican note series in the last five years.

Appendix V shows that in the case of **Grenada**, the CMD estimates and the time series forecasts for the five dollar denomination diverge considerably (by nine boxes). The key aspect of the CMD calculations responsible for the overestimation is the average monthly usage figure. This figure is based on usage over only the past few years. In the case of Grenada where there has been considerable construction activity since hurricane Ivan in 2004, usage has been abnormally high. However, there are signs that construction activity is tapering off as most projects near or come to completion. The use of the average monthly usage figure with the additional 15 per cent increase is likely to overstate significantly what demand for notes would be over the next three years when economic activity returns to trend

after CWC. The same argument applies to the overestimation of the CMD projection in the case where no adjustment is made (Appendix VI).

Montserrat presents a special case in the analysis for it is the only territory not forecast originally to experience a shortfall in any denomination. The CMD has had ample supply of banknotes to meet the demand from this territory. With the disruption to daily and economic life on the island since the onset of volcanic activity in 1995 the territory has not experienced as rapid an increase in demand for banknotes as the other territories have. It is therefore safe to conclude that an upward adjustment of 15 per cent in all the notes was not needed.

Notes in **St Kitts and Nevis** seem to suffer the same 15 per cent over-adjustment problem discussed above (Appendix V). In the no-adjustment results, the CMD and time series forecasts converge.

Saint Lucia is the most economically active territory in the ECCU, with demand for its notes (with the exception of the fifty dollar note) being correspondingly the highest. Saint Lucia is expected to gain the most from the CWC, with the largest number of tourists arriving there. As such is it a critical case for the Central Bank, in terms of being adequately prepared to meet requests from the commercial banks on the island. Time series projections of the volumes of notes required to cater for the anticipated increase in demand are consistently higher than those of the CMD with the exception of the fifty dollar note estimates. However, in the no adjustment table, the results of the two methods coincide for the fifty dollar note indicating that the divergence in the adjusted scenario is once more due to the 15 per cent scale factor.

The time series adjusted forecasts highlight the need for more boxes of twenty, fifty and one hundred dollar notes to be ordered for **St Vincent and the Grenadines** than what was estimated by the CMD. The two forecasting approaches, however, are in agreement over the ten dollar series while for the five dollar note, the CMD estimates more than the time series method. Nevertheless, the no adjustment results show that the CMD and times series

estimates are the same – an indication again that the difference in Appendix V is due to the lofty 15 per cent adjustment in the CMD estimation.

The most commonly circulated banknote denomination within the ECCU is the twenty dollar note. This is also the case in each individual territory except in Dominica where the five dollar note is the dominant denomination. For the twenty dollar note, by the adjusted CMD estimates, 339 boxes would be issued whereas the shock-adjusted time series projections show that 370 boxes should be ordered. This shortfall of 31 boxes would have been felt across the Union, with the most severe shortage occurring in Saint Lucia. The only denomination for which the CMD estimates outstrip the time series forecasts is the five dollar series in which case the CMD order should be more than adequate to meet the needs of the commercial banks.

Thus, the all-encompassing approach adopted for the CMD estimates, whereby all estimates, regardless of past trends in the demand for the denomination, were automatically scaled upwards by a 15 per cent factor is too arbitrary. This method does not zero in on the months for which it is believed CWC is likely to have its greatest impact. There is little reason to believe that there would be heavy economic activity going forward all the way to the end of December 2009 to justify a 15 per cent increase in all estimates for such an extended period. More than likely the level of economic activity will revert to trend shortly after the shock of CWC in early 2007.

6. CONCLUSION

An alternative approach to forecasting demand for banknotes considering the effects of CWC 2007 was developed. The aim was to improve upon the Currency Management Department's projections of banknote demand, in light of the fact that the department's current method indicates shortfalls in the Bank's supply of banknotes through to the end of December 2007. The forecasts show that the cricket event would represent a significant enough shock to the demand for currency to warrant an increase in the Currency Management Department's estimates used to inform its ordering policy. The results indicate that there is a need for

adjusting the Currency Management's estimates upwards for each banknote denomination in the ECCU with the exception of the five dollar note. The most likely explanation for the exception posed in the case of the five dollar note is that the Currency Management Department's 15 per cent adjustment represents overcompensation for the increased level of activity expected during the CWC period.

Future research should include a more formal model to study money demand in the ECCU is recommended.

Appendix I

Currency Department Banknotes Estimates (Volumes)

Denominations		$5	$10	$20	$50	$100
Anguilla	Total Stock Balance[+]	45,000	66,000	161,000	108,000	111,000
	Avg. Mthly Usage*	3,307	3,775	5,468	2,291	3,000
	21 Mths Req.~	69,447	79,275	114,828	48,111	63,000
	Est. Bal. – 31/12/07^	(24,447)	(13,275)	46,172	59,889	48,000
	Bal Exp to Last (mths)[#]	13	17	29	47	37

Denominations		$5	$10	$20	$50	$100
Antigua and Barbuda	Total Stock Balance	1,384,000	802,000	1,074,000	804,000	668,000
	Avg. Mthly Usage	59,291	39,484	65,742	33,000	36,397
	21 Mths Req.	1,245,111	829,164	1,380,582	693,000	764,337
	Est. Bal. – 31/12/07	138,889	(27,164)	(306,582)	111,000	(96,337)
	Bal Exp to Last (mths)	23	20	16	24	18

Denominations		$5	$10	$20	$50	$100
Dominica	Total Stock Balance	652,000	355,000	874,000	371,000	708,000
	Avg. Mthly Usage	40,291	23,307	39,130	10,952	13,651
	21 Mths Req.	846,111	489,447	821,730	229,992	286,671
	Est. Bal. – 31/12/07	(194,111)	(134,447)	52,270	141,008	421,329
	Bal Exp to Last (mths)	16	15	22	33	51

Denominations		$5	$10	$20	$50	$100
Grenada	Total Stock Balance	1,620,000	878,000	1,480,000	244,000	315,000
	Avg. Mthly Usage	71,452	47,130	83,810	20,259	29,588
	21 Mths Req.	1,500,492	989,730	1,760,010	425,439	621,348
	Est. Bal. – 31/12/07	119,508	(111,730)	(280,010)	(181,439)	(306,348)
	Bal Exp to Last (mths)	22	18	17	12	10

Denominations		$5	$10	$20	$50	$100
Montserrat	Total Stock Balance	171,000	74,000	150,000	127,000	247,000
	Avg. Mthly Usage	2,888	2,839	5,646	3,597	5,604
	21 Mths Req.	60,648	59,619	118,566	75,537	117,684
	Est. Bal. – 31/12/07	110,352	14,381	31,434	51,463	129,316
	Bal Exp to Last (mths)	59	26	26	35	44

Currency Department Banknotes Estimates (Volumes) (cont'd)

Denominations		$5	$10	$20	$50	$100
St Kitts and Nevis	Total Stock Balance	759,000	508,000	1,254,000	456,000	344,990
	Avg. Mthly Usage	37,307	24,065	48,323	17,646	15,191
	21 Mths Req.	783,447	505,365	1,014,783	370,566	319,011
	Est. Bal. – 31/12/07	(24,447)	2,635	239,217	85,434	25,979
	Bal Exp to Last (mths)	20	21	25	25	22

Denominations		$5	$10	$20	$50	$100
Saint Lucia	Total Stock Balance	2,753,000	834,000	2,007,000	920,000	412,000
	Avg. Mthly Usage	119,065	47,839	133,413	32,742	36,842
	21 Mths Req.	2,500,365	1,004,619	2,801,673	687,582	773,682
	Est. Bal. – 31/12/07	252,635	(170,619)	(794,673)	232,418	(361,682)
	Bal Exp to Last (mths)	23	17	15	28	11

Denominations		$5	$10	$20	$50	$100
St Vincent and the Grenadines	Total Stock Balance	1,102,000	511,000	863,000	328,000	279,000
	Avg. Mthly Usage	66,794	42,565	81,016	16,484	24,810
	21 Mths Req.	1,402,674	893,865	1,701,336	346,164	521,010
	Est. Bal. – 31/12/07	(300,674)	(382,865)	(838,336)	(18,164)	(242,010)
	Bal Exp to Last (mths)	16	12	10	19	11

[+]Total Stock Balance: Total stock of new notes as at 31/03/06

*Avg Mthly Usage: (opening stock as at January 2001 + new notes received – balance as at March 2006) / 63 months

~21 Mths Req.: Total Amount of Notes Required From April 2006 to Dec 2007 (avg mthly usage times 21)

^Est. Bal. – 31/12/07: Estimated balance at the end of 2007

[#]Bal Exp to Last (mths): Number of Months Total Stock Balance is Expected to Last (Total Stock Balance ÷ Avg Mthly Usage)

Appendix II

Number of Additional Visitors Expected for CWC 2007

Country	Number of Visitors
Antigua and Barbuda	15,000
Grenada	15,000
St Kitts and Nevis	15,000
Saint Lucia	17,000
St Vincent and the Grenadines	6,000

Appendix III

Currency in Circulation

Currency in Circulation
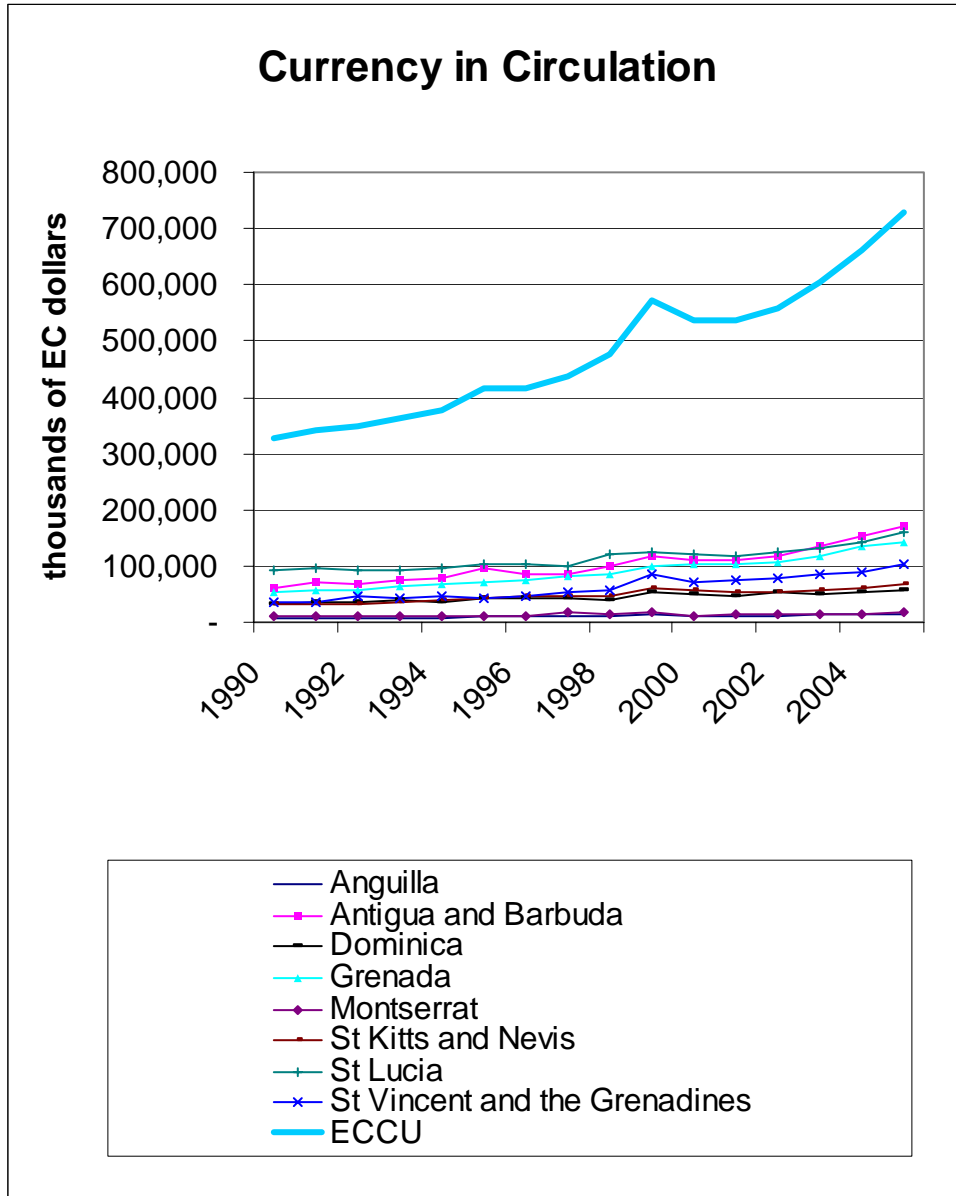
Appendix IV

Cashless Payment Instruments in the ECCU – January to December 2005

	Cheques	POS	Paperless Transfers	Other Activities
	% of Total Cashless Payments			
Anguilla	80.2	2.9	12.5	4.4
Antigua and Barbuda	60.3	1.9	29.4	8.4
Dominica	80.6	1.4	11.3	6.8
Grenada	73.6	0.5	24.3	1.7
Montserrat	82.8	0.2	13.9	3.2
St Kitts and Nevis	81.3	1.4	12.0	5.3
Saint Lucia	69.5	1.5	19.7	9.3
St Vincent and the Grenadines	70.0	1.5	22.9	5.7
ECCU	66.9	1.8	23.8	7.5

Appendix V

Forecast Results[5]:

Number of Boxes to Order by Denomination and Territory for Period up to December 2009[6] (Adjustments for Shock in February to April 2007)

	$5	$10	$20	$50	$100
Anguilla					
CMD Projection	3	3	3	1	1
RD Projection	3	3	3	-	-
Antigua and Barbuda					
CMD Projection	34	26	49	19	26
RD Projection	26	27	55	20	28
Dominica					
CMD Projection	28	17	25	6	-
RD Projection	27	14	24	7	-
Grenada					
CMD Projection	40	32	59	16	24
RD Projection	31	36	68	20	33
Montserrat					
CMD Projection	-	2	3	2	1
RD Projection	-	2	2	1	-
St Kitts and Nevis					
CMD Projection	24	17	29	10	12
RD Projection	20	15	25	8	12
Saint Lucia					
CMD Projection	70	34	103	14	31
RD Projection	73	37	114	13	39
St Vincent and the Grenadines					
CMD Projection	48	35	68	10	21
RD Projection	43	35	79	13	28

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[5] Time series results for Montserrat are not adjusted. See section 5 (II) for further details.
[6] Orders are placed by signifying the number of boxes required. A box contains 50,000 notes therefore volumes of notes required are rounded up to the nearest 50,000 and then divided by 50,000 to calculate the amount needed in terms of boxes.

Appendix VI

Forecast Results:

Number of Boxes to Order by Denomination and Territory for Period up to December 2009 (No Adjustments)

	$5	$10	$20	$50	$100
Anguilla					
CMD Projection	3	2	2	1	1
RD Projection	2	2	3	-	-
Antigua and Barbuda					
CMD Projection	28	21	42	16	22
RD Projection	24	25	53	18	27
Dominica					
CMD Projection	24	15	20	5	-
RD Projection	26	13	22	6	-
Grenada					
CMD Projection	33	27	50	14	21
RD Projection	29	35	66	20	33
Montserrat					
CMD Projection	-	2	3	2	1
RD Projection	-	2	2	1	-
St Kitts and Nevis					
CMD Projection	20	14	23	8	10
RD Projection	19	14	22	6	11
Saint Lucia					
CMD Projection	57	29	88	10	27
RD Projection	71	35	107	10	39
St Vincent and the Grenadines					
CMD Projection	41	30	59	9	19
RD Projection	41	34	76	12	27

Appendix VII

Time Series Forecast Models

	$5	$10	$20	$50	$100
Anguilla	ARIMA (1,0,1)	ARIMA (0,0,0)	Winter's Additive	ARIMA (0,0,0)	Simple Seasonal
Antigua and Barbuda	Simple Seasonal	Winter's Additive	Winter's Additive	Simple Seasonal	Simple Seasonal
Dominica	Simple Seasonal	Winter's Additive	Simple Seasonal	Winter's Additive	Simple Seasonal
Grenada	Simple Seasonal	Winter's Additive	Winter's Additive	Winter's Additive	Winter's Additive
Montserrat	Simple Seasonal	ARIMA (2,0,0)	ARIMA (2,0,0)	ARIMA (0,0,0)	Simple Seasonal
St Kitts and Nevis	Simple Seasonal	Winter's Additive	Simple Seasonal	Simple Seasonal	Simple Seasonal
Saint Lucia	Winter's Additive	Winter's Additive	Simple Seasonal	Simple Seasonal	Winter's Additive
St Vincent and the Grenadines	Simple Seasonal	Simple Seasonal	Winter's Additive	Winter's Additive	Winter's Additive