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- Winston Moore, Roland Craigwell and Kim Coppin	



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## Publisher's Note

The *Economic Review* is published three times a year in June, September and December, by the Central Bank of Barbados. It is prepared by the Bank's Research Department and contains articles of research undertaken at the Bank. In addition, we welcome contributions of a non-technical and empirical nature on economic and policy issues in the Caribbean. Book reviews and surveys are also welcome. All submitted papers are reviewed by the Editorial Committee\* and external referees.

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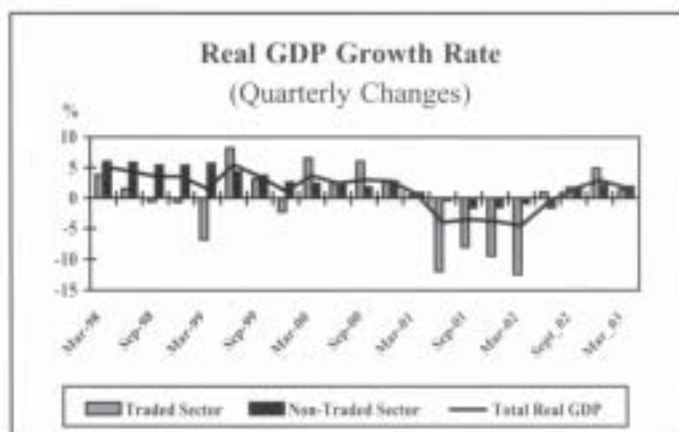


## Overview

During the first quarter of 2003, real economic activity expanded by an estimated 1.7%, continuing the positive growth trend exhibited during the last two quarters of 2002. Both the traded and non-traded sectors recorded improved performances, fuelled primarily by higher production of raw sugar and moderate increases in real output from the tourism, construction and wholesale and retail sectors. Notably, this first-quarter growth outturn was not accompanied by the historical accumulation in the net international reserves (NIR), as a contraction of \$8.5 million was registered, largely because of an early repayment by Government of a \$30 million external loan and a significant rise in spending on retained imports. Government recorded a smaller fiscal deficit, owing to increased collections of both personal and corporate taxes and a cutback in capital expenditure. Domestic deposits decreased during the three-month period under review, but with the continuing subdued demand by the non-financial private sector for credit from commercial banks, excess liquidity in the banking system expanded further. Despite the prevailing conditions in the international oil market, domestic inflation was only marginally higher, while the average rate of unemployment for the first quarter this year was slightly above the average rate for the same period in 2002.

The traded sectors grew by an estimated 1.3% in the January to March period of 2003, in contrast to a decline of 12.4% in the comparable period of 2002, due to an early start to the harvesting of the crop, and a modest pick-up in real tourism value-added. The expansion in non-traded activity, which was estimated at approximately 1.9%, benefited from significant growth in both construction and wholesale and retail.

For the first time since 1999, the current account of the balance of payments recorded a deficit in the first three months, as a substantial increase in retained imports outweighed gains in travel credits and in domestic merchandise exports. The capital and financial account registered a surplus of \$2.8 million, a figure that was significantly lower than that registered at the end of March 2002.



Domestic deposits fell by approximately \$94.7 million during the review period, the first such occurrence in the first quarter since 1992. Moreover, despite the easing of monetary policy since 2001, growth in commercial bank lending to the productive sectors continued to be sluggish. These developments contributed to a further build-up in excess liquidity, resulting in an excess liquidity ratio of around 19%. Amid this considerable level of domestic liquidity in the banking system, however, the treasury bill rate jumped from a low of 0.9% in February 2003 to 2.5% by the end of March.

The fiscal deficit was estimated at \$5.5 million, compared to deficits of \$42.2 million and \$18.3 million in the first three months of 2002 and 2001, respectively. A substantial reduction in capital outlays was partly responsible for this improvement, as some of Government's major capital projects were at or near completion. Additionally, there were double-digit gains in personal and corporate taxes resulting



from higher wages, improved collection of arrears and increased corporate profitability.

## Production, Prices and Employment

### Tourism

The tourism industry continued to show signs of improvement during the first quarter of 2003. Long-stay tourist arrivals rose by 2.9% after falling by almost 9% in the corresponding period of last year, and there was moderate growth in cruise visitors. As a result, real tourism value-added expanded by an estimated 2.7%, in contrast to a decrease of 8.1% one year earlier. The early re-launch of the Best of Barbados programme coupled with other marketing initiatives in the region helped to maintain the visibility of Barbados in traditional tourist markets in a very uncertain environment for travel. Arrivals from the United States were up 1.8%, compared to an increase of 6.8% in the same period last year. After six consecutive years of first quarter declines, stay-over visitors from Canada rose by 6.9%, partly because of the introduction of a charter out of Halifax, Nova Scotia. Despite a reduction in airlift out of the UK, visitor arrivals from this market were relatively stable, rising by 0.9%, while other European markets recorded growth of 4.5%. The number of persons travelling from CARICOM countries increased by 6.8%, in contrast to a marginal contraction in the first three months of 2002, primarily on ac-

count of a 7.1% expansion in long-stay arrivals from Trinidad and Tobago.

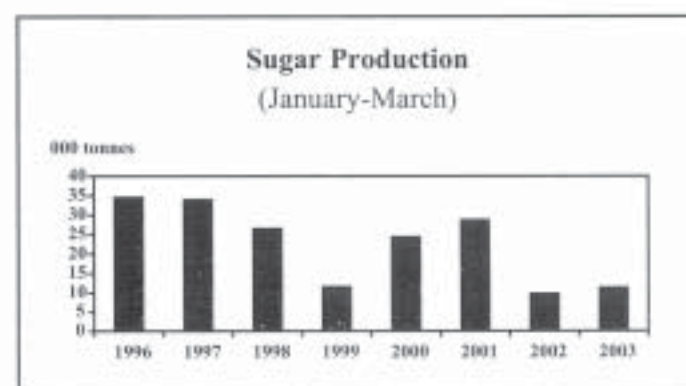
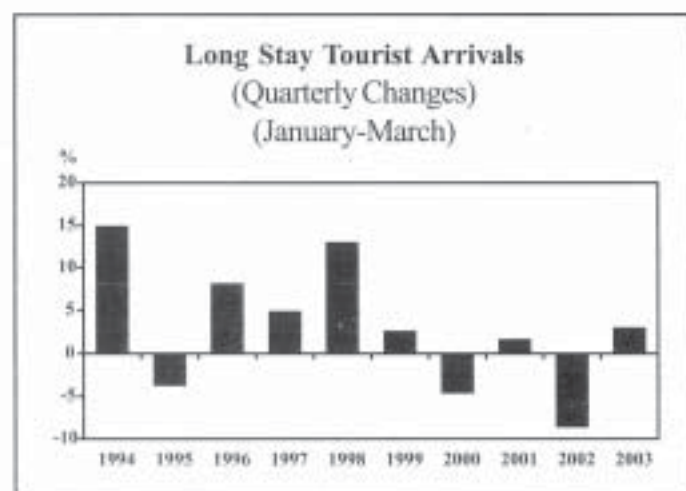
By the end of March 2003, total cruise passenger arrivals for the year were 212, 952, an increase of 1.8% over the figure recorded in the same period one year ago. This outturn, which contrasted with a decline of 7.6% in the January to March period of last year, represented the third successive quarterly improvement in cruise visits to Barbados, a reflection of a gradual recovery in the industry after the September 11<sup>th</sup> terrorist attacks.

### Manufacturing

The manufacturing industry recorded a modest first quarter contraction (1.7%), following a sluggish performance a year ago, despite increases in the production of beverages and tobacco and processed food products of 6.5% and 4.8%, respectively. Output of non-metallic mineral products and electronic components fell by 5.5% and 8.5%, respectively, while the production of chemicals registered a double-digit rate of decline.

### Agriculture and Fishing

The timely start to the harvesting of this year's sugar crop resulted in the production of 11,200 tonnes of raw sugar in the first three months of the year. This level of output was in stark contrast to the corresponding period of 2002, when protracted wage negotiations constrained the yield to just 9,600 tonnes. However, output in non-sugar agriculture and fishing fell by an estimated 6.2% in the first quarter, erasing



the 3.2% gain recorded in the same period last year. The downturn in the sector predominantly reflects considerable reductions in fish landings and milk production, which more than offset an increase of 5.2% in chicken output.

### **International Business Services**

Between January and March this year, an estimated 57 new licenses were issued to companies in the international business and financial services sector, 24 less than in the same period a year ago. This downturn was attributed to increased pressure on international businesses not to relocate offshore, as developed nations tried to prevent the loss of tax revenue. During the first quarter, 54 new licenses were issued to international business companies, compared to 75 in the corresponding period of 2002. Additionally, one new exempt insurance company, one new exempt insurance management company and one offshore bank were authorised to operate.

### **Construction**

After three consecutive years of rather docile activity, output in the construction industry grew by about 2.7%, some 6.9 percentage points higher than in 2002. Increased residential and tourism related building projects, including the Hilton, the Crane Beach Hotel, the Pavilion Court complex and the Clermont Green Townhouse venture, were the main contributors to the expansion in construction output.

### **Other Non-Traded Sectors**

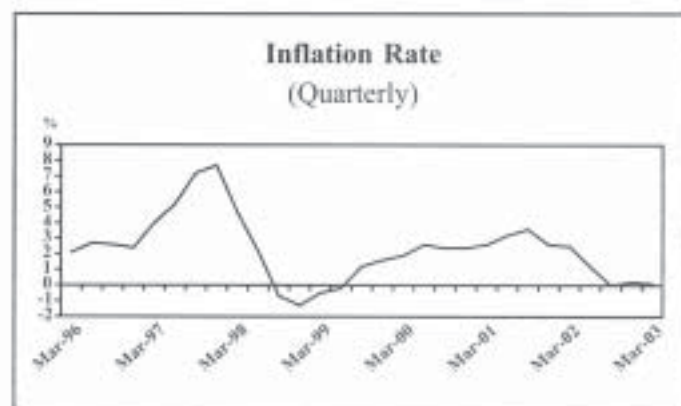
Aided primarily by the resurgence in tourism and construction activity, wholesale and retail trade grew by an estimated 4.2%, in contrast to last year's first-quarter decrease of 1.4%. Output in electricity, gas and water rose by 1.9%, on account of the overall upswing in the traded sectors' value-added, while there was a modest decline in transportation, storage and communications. Value-added in mining and quarrying deteriorated by approximately 12.4%, continuing the downward trend exhibited in every first quarter since 2000. A slowdown in quarrying was the chief reason for the weak output, as companies drew down their inventories.

As a result of natural resource depletion, both crude oil and natural gas output fell during the first quarter of 2003. The production of crude oil declined by 7.1% to 95,041 barrels, following a 19.6% shortfall over the corresponding period in 2002, and was the fourth consecutive fall during the first quarter. In addition, for the third successive year, natural gas production decreased (16.5%) over the review period, after a 25.4% downturn one year earlier. Consequently, sales of natural gas and crude oil declined by 12.9% and 6.4%, respectively.

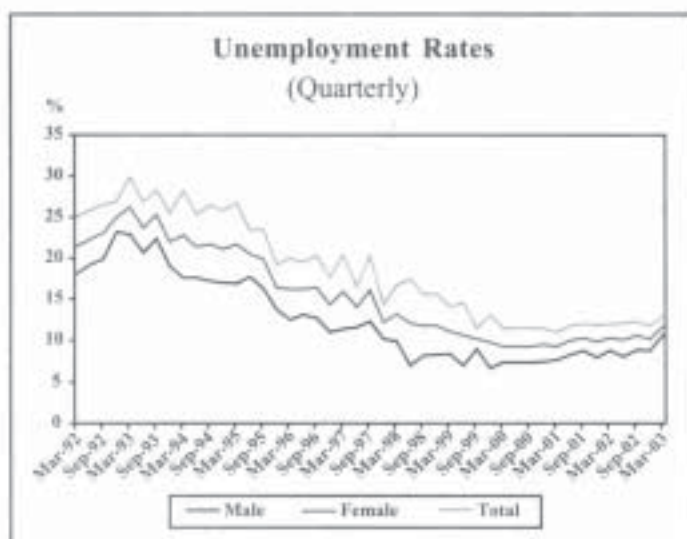
Electricity usage rose by 5.8% over the first three months of 2003, compared to a 6.1% upturn in 2002. Commercial/industrial consumption expanded by 6.4% and residential usage went up by 4.6%, following moderate gains in both sectors one year ago.

### **Prices and Employment**

During the first quarter of 2003, the annual average inflation rate was about 0.03%, compared to 2.4% in the corresponding period of the previous year. Prices of fuel and light had the greatest influence on inflation on account of rising electricity prices. Other components of the retail price index recording gains were medical and personal care and housing. Clothing and footwear prices and the cost of household operations and supplies registered moderate contractions. Categories exhibiting small declines were alcoholic beverages and tobacco and transportation.



Despite an increase in the number of individuals employed, the rate of unemployment for the first quarter of 2003 was 11.7%, up from 10.3% a year ago, as a result of a 4.0% expansion in the labour force. Unemployment for males was at 10.7%, a rise of 1.9 percentage points over the previous year's rate. The female unemployment figure was 12.9%, or 0.9 of a percentage point above the value reported in 2002. Over the first three months of 2003, employment grew to 129,700 or 1000 more persons than in the prior year. The upswing in employment reflected new jobs in government services, agriculture and fishing, and tourism.



## Financial Sector

### Deposits

Tempered by the sluggish growth in the NIR, domestic deposits declined by an estimated \$94.7 million between January and March this year, in contrast to an expansion of \$211.4 million in the corresponding period of last year. Deposits held by the Government decreased by \$17.1 million (15.9%), following a 15.2% gain in the same period of 2002, and business firms' deposits waned by 1.7%, after the 4.2% decline recorded in the first three months a year ago. The deposits held by financial institutions and private individuals fell by 2.1% and 2.8%, respectively. However, a 4.3% increase

was recorded in the deposits maintained by statutory bodies.

### Credit

In the first three months of 2003, credit to the non-financial private sector contracted by about \$6.6 million, after a weak performance in the comparable period one year earlier. Credit to the personal and distributive sectors fell by \$37.7 million and \$18.5 million, respectively. In contrast, credit to statutory bodies expanded by \$35.7 million while loans to the professional and other services and tourism sectors grew by \$11.9 million and \$3.4 million respectively. Financial sector credit plunged by an estimated 63.2% in the first quarter of 2003, after growing by 33.1% in the corresponding period last year. Mutual's repayment of the loans secured to purchase Life of Barbados Ltd. was largely responsible for this outcome.

### Liquidity and Interest Rates

As a result of weak credit demand, the financial system was characterised by high liquidity during the review period. The excess liquidity ratio therefore rose 1.1 percentage points from the rate at the end of December 2002 to 18.9% at the end of March. Despite the elevated levels of liquidity, the treasury bill rate jumped from 1.5% at the close of last year to 2.5% at end-March this year. The weighted average rate on total loans dipped 2 basis points (0.02 percentage points) to 10.32%, and the weighted average deposit rate fell by 5 basis points (0.05 percentage points) to 2.56%.



**Summary Accounts of the Banking System**  
((\$Million))

	2001				2002				2003 <sup>P</sup>
	Mar.	Jun.	Sep.	Dec.	Mar.	Jun.	Sep.	Dec.	Mar.
<b>Net International Reserves</b>	1,204.5	1,224.3	1,214.8	1,534.1	1,623.4	1,606.1	1,570.6	1,711.3	1,939.9
Monetary Authorities	1,096.4	1,115.5	1,106.6	1,414.1	1,482.3	1,485.3	1,441.3	1,366.4	1,358.0
Commercial Banks	108.1	108.8	108.2	120.0	141.3	120.8	129.3	344.9	582.0
<b>Net Domestic Assets</b>	2,167.0	2,234.3	2,266.3	2,002.5	2,004.9	2,133.6	2,157.2	2,186.4	1,944.8
Credit to public sector	25.5	120.9	124.8	(67.1)	(94.8)	(5.4)	158.3	366.9	349.5
Central Government (net)	337.3	405.7	477.2	241.6	235.0	390.7	553.2	659.3	644.2
Rest of Public Sector	(311.8)	(284.8)	(352.4)	(308.7)	(329.9)	(396.1)	(394.9)	(292.4)	(294.7)
<b>Credit to Rest of Financial System</b>	125.5	125.6	128.6	115.9	148.2	250.4	238.4	167.1	143.6
<b>Liabilities to Other Financial Institutions</b>	257.7	244.3	254.5	265.8	350.1	359.3	374.1	403.9	378.5
<b>Credit to Non-Financial Private Sector</b>	2,516.4	2,508.6	2,526.1	2,512.6	2,506.9	2,513.5	2,442.0	2,599.2	2,592.6
<b>Liabilities to the Non-Financial Private Sector</b>	3,371.6	3,458.6	3,481.1	3,536.8	3,628.3	3,739.7	3,727.8	3,897.7	3,884.8
Currency in Circulation	301.2	306.8	307.0	312.4	318.1	321.1	321.1	337.5	329.3
Demand Deposits	775.6	779.4	784.3	836.8	895.9	926.7	905.5	1,096.6	1,053.6
Time Deposits	390.7	418.2	425.0	413.1	399.1	417.2	384.0	345.9	347.7
Savings Deposits	1,904.1	1,954.2	1,964.9	1,974.5	2,015.4	2,074.6	2,117.2	2,117.7	2,154.1
<b>MEMO:</b>									
Domestic Deposits	3,794.7	3,866.1	3,978.1	3,971.8	4,183.2	4,417.7	4,360.6	4,524.7	4,430.0
Liquid Assets	1,055.5	1,080.4	1,075.4	1,392.4	1,459.9	1,471.4	1,436.5	1,365.5	1,356.6
Loans & Advances	2,721.3	2,722.5	2,757.1	2,732.5	2,771.5	2,876.2	2,792.8	2,910.3	2,811.0

Source: Central Bank of Barbados

P: Indicates Provisional

### **Capital Market Developments**

At the end of March 2003, treasury bills outstanding amounted to \$496.8 million, which was virtually unchanged from the figure at the end of December 2002. During the three-month period under review, the seven treasury bill auctions conducted were each substantially over-subscribed. Commercial banks were the primary investors in treasury bills, holding 96.5% of all outstanding issues.

In the first three months of 2003, there was one issue of five-year savings bonds with a nominal value of \$5.0 million, and an effective interest rate of 4.77%. The amount of government debentures outstanding at the end of March totalled \$2.0 billion, \$29 million above the amount recorded at the end of last year.

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At the end of March 2003, the total market capitalisation of companies trading on the Barbados Stock Exchange (BSE) was \$10.7 billion, which represents an increase of \$0.8 million since the end of December 2002, primarily reflecting growth of 34.5% in the capitalisation of cross-listed companies. Over the first three months of 2003, the size of both the local and junior markets, as determined by changes in their market capitalisations, decreased by approximately 2.5%.

The local stock market index fell marginally to 2274.6 points by end-March, following a 2.6% decrease in the same period last year. The junior market index also registered a slight decline of 3.9%, to 2021.2 by the end of March. After a negligible increase over the first three months of 2002, the cross-listed index rose by an estimated 27.4% between year-end and March this year, reaching a value of 1213.65.

The share prices of eight companies listed on the BSE advanced over the review period. The top performers were Grace Kennedy and Company and Sagicor Financial Corporation, whose share prices rose by 57.1% to \$1.65 per share and 47.7% to \$2.55 per share, respectively. The worst performer among the listed companies was Cable and Wireless Barbados, whose share price fell by 30.8% to \$1.80 per share.

## **Public Sector**

### **Revenue**

Total Government revenue increased by about 4.2% to \$541.2 million in the first quarter of 2003, following a 2.2% decline recorded in the comparable period a year ago. The upturn was attributed to a 19.1% growth in direct tax collections, which contrasted with the 14.3% decrease between January and March of last year. As a result of higher incomes and continued collection of arrears, personal taxes grew by 23.1%, compared to a marginal increase during the similar period a year earlier. Additionally, corporation taxes advanced by 24.5%, owing to higher levels of corpo-

rate profitability in 2002. However, property taxes were down by 11.8%, reflecting the reduction in the rate. Indirect taxes decreased by 1.1% in the first quarter, compared to a 5.3% expansion in the January to March period of 2002. Despite the upturn in real economic activity, value-added taxes (VAT) declined by \$5.6 million (3.9%) and import duties fell by about 2.4% after a robust expansion of 66.1% reported one year prior, when a 60% tariff was imposed on selected imports. Non-tax revenue shrank by an estimated \$16.1 million, after receipts of \$57.2 million were recorded at the same time a year ago.

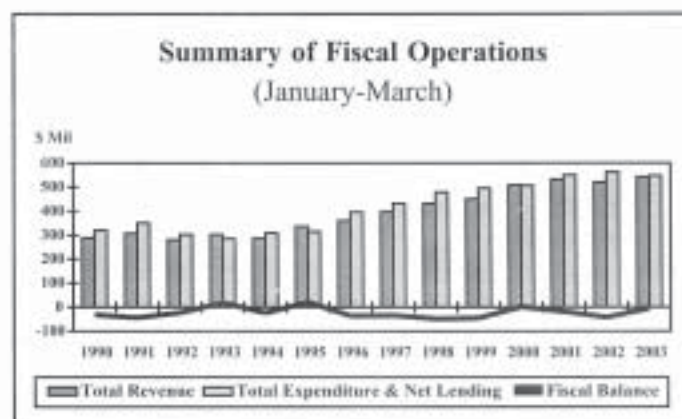
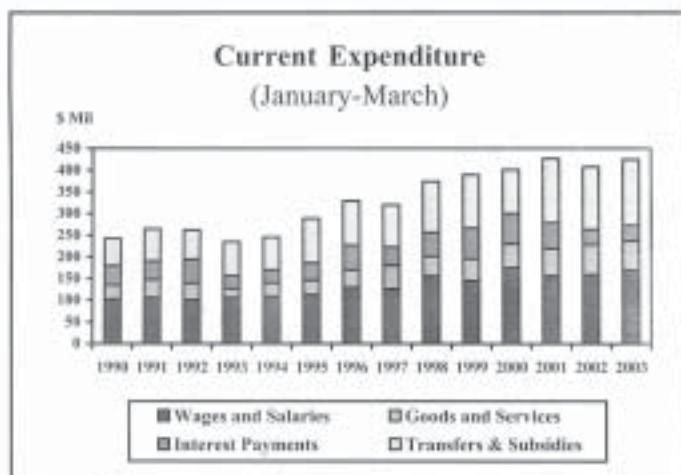
### **Expenditure**

Total Government expenditure declined by an estimated 2.6% to \$546.7 million between January and March this year, the first contraction registered in a first quarter since 1993. There was a 4.2% expansion in current spending over the review period, in contrast to a 4.4% reduction in the comparable period one year earlier. Wages and salaries grew by 6.3% because of marginally higher incomes of government workers and an increase in the national insurance rate, while expenditure on goods and services decreased by 3.0%, in line with the cut-back in capital expenditure. Interest payments rose by 3.2%, as a \$9.6 million hike in domestic interest outlays outstripped an \$8.6 million decline in external interest payments. Transfers and subsidies went up by 5.8%, a turnaround from the 2.8% fall-off recorded in the first quarter of 2002.

Capital expenditure totalled \$120.2 million or 22.0% lower than the figure reported in the first three months of 2002. The completion of a number of capital works projects that were initiated in the last few years, such as the South Coast Sewerage Project and the Forensic Science Centre, were responsible for the downturn.

### **Financing**

Government recorded an increase in its net financing of operations during the first quarter of 2003. The National Insurance Scheme and private non-banks augmented their



**Government Financing**  
(\$Million)

	Fiscal Year			January - March				
	2000/01	2001/02	2002/03	1999	2000	2001	2002	2003 <sup>P</sup>
<b>Domestic Financing</b>	(123.5)	(104.3)	271.6	51.5	(6.7)	8.0	41.4	21.5
Central Bank	(266.4)	(195.4)	299.8	(39.8)	(138.9)	(137.7)	(40.5)	(19.0)
Commercial Banks	158.2	155.0	90.3	(27.2)	29.3	28.6	32.9	7.3
National Insurance Scheme	(45.4)	37.2	104.6	(6.4)	59.6	(1.6)	29.8	25.1
Private Non - Bank	7.6	7.3	83.0	15.2	27.1	22.3	(33.5)	18.3
Divestment	52.2	0.0	0.0	0.0	0.0	52.2	0.0	0.0
Other	(29.6)	(108.3)	(306.1)	110.2	16.3	44.1	52.7	(10.2)
<b>Foreign Financing</b>	220.6	319.5	(11.8)	(7.1)	5.0	10.3	0.8	(16.0)
Capital Markets	200.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0
Project Funds	54.7	67.0	65.8	5.0	20.9	21.5	21.1	5.0
Policy Loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amortisation	(34.0)	(47.6)	(77.6)	(12.0)	(15.8)	(11.3)	(20.3)	(21.0)
Divestment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total Financing</b>	97.2	215.2	259.9	45.0	(1.6)	18.3	42.2	(5.5)

Source: Central Bank of Barbados

P: Indicates Provisional

holdings of Government paper by \$25.2 million and \$18.3 million, respectively, whilst commercial banks added to their share of Government securities by \$7.3 million, and Government increased its net deposits at the Central Bank by

\$19.0 million. Net foreign financing contracted by \$16.0 million, as \$21.0 million in amortisation payments were more than the \$5.0 million inflow of project funds.

**Government Operations**  
(Million)

	2000/01	2001/02	2002/03	1999	2000	2001	2002 <sup>P</sup>	2003 <sup>P</sup>
<b>Total Current Revenue</b>	1,731.3	1,737.4	1,744.9	449.6	507.5	531.1	519.5	541.2
<b>Tax Revenue</b>	1,610.0	1,623.5	1,636.3	427.3	477.6	484.8	462.2	500.1
<i>Direct Taxes</i>	708.8	719.0	736.6	183.1	218.3	247.4	212.0	252.6
a) Personal	313.3	319.2	358.1	73.6	87.8	92.5	93.2	114.7
b) Corporate	248.0	243.1	220.2	86.6	99.9	116.4	88.5	110.2
c) Levies	16.1	16.5	17.7	4.7	5.2	5.8	4.4	5.2
d) Stabilization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
e) Property	93.7	108.5	95.8	12.1	19.1	22.5	16.9	14.9
f) Other	37.7	31.7	44.7	6.1	6.3	10.2	9.1	7.5
<i>Indirect Taxes</i>	901.2	904.5	899.7	244.1	259.3	237.4	250.2	247.5
a) Consumption	(0.1)	0.1	0.0	0.1	0.5	0.0	0.0	0.0
b) Stamp	14.1	14.5	11.8	3.4	3.5	4.5	2.4	3.5
c) VAT	491.6	491.2	504.5	117.9	141.3	132.0	142.3	136.7
d) Excises	160.1	136.0	114.9	55.6	45.0	46.3	33.5	35.3
e) Import Duties	135.4	130.0	163.3	38.4	34.4	22.3	37.1	36.2
f) Hotel & Restaurant	0.7	0.4	1.2	0.1	0.2	0.2	0.3	0.2
g) Other	99.4	132.3	104.0	28.7	34.4	32.1	34.6	35.6
<b>Non Tax Revenue &amp; Grants</b>	121.3	113.9	108.6	22.3	29.8	46.3	57.2	41.1
<b>Current Expenditure</b>	1,528.3	1,620.3	1,680.2	389.7	401.3	427.0	408.0	425.3
Wages & Salaries	640.8	644.9	678.4	145.2	175.2	156.4	159.4	169.4
Goods & Services	190.3	199.7	213.4	50.7	54.9	63.6	69.6	67.5
Interest Payments	225.8	285.8	267.9	70.3	70.4	58.8	34.9	36.0
External	82.7	119.4	121.6	2.9	26.3	39.2	22.7	14.1
Domestic	143.1	166.4	146.3	67.4	44.1	19.6	12.2	21.8
Transfers & Subsidies	471.4	489.9	520.5	123.5	100.8	148.2	144.1	152.4
<b>Current Account Balance</b>	203.0	117.1	64.7	59.9	106.1	104.1	111.4	115.9
<b>Capital Expenditure</b>	291.0	319.8	320.0	105.6	103.2	114.2	154.0	120.2
<b>Net Lending</b>	9.2	12.5	4.6	(0.7)	1.2	8.2	(0.4)	1.3
<b>Total Expenditure &amp; Net Lending</b>	1,828.4	1,952.6	2,004.7	494.6	505.8	549.4	561.6	546.7
<b>Overall Balance</b>	(97.2)	(215.2)	(259.9)	(45.1)	1.6	(18.3)	(42.2)	(5.5)

Source: Central Bank of Barbados and Accountant General

P: Indicates Provisional

## Foreign Trade and Payments

### Current Account Developments

For the first time since 1999, the external current ac-

count registered a deficit (\$4.1 million) in the first quarter, mainly because of a substantial pick-up in retained imports. In line with the increase in real economic activity, retained imports climbed by 11.0% (\$48.3 million). Boosted prima-

rily by a jump in the value of fuel imports (70.5%), intermediate goods surged 19.8%, in contrast to a 16.2% reduction in the same period last year. Domestic exports rose by an

estimated \$2.2 million, mainly because of a 6.5% expansion in food and beverages exports. Receipts from exports of electrical components and chemicals, however, contracted

**Balance of Payments**  
(January-March)  
(\$Millions)

	1998	1999	2000	2001	2002	2003 <sup>P</sup>
<b>Current Account Balance</b>	105.0	-23.2	9.0	70.2	47.0	-4.1
Merchandise Trade	-308.1	-395.4	-359.8	-340.0	-318.9	-349.8
Total Exports (BOP basis)	116.1	98.6	104.2	116.9	89.5	73.3
<b>Domestic Exports</b>	102.0	83.0	85.0	95.0	72.0	74.2
Sugar	19.6	0.0	0.7	15.8	0.0	0.0
Electronic Components	12.4	16.2	9.8	11.1	6.4	6.4
Chemicals	11.7	11.5	12.4	10.5	11.3	9.8
Food/Beverages	25.0	20.0	21.5	23.0	20.0	21.3
All Other	33.3	35.2	40.7	34.7	34.3	36.8
Total Imports (BOP basis)	452.2	521.4	493.5	485.5	430.1	449.1
<b>Retained Imports</b>	469.3	549.4	513.7	499.5	440.9	489.2
Consumer Goods	191.5	240.5	208.3	210.5	193.2	191.1
Capital Goods	101.1	141.9	130.5	102.1	90.6	109.9
Intermediate Goods	174.4	166.0	173.3	185.5	155.4	186.2
Miscellaneous Goods	2.3	1.0	1.6	1.4	1.4	2.0
<b>Services (net)</b>	413.9	386.5	379.6	424.2	389.6	364.1
Travel Credits	477.0	446.2	433.8	473.2	444.6	434.4
Other	-63.1	-59.9	-54.2	-49.0	-31.3	35.7
Investment Income (net)	-22.1	-37.5	-44.3	-47.3	-53.2	-52.4
Transfers (net)	21.3	23.4	33.5	33.2	29.6	33.9
<b>Capital and Financial Account</b>	10.8	17.9	96.9	80.1	40.5	2.8
Long term	5.3	-2.8	80.9	80.5	17.9	-17.2
Public Sector	4.4	-0.3	27.9	16.4	-1.6	-39.7
Disbursement	12.3	11.2	46.2	30.0	20.0	20.0
Amortization	7.9	11.5	18.4	13.6	21.6	59.7
Private Sector	0.9	-2.5	53.0	64.1	19.5	22.5
Disbursement	15.2	0.0	55.5	65.0	22.0	25.0
Total Outflows	14.3	2.5	2.5	0.9	2.5	2.5
Other	-6.5	8.7	2.9	-24.1	0.0	0.0
Short-term	12.0	12.0	13.1	23.7	22.6	20.0
Errors & Omissions	-36.7	108.0	65.4	-26.7	-32.2	230.3
<b>Balance for Official Financing</b>	79.1	102.7	171.3	123.6	65.1	-1.5
Official financing (net)	0.0	0.0	0.0	0.0	0.0	0.0
IMF	0.0	0.0	0.0	0.0	0.0	0.0
Other Financial Institutions	0.0	0.0	0.0	0.0	0.0	0.0
<b>Reserve movements (CBB basis)</b>						
(-Increase/+Decrease)	-79.1	-102.7	-171.3	-123.6	-89.3	-228.6
Change in NIR (IMF basis)						
(-Increase/+Decrease)	-72.6	-14.8	-136.9	-127.7	-68.0	8.5

Source: Central Bank of Barbados

P: Indicates Provisional

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by 13.4% and 0.9%, respectively. Net foreign receipts from services contracted by about 6.5%, compared to last year's January to March fall-off of 8.2%. A decline of 2.3% in travel credits, despite the upswing in tourist arrivals between January and March 2003, was mainly responsible for this downturn. Net transportation outflows grew by \$13.3 million as a result of strong import demand, while net income outflows were lower than in the first quarter last year due to a decrease in foreign interest payments.

#### ***Capital and Financial Account Developments***

At the end of March 2003, the capital and financial account surplus amounted to an estimated \$2.8 million, significantly lower than the \$40.5 million surplus recorded in the same period last year. The reduction stemmed from net long-term public outflows amounting to \$39.7 million, boosted by a \$30.0 million early loan repayment by the Government of Barbados.

Net long-term private sector capital inflows measured \$22.5 million, \$3.0 million higher than a year ago, while pre-shipment financing for the sugar industry totalled around \$20.0 million, almost on par with 2002.

### **Regional Economic Developments**

#### ***Overview***

The majority of regional economies recorded expansions in real output in 2002. In particular, real GDP grew by 2.7% in Trinidad and Tobago, by 1.3% in Guyana and by 1% in Jamaica. In the case of the OECS sub-region, while Antigua and Barbuda, St. Vincent and the Grenadines, St. Lucia and Grenada registered marginal economic growth, the economies of Dominica, Montserrat and Anguilla contracted in 2002. Interest rates in the region were generally lower, and, with the notable exception of Guyana, inflation was relatively subdued when compared to the rates of inflation in 2001. A few Caribbean countries reported improved fiscal performances, while the international reserves of most of

the regional Central Banks declined by moderate amounts during 2002 with the notable exception of Jamaica, where there was a sizeable contraction. Additionally, all three of the region's floating currencies depreciated last year.

#### ***Tourism***

During 2002, the tourism sector of most regional economies was severely affected by the backlash from the September 11th terrorist attacks. In addition to cancellations of reservations arising from safety concerns, many potential stay-over visitors chose to attend World Cup Football Finals in South Korea and Japan in May and June, rather than vacation in the Caribbean. These developments contributed to declines in long-stay tourist arrivals to The Bahamas and Jamaica of 1.8% and 0.8% respectively. In contrast, Belize recorded an increase of 1.8% in arrivals, while the number of visitors to Jamaica remained virtually unchanged from 2001's figure. With the exception of Anguilla and Montserrat, which registered decreases of 8.7% and 8.4%, respectively, overall long-stay arrivals of the OECS sub-region grew by 1.0%. In particular, St. Vincent and the Grenadines recorded an upswing of 8.4% in visitors, while stop-over travellers to Grenada climbed by 4.7%. Dominica and St. Lucia registered slight increases in long-stay guests, as moderate rises during the summer period offset a weak winter season.

Between January and December last year, cruise passenger arrivals to Jamaica and Martinique rose by 3.0% and 2.4%, respectively, while The Bahamas and Bermuda experienced upturns in cruise visitors of 9.8% and 11.5%. Most notably, Belize realised a six-fold increase in cruise passengers in 2002, owing to new agreements with various cruise lines for year-round port calls to the country. Substantial increases were also recorded in St. Maarten (21.6%), the Cayman Islands (29.6%) and Aruba (19.5%). In contrast, the cruise industry in the OECS performed poorly over the review period. The number of cruise passengers visiting Antigua and Barbuda deteriorated by 23.6%, while Grenada and St. Lucia recorded downturns of 8.0% and

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21.0%, respectively. Other states registering significant reductions in cruise visitors last year were Puerto Rico (9.7%) and Trinidad and Tobago (26.9%).

### ***Agriculture***

The region produced 209,533 tonnes of bananas in 2002, representing an improvement of 29.2% over the outturn in 2001. In particular, banana output in Belize surged, as the industry recovered from the damage caused by Hurricane Iris in 2001. The Windward Islands recorded strong growth in banana production, on account of upgrades in the technology of their irrigation systems. Jamaica, however, registered a 7.3% slide in banana output because of harsh weather conditions in the second quarter of 2002.

In 2002, sugar output in the region improved by 5.9%, boosted mainly by increases in production of 7.2% and 5.8% in Belize and Guyana, respectively. However, the yield of sugar in the OECS contracted by 4.8%, following a 24.5% gain in 2001. The weak performance last year was due to mechanical down time and a lower sucrose content of the crop. Sugar production in Trinidad fell by 14.8% during 2002, compared to a 16.7% contraction the previous year, while sugar output in Jamaica declined by 14.7%, following a 5.0% decrease in 2001.

Rice production in Guyana shrank by 10.5% in 2002, in contrast to the 10.4% expansion in 2001. Additionally, earnings from papayas in Belize ballooned by 50.0% to Bz\$15.5 million during the review period.

### ***Minerals and Timber***

Jamaica produced an estimated 4.0 million tonnes of bauxite last year, a gain of 11.9% over the figure produced in 2001. Alumina production rose 2.7%, after a 1.6% shortfall recorded a year earlier. The amount of bauxite produced in Guyana decreased by 18.5%, following a downturn of 25.2% in 2001. Additionally, timber output fell by 8.0%, in contrast to a 4.6% increase in the previous year,

while the yield of raw gold decreased by 4.2% over the review period, after the 4.8% improvement reported in 2001.

Trinidad and Tobago's petroleum industry turned in a strong performance in 2002. Crude petroleum output climbed by 14.9%, after declines of 4.9% and 4.4% in the last two years. In addition, petrochemical production grew by 6.8%, following an 11.2% expansion in 2001. However, the yield of petroleum by-products dipped 2.8% below the level recorded a year earlier.

### ***Interest Rates***

The average loan and deposit rates in the OECS fell moderately, reaching 11.3% and 3.8%, respectively, at the end of the review period. Excess liquidity remained low, characterised by an excess reserves to deposit ratio of only 3.29% at the end of December 2002.

In May 2002, the Central Bank of Trinidad and Tobago targeted a new short-term interest rate known as the overnight repurchase (repo) rate. The initial repo rate was set at 5.75%, with a discount rate of 7.75%. In August, the Central Bank cut both of these rates by 50 basis points in an attempt to stimulate domestic demand. Consequently, the basic prime lending rate fell to 11.5% at the end of December 2002, down from 14.5% at the close of the previous year.

During the first six months of 2002, the Bank of Jamaica pursued an accommodative monetary policy. However, in the latter half of the year, the reverse repurchase rate was twice adjusted upwards in an attempt to influence the availability of foreign exchange. The subsequent improvement in the foreign currency supply allowed the central bank to revise the rate downward at the end of October. This brought the 90-day rate to 18.25% and the 120-day rate to 18.40%. Liquidity remained strong over the review period, with the excess liquidity ratio reaching a high of 18.7% in the third quarter and settling at 14.9% at the end of the

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year. Both the average savings rate and average lending rate contracted modestly, to 9.0% and 25.0%, respectively, at end-December 2002, but the treasury bill rate was unchanged at 15.7%.

During 2002, there was a general downward trend in domestic interest rates in Guyana. The weighted average loan rate fell to 16.8%, from 17.60% at the end of 2001, while the small savings rate declined by 2.4 percentage points, to 4.25%. In addition, the treasury bill rate was 6.25% at the end of 2002, compared to 8.75% at the close of the previous year. In Belize, the average lending rate slid 9 basis points to 14.5%, while the average deposit rate grew by 2 basis points to 4.5%, reducing the interest rate spread to 10.0%.

### **Prices**

In Trinidad and Tobago, the year-on-year inflation rate was 4.1% at the end of 2002, 1.4 percentage points lower than the rate at the same time a year ago. The main contributors to inflation during the review period were the food and drink and tobacco categories, which experienced increases in their price levels of 10.2% and 9.0%, respectively.

Jamaica recorded a point-to-point inflation rate of 7.3% at December 2002, compared to a rate of 8.7% in the previous year. Rising prices for housing and other housing expenses, food and drink and miscellaneous expenses were largely responsible for this outturn.

At the close of last year, the Bahamas reported a point-to-point inflation rate of 0.1%, while a rate of 2.3% was registered in Belize. The inflation rate in the OECS countries dipped slightly from the end of 2001, to 0.8% at end-December of 2002.

Guyana's year-on-year inflation rate was 6.0%, significantly higher than the 1.5% recorded at the end of 2001, largely because of a substantial increase in the retail price of housing which rose by 7.9 percentage points to 9.5%.

### **Exchange Rates**

All of the floating exchange rate economies recorded depreciations in the value of their currencies during 2002. Hampered by the deterioration in the fiscal position, Jamaica's exchange rate depreciated by 7.5%, to J\$ 50.97 per US\$ 1 at the end of December 2002. The value of the Trinidad and Tobago dollar also declined, settling at TTS 6.30 per US\$ 1 at end-December 2002, down from TTS 6.23 per US\$ 1 at the close of the previous year. The Guyanese dollar depreciated by 1.2%, trading at GUY\$ 191.75 to US\$ 1 at the close of last year.

### **Public Sector Operations**

During 2002, the Government of Guyana recorded a fiscal deficit of US\$9.9 million, an improvement of US\$ 2.7 million over the deficit reported at the end of 2001, primarily due to increases in current and capital revenue of 7.4% and 12.4%, respectively, which offset a 3.1% rise in current expenditure.

In Belize, the fiscal deficit contracted by 44.3% to US\$ 79.3 million during 2002, principally on account of an increase in current revenue of US\$53.6 million. As a result of a J\$16.5 billion hike in total expenditure, Jamaica's overall deficit widened to J\$ 32.4 billion, a deterioration of 52.6% from the figure recorded in 2001.

During 2002, the fiscal operations of the governments in the OECS collectively resulted in a contraction of EC \$50.9 million in the overall deficit to EC \$449.4 million. A reduction in capital expenditure coupled with gains in capital revenue and grants were chiefly responsible for the improvement.

Between January and September 2002, the Trinidad and Tobago Government realised a fiscal surplus of TT \$560.00 million, some TT \$150.4 million lower than the fiscal surplus in the corresponding nine-month period of 2001. The deterioration in the fiscal accounts largely resulted from a rise of 6.7% in current expenditure.

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### ***Foreign Sector Developments***

The net international reserves (NIR) of the Bank of Jamaica totalled approximately US \$1.6 billion, or 27.9 weeks of import reserve cover, at the end of December 2002, representing a decline of US\$ 240 million from the stock of foreign reserves at the end of 2001.

At the end of 2002, Trinidad and Tobago reported virtually unchanged gross official reserves of US \$1.9 billion, equivalent to approximately 23.2 weeks of imports. In Guyana the NIR fell by US\$ 3.7 million to US \$183.7 million in 2002, owing to a widening in the balance of payments deficit, which resulted from a reduction in net medium and long-term capital inflows.

The improvement in exports of major commodities from OECS members during 2002 contributed to an overall increase of almost US\$ 50 million in the net foreign reserves, to US \$684.4 million by the end of the year.

The Central Bank of Belize recorded US \$114.4 million in gross international reserves at the close of 2002, a contraction of US\$ 4.9 million since the end of 2001, mainly because of a worsening in the current account deficit and a 10.9% fall-off in capital and financial inflows.

### **International Economic Developments**

#### ***Overview***

The slowdown in the pace of global economic recovery between January and March of 2003, primarily reflected the uncertainty in the run up to the US-Iraq war and the continued poor performance of global equity markets. As a result, industrial production was sluggish in most developed economies, the volume of global trade waned, and labour markets remained soft. In the foreign exchange markets, the US dollar fell against most of the major currencies throughout the first quarter, mirroring the geopolitical uncertainty and a widening current account deficit. However,

since the start of the US-led war against Iraq in mid-March, the US dollar bucked the downward trend. In emerging markets, debt spreads have declined substantially since October 2002, indicating improved macroeconomic fundamentals and reduced perception of risk. The commodity index advanced in the 12 months ended March 2003, primarily the result of upswings in the prices of oil and gold.

#### ***North America***

US economic policy has been very accommodative, in order to attenuate the effects of the bursting of the equity bubble and the fall-out from the September 11th terrorist attacks. Monetary policy remained relaxed, with the short-term interest rate during the first quarter unchanged from the historic low of 1.25% reached in November 2002. In addition, fiscal policy was clearly expansionary over the same period, with government spending more and cutting taxes. It is believed that these factors kept the economy on the recovery path, and real GDP was estimated to have grown by 2.0% over the first three months of 2003, following a growth rate of 1.7% in the January to March period of 2002.

The unemployment rate in the US at the end of March was 5.8%, which compared favourably with the 6.0% registered at the end of last year; this, however, was a result of some laid-off workers dropping out of the labour force. Indeed, there were 108,000 jobs lost in March 2003, following a reduction of 357,000 in employment levels in February, primarily in the manufacturing and transportation sectors. The annual inflation rate was 3.0% at the end of March, some 1.5 percentage points higher than the rate recorded one year earlier. The increase in consumer prices was largely driven by the high cost of fuel during the quarter. Hence, when energy and food are excluded from the consumer price index, the core rate of inflation is only 1.7%.

With the Canadian economy performing near to full capacity, and inflation mounting, real GDP was estimated to have grown by an annualised rate of 1.8% in the first three months of 2003. Inflation was estimated at 4.5% at the end

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of March, owing to stronger consumer demand and rising energy costs. This was considerably higher than the Central Bank of Canada's inflation target of 2.0%, and as a result, the Bank raised its key policy rate in March by 25 basis points, to 3.0%.

The opposing monetary policy actions by the Central Bank of Canada and the Federal Reserve resulted in a widening of short-term interest rate spreads between the two countries, which helped to boost the Canadian/US dollar exchange rate by 7.1% over the review period.

### *Europe*

The Euro-area grew by approximately 0.6% during the first three months of the year, reflecting waning domestic and external demand. The strengthening of the euro against the US dollar dampened external demand and inflation. Consequently, the annual inflation rate was 2.4% at the end of March, unchanged from February's figure.

In an effort to boost economic activity in the Euro-zone, the European Central Bank reduced its key policy interest rate by 0.25 percentage points to 2.5%. Given the continued high volatility in financial markets, global uncertainty, and the low level of short-term interest rates on investment paper prevailing in the Euro-zone, considerable excess liquidity accumulated in the banking system. Nevertheless, credit growth showed signs of recovery during the first quarter.

As the dominant economy in the Euro-zone, Germany's stagnation remained worrisome over the review period, with industrial production and retail sales continuing to slump, and the jobless rate reaching a three-year high. Commercial bank profits were lacklustre, corporate insolvencies rose, and falling equity prices eroded bank reserves. As a result, banks exhibited heightened risk aversion, which in turn reduced credit growth over the review period. Moreover, fiscal policy was constrained by the Stability and Growth Pact. Hence, even though the German economy was struggling,

policy makers were forced to reduce spending and raise taxes.

Buoyed by robust household and government expenditure, economic activity in the UK continued to recover, in contrast to the rest of Europe. However, business investment remained weak. As a result of higher prices of oil and housing, inflation at the end of the quarter was 3.1%, exceeding the 2.5% target set by the Monetary Policy Committee. Nevertheless, in light of weakening prospects for external demand, the Bank of England eased its policy rate in February by 25 basis points to 3.75%, for the first time since November 2001.

### *Asia*

During the first three months of 2003, real GDP in Japan remained flat, with weak private consumption offsetting a nascent recovery in business fixed investment. Housing investment continued to be sluggish and public investment fell marginally. Additionally, growth in net exports was virtually flat over the review period. Japan continued to be plagued with excess capacity, which was reflected in its high unemployment rate of 5.4% at the end of the March. Nevertheless, new job offers were on an upward trend during the first quarter, and the number of employees fell at a slower pace compared to the rate of job losses in the first quarter of last year.

After four consecutive years of declining prices, deflation in Japan has become more or less entrenched. However, there was some upward pressure on prices due to rising fuel costs during the first quarter, and consequently the year-on-year decline was 0.1%, in contrast to 1.2% recorded in March of 2002.

In contrast, China's economy grew robustly over the first three months of this year, as both fixed asset investment and foreign investment surged. However, China recorded a trade deficit of US\$600 million in the January-Feb-

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ruary period, an outcome attributed to increased petroleum imports at higher prices. As expected, the gradual increase in oil prices were a significant factor in raising the inflation rate from below 0% at end-December 2002 to 0.6% at the end of March this year, the first quarterly increase since December 2001.

In South Korea, the economy contracted over the review period. Consumption and business investment declined, and it was reflected in the substantial increase in inventories. The inflation rate was 4.2% at end-March 2003, compared to 2.3% at the same time last year. This was due to rises in public and private service charges, and upswings in the prices of agricultural and petroleum-based products. Owing to the rise in exports, the NIR rose to US\$ 123.8 billion at the close of the first quarter, US\$ 2.4 billion higher than at December 2002. The *won* strengthened against the dollar, trading at 1 237 *wons*/US\$ 1 at the end of March, down from 1 326 *wons*/US\$ 1 at the same time a year ago.

### *Latin America*

The recession in Argentina continued to ease in the first quarter of 2003. All the industrial sectors recorded growth, particularly the textile, automobile and mechanical sub-industries. According to the Ministry of Economy, the primary public sector surplus was on target with the US \$430 million agreed to with the IMF. The peso continued to appreciate against the US dollar, reaching 2.97 *pesos*/US\$1 at the end of March. Fuelled by a depreciating currency in 2002, the annual inflation rate was 36.1% at the end of the quarter, substantially higher than the 7.9% recorded one year ago.

Brazil registered moderate real GDP growth in the first three months of the year, resulting from a healthy expansion in domestic exports. The annual inflation rate in February reached 15.1%, the highest value observed since August 1996, largely because of increases in transportation tariffs, gasoline prices and education costs. In an attempt to stem

the rise in inflation, the Central Bank Monetary Policy Committee raised their key policy rate to 26.5%, the highest rate since May 1999. Simultaneously, the monetary authorities adjusted the reserve requirement from 45% to 60% of demand deposits. The *real* appreciated by 5.3% over the quarter, trading at 3.33 *reales*/US\$ 1, as increased investment inflows into the country reflected greater confidence in the economy.

Economic activity in Chile remained sluggish during the first quarter of 2003. At the end of March Chile's annual inflation rate was 4.2%, up from 3.0% in January. The core inflation index, which excludes the movement in the price of fuel, rose from 1.7% to 2.4% over the same period. Fitch, an international rating agency, downgraded the Chilean *peso* rating from A+ to AA- at the end of February, due to concerns about the country's vulnerability to terms of trade shocks and its poor income distribution. The exchange rate continued to weaken in the first quarter, trading at 733.3 *pesos*/US\$1 in March, down from 720.3 *pesos* /US\$1 at the end of December.

### *Commodity Prices*

Commodity prices rose by 20.0% in the 12 months ended March 2003, largely influenced by a surge in the price of petroleum. US-Iraq tensions during the period and the Venezuelan oil strike in the fourth quarter of last year were primarily responsible for the hike in oil prices. After rising to a peak of almost \$34 per barrel, the average cost of petroleum moderated to \$30 per barrel at end-March this year, but was 28.2% higher than a year ago.

Most industrial metal prices declined moderately over the review period, influenced by expectations for global economic activity and the accumulation of metal inventories. However, double-digit growth in the prices of nickel and tin outstripped the decline in the price levels of other industrial metals. Global instability and volatile financial markets contributed to increased demand for precious metals. Conse-

quently, gold prices rose by over 25% during 2002 to 6-year highs in 2003, before abating somewhat in February and March. The food index rose by 9.7% since March 2002,

fuelled by large price increases in sugar, wheat and soybeans.

### Commodity Prices

Commodities	Mar-03	Dec-02	Mar-02	% Change on Dec - 02	% Change on Mar -02
<b>Total</b> (Index of Market Prices)	121.8	115.0	101.5	5.9	20.1
<b>Food</b> (Index of Market Prices)	85.2	85.5	77.7	- 0.4	9.7
Sugar (US cents/lb)	7.9	7.5	5.9	4.7	32.8
Bananas (US \$/40lb)	481.1	566.0	571.2	-15.0	-15.8
Rice (US \$/metric ton)	197.0	185.3	189.3	6.3	4.1
Wheat (US \$/bushel)	141.8	169.0	122.6	-16.1	15.7
Soybeans (US \$/metric ton)	504.7	581.6	355.0	-13.2	42.2
<b>Metals</b> (Index of Market Prices)	75.3	73.2	73.6	2.9	2.4
Iron Ore (US\$/metric ton)	29.3	29.3	29.3	0	0
Copper (US \$/metric ton)	1,655.7	1,593.0	1,607.4	3.9	3.0
Gold (US\$/fine troy ounce)	340.6	331.9	294.1	2.6	15.8
Silver (US cents/ troy ounce)	454.7	465.8	457.0	-2.4	-0.5
<b>Petroleum</b> (US\$/barrel)	30.3	27.9	23.6	8.7	28.3

Source: IMF/World Bank Commodity Prices



### Abstract

This study examines the productivity impact of ATM deployment in the Barbadian banking industry over the period 1979 to 2001 using a Cobb-Douglas production function specification augmented with ATM implementation dummies. The panel regressions show that the introduction of ATMs increased bank productivity by between 3% to 18%.

*Keywords: Productivity, Banking, IT Deployment*

### Introduction

Information technology (IT) investment is an important element of new capital formation in the financial services sector. One development in the area of IT, the automatic teller machine (ATM), has become an integral part of the way Barbadians transact banking business. ATMs circumvent the need to join a bank queue by providing several of the services offered at the teller's station. Additionally, these machines provide services that would otherwise be unavailable, such as 24-hour access to funds at locations remote from bank branches. Several banks have also entered into mutual access arrangements via the CarIFS system, so that one institution's clients can access funds through another's ATM.

The main purpose of this paper is to investigate the effect of ATM deployment on bank productivity in Barbados over the period 1979 to 2001, using an unrestricted Cobb-Douglas production function. Few studies have investigated the effect of IT on productivity in the banking industry and have yielded conflicting results. For example, Frei, Harker and Hunter (1997) and Parsons, Gotlieb and Denny (1993), both utilising US banking data, report that IT investment has an insignificant effect on productivity, while Haynes and Thompson (2000), employing data on

UK building societies, find that the ATM innovation increases the productivity of adopters by between 7 and 9% relative to non-adopters.

Inherent in examining the impact of ATM technology on bank productivity is the difficulty of correctly defining the output variable. Haynes and Thompson (2000) utilise real earning assets while Frei, Harker and Hunter (1997) use total loans plus total deposits. However, the output of the banking firm should not be linked to a single indicator, but to a multiplicity of indicators that attempt to capture the many services offered by a commercial bank. In this regard, this paper departs from previous studies by obtaining estimates of bank output, which is consistent with international national accounting standards. The approach accounts for the services provided by commercial banks, which can be associated directly to fees charged, and for the intermediation services which are indirectly measured by comparing the interest paid and received to a reference or risk-free rate of interest. This research also adds to the literature on developing countries since most of the work on productivity has been undertaken on developed economies such as the US and UK. In addition, it provides policy makers, bankers and other interested persons with the first estimates of the impact of ATM deployment in Barbados.

This paper is divided into four sections. Following the introduction, Section 2 outlines the methodology and describes the data. Section 3 presents the empirical results while Section 4 concludes.

### Methodology and Data

Following Haynes and Thompson (2000) and Frei, Harker and Hunter (1997) this study uses a Cobb-Douglas production function methodology to model banks' output determination. Before augmenting the ATM variables, the production frontier is assumed to be of the following form:

$$q_{it} = A_{it} L_{it}^{\beta_1} K1_{it}^{\beta_2} K2_{it}^{\beta_3} \quad (1)$$

where  $i$  is a firm index,  $t$  is time index,  $q_{it}$  is an output indicator,  $L$  is labour,  $K1$  is fixed capital and  $K2$  is a proxy

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for financial capital. Taking logarithms of Equation (1) and augmenting with the ATM binary variables, the estimation equation becomes:

$$\ln q_{it} = \alpha_i + \beta_1 \ln L_{it} + \beta_2 \ln K1_{it} + \beta_3 \ln K2_{it} + \beta_4 ATM_{it} + \beta_5 ATML1_{it} + \dots + \beta_6 ATML5_{it} + \varepsilon_{it} \quad (2)$$

where  $\alpha_i$  gives the firm-specific, fixed effects,  $ATM$  is a dummy variable which takes the value of 1 for the year ATM technologies are introduced by the  $i$  bank and zero otherwise, while  $ATML1$ - $ATML5$  are dummy variables which take the value of 1 for years one to five after ATM technologies are introduced and zero otherwise and  $\varepsilon_{it}$  is an error term which is assumed to have normal properties. The signs of  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  are expected to be positive given that higher inputs should result in greater output.

Similarly, the coefficients of the ATM dummies are expected to be positive, since the introduction of ATMs reduces the complement of staff and branches required by a given bank to under take normal day-to-day operations. By extension, the lagged ATM dummies are included to test whether the introduction of ATM technologies affects bank productivity in periods other than the implementation year.

Pooled and fixed effects specifications of Equation (2) are estimated, along with various production function specifications such as the translog and the constant returns to scale models. The results from these latter specifications did not change the overall findings of the study and are therefore not presented. However, as Cable and Wilson (1989) shows, it is likely that the labour variable is endogenously determined in the specification given in Equation (2), therefore each model is also estimated by instrumental variables.

The output variable is derived using the methodology proposed by the System of National Accounts (SNA) 1993 (Commission of the European Communities, et. al., 1993). This approach disaggregates the output of financial intermediaries into two main components, financial intermediation services directly measured (FISDM) and financial intermediation services (the service of channelling funds from surplus to deficit economic agents) indirectly measured

(FISIM). Eurostat (2001) recommends that real FISIM output be estimated as the sum of: (1) the difference between the interest actually charged on loans and the amount that would be paid if a risk-free rate is utilised, and (2) the interest that would have to be paid on deposits if the risk-free rate is used and the interest actually paid. The base year estimates of FISIM can then be extrapolated using real loans and deposits, respectively (the consumer price index is employed as the deflator in both instances). Financial intermediaries also provide other ancillary services for which there are explicit fees, such as currency exchange. These values can be deflated by a price index to give a real estimate of FISDM. The summation of real FISIM and FISDM therefore produces an output indicator, which is consistent with international national accounting methodologies. The definitions of the other explanatory variables are presented in Table 1.

The sample employed in this study consists of an un-

Table 1  
Definition of Variables

Variables	Definition
Q	Total value of financial services provided by the bank expressed in constant 1995 prices
L	Total number of employees
K1	Book value of premises and fixed assets expressed in constant 1995 prices
K2	Other earning assets (such as investments, etc.) expressed in constant 1995 prices
ATM	Dummy variable which takes the value 1 for the year ATM technologies are introduced and zero otherwise
ATML1-ATML5	Dummy variable which takes the value 1 for years one to five after ATM technologies are introduced and zero otherwise

balanced panel of the seven local commercial banks over the period 1979 to 2001. The summary statistics of the variables are given in Table 2 for five periods. The value of real output of commercial banks has generally trended upwards throughout most the period under consideration primarily due to a relatively robust rate of growth in real

Table 2  
Definition of Variables

Variables	Years									
	1979-1983		1984-1988		1989-1993		1994-1998		1999-2001	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Q (BDS \$Mil)	29.7	16.0	33.3	19.3	36.6	19.9	48.2	25.0	65.8	36.5
L (Persons)	221.3	161.6	202.0	158.8	257.2	175.3	276.3	153.1	286.3	139.4
K1 (BDS \$Mil)	8.1	9.4	8.4	7.6	11.4	9.8	17.0	11.1	27.5	15.3
K2 (BDS \$Mil)	45.9	26.3	59.4	30.9	73.0	37.8	108.8	70.8	138.9	68.9

economic activity experienced during the period. Economic growth increases the demand for financial services and by extension the output of commercial banks. During the 1999-2001 period, average commercial bank output was estimated at \$65.8 million, which was more than double the level of output registered in the 1979-1983 period. As a result of the increased demand for financial services banks have significantly expanded their stock of fixed capital during the latter half of the 1990s. While in the 1979-1983 period the average bank held \$8.1 million in real fixed assets, by 1994-1998 the stock had risen to \$17.0 million and to \$27.5 million over 1999-2001. Similar expansions in other earning assets were also observed reflecting an increase in the proportion of commercial bank assets held in investments.

## Results

Table 3 reports the unrestricted Cobb-Douglas estimation results using the pooled, fixed effects and instrumental variables estimators. The three models are presented for comparison purposes; however, a Wald test showed that the fixed effects specification is superior to the pooled model. In addition, the instrumental variables estimator model allows the labour variable to be endogenously determined. Therefore, the remainder of this section will focus, for the most part, on the estimation results from the production function model estimated by the instrumental variables technique. The model accounts for at least 85% of the variation in output in the basic production function specification. In addition, the chi-square statistic shows that the regression model provides an adequate representation of the data generating process of commercial bank output. In the basic production function model estimated by fixed effects both the labour

Table 3  
Definition of Variables

Variable	Pooled Model	Fixed Effects	IV	Pooled Model	Fixed Effects	IV
L	0.401 (0.172)*	0.328 (0.294)	0.513 (0.112)**	0.400 (0.194)*	0.446 (0.288)	0.278 (0.129)*
K1	0.108 (0.081)	0.163 (0.130)	0.147 (0.051)**	0.105 (0.093)	0.085 (0.133)	0.164 (0.052)**
K2	0.416 (0.092)**	0.255 (0.054)**	0.465 (0.077)**	0.430 (0.108)**	0.171 (0.040)**	0.509 (0.079)**
Constant	2.718 (0.605)**	-	2.281 (0.462)*	2.633 (0.895)**	-	1.892 (0.629)**
ATM	-	-	-	-0.242 (0.068)**	-0.122 (0.073)	-0.269 (0.102)**
ATML1	-	-	-	-0.194 (0.083)*	-0.045 (0.079)	-0.235 (0.062)**
ATML2	-	-	-	-0.058 (0.088)	-0.056 (0.070)	-0.049 (0.100)
ATML3	-	-	-	0.064 (0.071)	0.097 (0.084)	0.030 (0.055)
ATML4	-	-	-	0.063 (0.055)	0.080 (0.049)	0.059 (0.056)
ATML5	-	-	-	0.179 (0.042)**	0.191 (0.033)**	0.167 (0.060)**
R-Squared	0.866 0.307 697.5**	0.906 0.263 113.2**	0.853 0.322 463.5**	0.879 0.298 82.5**	0.920 0.249 161.6**	0.866 0.312 26.7**
Obs.	157	157	157	157	157	157

Notes: White robust standard errors are reported in parentheses below the coefficients.

\*\*, \* denotes significance at the 1 and 5 percent level, respectively.

Instruments used are real national income growth, total assets, a trend and the ATM dummies.

and fixed capital variables are insignificant determinants of output. The insignificance of the K1 variable seems to be associated with the endogeneity of the labour indicator, since when instrumental variables is employed, both labour and capital are positively and significantly related to output.

Turning now to the variables of interest, the ATM dummies, chi-square tests statistics, which assess the joint significance of the ATM dummies, yields values of 62.4 for the pooled model, 5172.2 for the fixed effects specification and 59.3 for the instrumental variables model, which are all significant at the 1% level of testing. These results indicate that the coefficients of the ATM variables cannot be restricted to zero. The coefficient estimates show that in the first three years of using ATM technologies bank productivity usually declines. This could be associated with cost related to staff training and difficulties in encouraging customers to utilise the new technology. However, after this initial period, productivity increases are positive. The coefficient estimates range from 0.03 and 0.18 in these periods and are equivalent to a productivity gain of approximately three to

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eighteen percent.<sup>1</sup> This estimate is consistent with the productivity gains of between 7 and 9% reported by Haynes and Thompson (2000) for the introduction of ATM technologies among UK building societies.

### **Conclusions**

This study has used an augmented production function approach to explore the productivity effects of ATM intro-

duction on Barbadian commercial banks over the period 1979 to 2001. The results show that ATM introduction initially lowers bank productivity due to implementation costs related to staff training, customer awareness programmes and the like. However, after the technology has been fully implemented and is being effectively utilised, the productivity gains range from 3% to 18% in any given year.

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<sup>1</sup> A similar result is obtained if the dependent variable is specified analogous to those used by Frei, Harker and Hunter (1997) and Haynes and Thompson (2000).

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