

INTERNATIONAL MONETARY FUND



Staff Country Reports

Eastern Caribbean Currency Union: Selected Issues

This Selected Issues paper for the Eastern Caribbean Currency Union (ECCU) was prepared by a staff team of the International Monetary Fund as background documentation for the periodic regional surveillance on the ECCU. It is based on the information available at the time it was completed on December 21, 2006. The views expressed in this document are those of the staff team and do not necessarily reflect the views of the institutions or governments of the ECCU or the Executive Board of the IMF.

The policy of publication of staff reports and other documents by the IMF allows for the deletion of market-sensitive information.

To assist the IMF in evaluating the publication policy, reader comments are invited and may be sent by e-mail to publicationpolicy@imf.org.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
700 19th Street, N.W. • Washington, D.C. 20431
Telephone: (202) 623 7430 • Telefax: (202) 623 7201
E-mail: publications@imf.org • Internet: <http://www.imf.org>

Price: \$18.00 a copy

**International Monetary Fund
Washington, D.C.**

This page intentionally left blank

INTERNATIONAL MONETARY FUND

EASTERN CARIBBEAN CURRENCY UNION

Selected Issues

Prepared by Paul Cashin, Montfort Mlachila, Shaun Roache,
Guillermo Vuletin, Ping Wang (all WHD) and Tobias Rasmussen (APD)

Approved by the Western Hemisphere Department

December 21, 2006

	Contents	Page
Executive Summary		3
I. Income Dispersion and Co-Movement in the Eastern Caribbean Currency Union...		4
A. Introduction		4
B. Data		4
C. Growth and Convergence		5
D. Income Trends.....		6
E. Income Cycles, Co-movement and Shock Persistence.....		7
F. Conclusions.....		8
II. The Macroeconomic Impact of Trade Preference Erosion on the Windward Islands		18
A. Introduction.....		18
B. Industry and Historical Overview		19
C. The Impact of Preference Erosion on Caribbean Countries.....		21
D. Evolution of Banana Export Prices, Quantities, and Values.....		22
E. Estimation of Implicit Assistance from Banana Trade Preferences.....		23
F. Expected Economic Impact of EU Preference Erosion.....		25
G. Estimates of the Macroeconomic Impact of Implicit Assistance.....		26
H. Conclusions.....		28
III. The Size of the Informal Economy in the Caribbean		44
A. Introduction.....		44
B. Methods of Estimating the Size of the Informal Economy		45
C. Data and Methodology		46
D. Empirical Results		48
E. Concluding Remarks		51

IV.	Social Security in the Eastern Caribbean Currency Union.....	67
	A. Introduction.....	67
	B. Background on Social Security Schemes.....	68
	C. Financial Outlook.....	70
	D. Investment of Social Security Reserve Assets.....	72
	E. Linkages of Social Security Schemes with Financial Sector.....	74
	F. Scheme Administration Costs.....	75
	G. Conclusions and Reform Options.....	76
V.	Domestic Investment and the Cost of Capital.....	90
	A. Introduction.....	90
	B. The Model and Data.....	91
	C. Estimation Issues.....	94
	D. Empirical Results.....	95
	E. Conclusions.....	96

EXECUTIVE SUMMARY

The analytical work associated with the 2006 Eastern Caribbean Currency Union Regional Discussions continues the staff's work on defining the policy agenda to enable the Eastern Caribbean Currency Union (ECCU) region to reduce vulnerabilities and move to a sustained growth path.

The ECCU is both a monetary union and—with the gradual integration of labor, capital and goods markets—increasingly an economic union. However, **Chapter I: Income Dispersion and Co-Movement in the ECCU** finds that incomes are diverging, with the Leeward Islands converging to a higher income level than the Windward Islands. Cyclical movements in per capita income appear, though, highly synchronized among ECCU countries. Continued progression toward a formal economic union (by lowering obstacles to the free movement of persons, goods and capital) could contribute to a lowering of income disparities in the ECCU.

Trade preferences for the export of bananas to the European Union have afforded the Windward Islands with large—yet declining—implicit assistance. **Chapter II: The Macroeconomic Impact of Trade Preference Erosion on the Windward Islands** demonstrates the substantial impact from preference erosion on growth, trade balances and fiscal positions. While much of the macroeconomic impact of preference erosion has already been experienced by ECCU economies, a challenge remains in ameliorating the adverse social effects of employment loss and declining producer incomes.

Chapter III: The Size of the Informal Economy in the Caribbean finds considerable variation in the region, with estimates for the early 2000s ranging from a low of around 15 percent of measured GDP for The Bahamas to a high of over 50 percent of measured GDP for St. Vincent and the Grenadines. Key determinants include the tax burden, the size of the agriculture sector, and the significance of labor rigidities. This suggests the potential for significant revenue gains from tax reforms to increase compliance and broaden tax bases.

Population aging and the maturation of the schemes present major challenges to the defined-benefit social security schemes of the ECCU (**Chapter IV: Social Security in the ECCU**). In the absence of reform, the region's social security schemes will soon begin to incur large cash flow deficits and declining reserves. The adverse effects of this process are amplified by the very prominent role played by social security in ECCU economies as a major investor and depositor in the banking system. Reforms have recently been introduced in some ECCU countries, but early action in other countries would minimize any negative economic impact.

While investment-to-GDP ratios across the ECCU are relatively high, the growth returns have been disappointingly low (**Chapter V: Domestic Investment and the Cost of Capital**). Private domestic investment—a potential catalyst for growth—displays limited multiplier effects from public investment and FDI and is highly sensitive to the cost of capital. Thus public policy to stimulate private domestic investment in the ECCU should focus on creating conditions for lowering the cost of capital, rather than extending costly tax concessions in an attempt to attract FDI.

I. INCOME DISPERSION AND CO-MOVEMENT IN THE EASTERN CARIBBEAN CURRENCY UNION¹

A. Introduction

1. **The Eastern Caribbean Currency Union is a monetary union that is increasingly moving toward economic union.** The island economies of the currency union share similar economic and institutional structures, and an important question is whether the process of deepening economic integration has led to convergence of income levels and cyclical fluctuations across members of the currency union? In principle, as integration deepens there should be an intensification in trade, financial and migration links across national boundaries, which lays the groundwork for a convergence of national incomes and business cycles (Frankel and Rose, 1998). An alternative view is that increasing trade integration can engender increased industrial specialization by country, and thereby yield more asynchronous business cycles due to industry-specific shocks.

2. **The goal of this chapter is to establish key stylized facts regarding income convergence in Eastern Caribbean Currency Union (ECCU) countries.** Examination will be made of both the process of convergence of long-run (trend) income levels and whether there has been synchronization of business cycles (deviation from trend income levels). These issues are important as they have implications for the role of national fiscal policies and region-wide monetary policy in countering shocks to the evolution of incomes in the ECCU.

3. **The plan of this chapter is as follows.** The data are briefly described in Section B. In Section C the evidence for income convergence among ECCU countries is examined, while Section D analyses comovement in ECCU income trends. Comovement of ECCU output cycles and the persistence of income shocks are set out in Section E. Section F concludes.

B. Data

4. **Data used in the empirical analysis include series on domestic output and per capita output.** The macroeconomic time series cover the six Fund-member countries (Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines) and the two United Kingdom territories (Anguilla and Montserrat), which constitute the eight members of the ECCU.² The logarithm of annual real GDP (in millions of Eastern Caribbean dollars, base year 1990) is used to measure real output in each

¹ Prepared by Paul Cashin and Ping Wang.

² While the ECCU consists of six independent countries and two territories of the United Kingdom, for ease of exposition all eight jurisdictions will be denoted as countries in this chapter.

jurisdiction.³ Real per capita output is derived using population measures taken from the IMF's *International Financial Statistics*. Data series are annual in frequency, and cover the period 1977 to 2005. All macroeconomic time series are converted into logarithms for the empirical work.

5. **Real per capita output in Fund-member ECCU countries has grown at different rates.** Figure I.1 plots the path of ECCU real per capita output over the past three decades—the strong post-1977 growth performance of St. Kitts and Nevis is revealed in the data, as is the mediocre growth performance of Dominica and St. Lucia.

C. Growth and Convergence

6. **Economic growth in the countries of the ECCU has been rather volatile** (Rasmussen and Tolosa, 2006). During this growth process, have flows of goods, labor, capital, and remittances served to equalize per capita incomes across member countries of the ECCU? Following the empirical growth literature, we measure the extent of σ -convergence—that is, we examine whether the dispersion of real per capita incomes across the economies of the ECCU have tended to fall over time, which would indicate that income levels in the rich and poor countries of the ECCU are becoming more similar. In analyzing σ -convergence it is assumed that ECCU countries share the same long-run equilibrium level of per capita income, determined by common technologies and common preferences for saving.

7. **Overall, there has been income divergence in the ECCU over the past three decades.** Figure I.2 shows the cross-sectional standard deviation of the logarithm of real per capita income. We observe that the dispersion rose from about 0.42 in 1977 to reach about 0.53 by 2002, and then narrowed to reach about 0.50 by 2005. While the dispersion of per capita incomes was broadly stable in the 1980s and 1990s, after that time income divergence occurred across the countries of the ECCU, with a minor reversal since the turn of the century.⁴

8. **However, there does appear to be income convergence within subgroups of ECCU countries.** Following Norman and Walker (2004), we separate the eight countries into two subgroups (or convergence clubs)—on the basis of economic similarities and geographic proximity—and examine whether there is income convergence among the members of each 'club.' For this purpose, we divide the ECCU into a Leeward Islands club

³ The annual national accounts GDP data are taken from the Eastern Caribbean Central Bank (ECCB), the IMF's *International Financial Statistics* and *World Economic Outlook* databases, and from Fund staff estimates.

⁴ In the Caribbean context, Atkins and Boyd (1998) find weak evidence of income convergence over the period 1960–92.

(Anguilla, Antigua and Barbuda, Montserrat, and St. Kitts and Nevis) and a Windward Islands club (Dominica, Grenada, St. Lucia, and St. Vincent and the Grenadines). The results illustrate that income dispersion within the Leeward and Windward Islands clubs has fallen over the last three decades, with dispersion falling relatively faster among the Leeward Islands (Figure I.3).

9. **Similarly, while there is little evidence of income ‘catch up’ for the ECCU as a whole, there is income catch up within the two ECCU clubs.** A simple scatter plot of initial real per capita income in 1977 and the rate of growth in subsequent decades yield a negative (yet not statistically significant) relationship for the ECCU (Figure I.4). Accordingly, there is little evidence of incomes of the initially poor countries converging on those of the initially rich (as would be implied by the Solow-Swan neoclassical growth model). However, there is evidence of an inverse relationship between initial income and subsequent growth, for both the Leeward and Windward Islands (Figures I.5 and I.6).

D. Income Trends

10. **An analysis of the extent of comovement between measures of output requires the separation of income series into trend and cyclical components.** As such, we use a business cycle filter that will eliminate the slowly-evolving, long-term (“trend”) component and the rapidly-varying (“irregular”) component of real GDP, leaving behind the short-term (“business-cycle”) component of real GDP. In separating the income data into its trend (nonstationary) and cyclical (stationary) components we use the frequency domain (FD) filter developed by Corbae and Ouliaris (2006). The FD filter is a univariate detrending technique that removes the low-frequency (trend) and high-frequency (irregular) components of the data, leaving behind the business cycle components.⁵ Following Cashin and Ouliaris (2004) and Burns and Mitchell’s (1946) ‘cycle dating rules,’ the cyclical component is set at frequencies of between two and eight years.

11. **The trend component of ECCU real per capita incomes are all rising** (Figure I.7). The extracted trend components of per capita income reveal the slowdown in rates of growth in the early 1990s, apart from St. Kitts and Nevis, Grenada and St. Vincent and the Grenadines. Montserrat stands out as having greater income volatility than the other ECCU jurisdictions, most likely induced by the natural disasters (volcanic eruptions) of the

⁵ Corbae and Ouliaris (2006) propose a new approach to estimating the growth cycle that starts from the level of a time series. Using frequency domain techniques and recent developments in spectral regression for nonstationary time series, they propose an approximate “ideal” band pass filter for estimating deviations from trend (which need not be linear). Using Monte Carlo simulations, they demonstrate that the new filter has superior statistical properties to other popular filters (such as Hodrick and Prescott, 1980; Baxter and King, 1999). In particular, they show that the FD filter, in contrast to the other two filters, is statistically consistent in the sense that the filtered series asymptotically converges to the true deviation-from-trend cycle.

mid-1990s. Ocular methods suggest that the four Leeward Islands (Antigua and Barbuda, Anguilla, St. Kitts and Nevis, and Montserrat) share a common trend in their outputs, while the four Windward Islands (Dominica, Grenada, St. Lucia and St. Vincent and the Grenadines) share a common, yet smaller, trend.

E. Income Cycles, Co-movement and Shock Persistence

12. **Another important aspect of convergence concerns short-term income cycles (deviation from trend movements).**⁶ The (stationary) cyclical component of ECCU per capita incomes are strongly correlated, except for those of Montserrat (Table I.1).⁷ Anguilla, for example, is highly correlated with Antigua and Barbuda and St. Kitts and Nevis. Similarly, St. Vincent and the Grenadines is highly correlated with Dominica and St. Lucia. Figure I.8 sets out the cyclical component of real per capita income in the ECCU. The cycles appear to be well synchronized, except for Montserrat which displays a cycle with a much greater amplitude. In addition, cyclical movements in income across ECCU countries appear to be particularly synchronous since the mid-1990s. These results concord with the view of Frankel and Rose (1998), who argue that if exchange rates are successfully pegged, and trade and financial links develop, then national business cycles within currency unions are likely to converge.^{8 9}

13. **As part of the convergence process, the synchronicity of the cross-correlations among national business cycles may have changed over time.** Accordingly, we calculate rolling correlations of per capita income cycles (using a 10-year window) among the members of the Leeward and Windward Islands. For the Leewards, the results indicate that while the cycles of Anguilla, Antigua and Barbuda and St. Kitts and Nevis are highly synchronized and stable over time, the synchronicity of Montserrat cycles with other

⁶ Earlier analyses of Caribbean business cycles include Mamingi (1999), Borda, Manioc and Mantauban (2000), Craigwell and Maurin (2002), and Cashin (2006). See also Cashin and Wang (2005) for an examination of comovement of Caribbean cyclical output and key macroeconomic variables.

⁷ We performed Phillips-Perron unit root tests on cyclical components of all series, derived with the FD filter, and confirmed that the cyclical component of all real output series were stationary. The results of these unit root tests are not reported, but are available upon request.

⁸ Rose and Engel (2002) also find that countries that use the same currency tend to have highly synchronized business cycles. The direction of causality is of interest here. While it is true that countries with synchronized business cycles are more likely to adopt a common currency, it is also true that members of a currency union should experience more synchronized business cycles (given the absence of idiosyncratic monetary policy shocks).

⁹ Using data for the ECCU and several Caribbean countries which maintain a fixed exchange rate regime, Fielding and Shields (2005) find that there is no evidence that the members of a monetary union (which share a common currency) experience a greater degree of business cycle convergence than countries which share a common peg.

Leeward countries has been decreasing over time (Figure I.9). For the Windwards, there has been a general increase in synchronicity of cycles over time, albeit from an initially low level of comovement (Figure I.10).

14. **We can also examine income convergence by analyzing the persistence of shocks to per capita output.** Accordingly, we follow Alexiadis and Tomkins (2004) and define the dependent variable in an autoregressive model as: (i) the logarithm of the differential between national and ECCU average per capita incomes; and (ii) the logarithm of the differential between national and ‘club’ average per capita incomes. Rather than consider the whole impulse response function to gauge the degree of persistence, we follow Rogoff (1996) and use a scalar measure of persistence that summarizes the impulse response function: the half-life of a unit shock (HLS). For a first-order autoregressive model (with autoregressive parameter $\alpha \geq 0$), the HLS gives the length of time until the impulse response of a unit shock is half its original magnitude, and is defined as $HLS = \text{ABS}(\log(1/2)/\log(\alpha))$. A short half life for the income differential indicates that any deviation in national per capita income from the ECCU mean per capita income (or ‘club’ mean per capita income) is short-lived, while a long half life indicates the opposite.

15. **Our findings indicate that the persistence of income shocks varies across ECCU countries** (Table I.2). Differentials between national income and the ECCU average income for the Windward Island countries are typically longer than for their Leeward Island counterparts. However, the persistence of shocks to income differentials defined as the deviation of national incomes from the club average (common steady-state income) is typically shorter for Windward Island countries. The calculated half lives of income differentials are all finite, so there is a tendency (albeit sometimes slow) for income differentials to shrink. Importantly, St. Kitts and Nevis displays long-lived shocks of its income from both the ECCU average and the Leeward Islands club average, while St. Vincent and the Grenadines’ income differential also takes a long time to return to the Windward Islands’ club mean income. The results for both countries reflect that their growth performance over the sample period has been considerably better than both the ECCU average and Leeward Islands average (for St. Kitts and Nevis) and better than the Windward Islands average (for St. Vincent and the Grenadines).

F. Conclusions

16. **This chapter has examined trends and cycles in ECCU per capita incomes.** While the neoclassical growth model would suggest that if economies are similar then their per capita incomes should be converging to a common long-run steady state, little evidence is found that per capita incomes in the ECCU are converging to a common region-wide equilibrium.

17. **Analyses of comovement of national trend incomes reveals that there are two possible convergence ‘clubs’ in the ECCU—the Leeward Islands and the Windward Islands.** Similarities in structural and technological conditions are likely to have engendered these region-specific convergence clubs. Based on trend real per capita incomes, it appears that the members of each ‘club’ are converging to their own long-run equilibrium level of income. Importantly, the long-run equilibrium income level for the Windwards club appears to be considerably below that of the Leewards club.

18. **There is strong evidence for synchronization of the cyclical component of per capita incomes in the ECCU.** National income cycles (measured as percentage deviation from trend income) reveal that while there is some variation in the 1970s and 1980s, cyclical movements in income have been well coordinated since the mid-1990s. This comovement of ECCU business cycles implies that the members of the currency union experience broadly similar shocks to output.

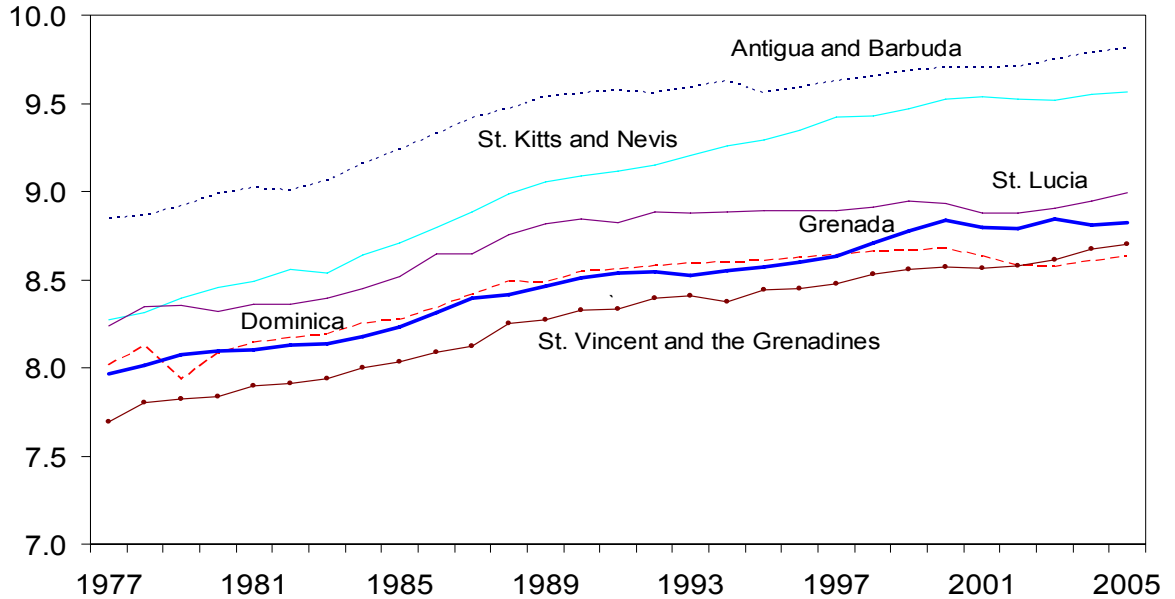
19. **Among monetary and economic unions, the existence of large and persistent differences in national or regional per capita incomes has typically been regarded as reflective of an incomplete process of economic integration.** Given the loss of independent national monetary policies inside monetary unions, reducing any divergence of per capita incomes requires additional measures to promote the freer flow of factors and the transferal of resources from high-income to low-income regions.

20. **The creation of a single economic space within the Organization of Eastern Caribbean States could contribute to a lowering of income disparities.**¹⁰ The *Treaty of Basseterre*, which established the OECS in 1981, provides for the essential elements of an economic union by calling for the removal of obstacles to the free movement of persons, goods, services and capital. In October 2002 the OECS Authority reiterated its commitment to the creation of an OECS Economic Union, but since that time there has been slow progress on the removal of restrictions on the flow of factors and goods across the borders of OECS countries (Mlachila et al., 2006).¹¹

¹⁰ The Organization of Eastern Caribbean States (OECS) consists of the eight member countries and territories of the ECCU and the British Virgin Islands.

¹¹ In June 2006 the OECS Authority reviewed the new draft OECS Treaty, and members signed a Declaration of Intent which affirmed their commitment to the establishment of an OECS Economic Union by July 2007.

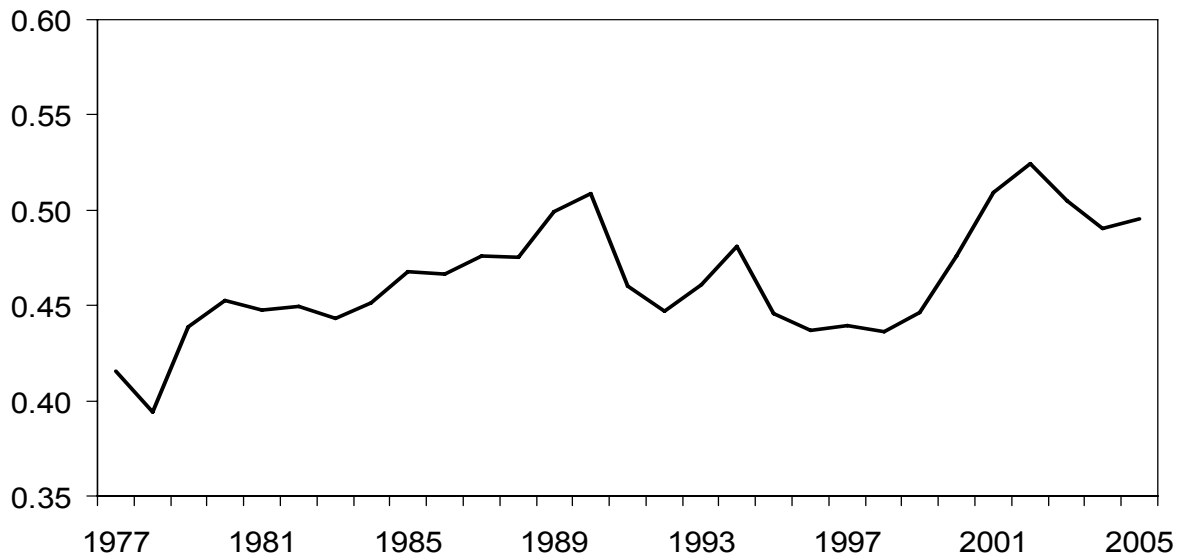
Figure I.1. ECCU: Real GDP Per Capita, 1977–2005



Sources: Eastern Caribbean Central Bank; IMF, International Financial Statistics; and Fund staff calculations.

Note: Real GDP per capita is in logarithmic form.

Figure I.2. ECCU: Standard Deviation of Real Per Capita Income, 1977–2005



Sources: Eastern Caribbean Central Bank; IMF, International Financial Statistics; and Fund staff estimates.

Figure I.3. ECCU: Standard Deviation of Real Per Capita Income by Clubs, 1977–2005

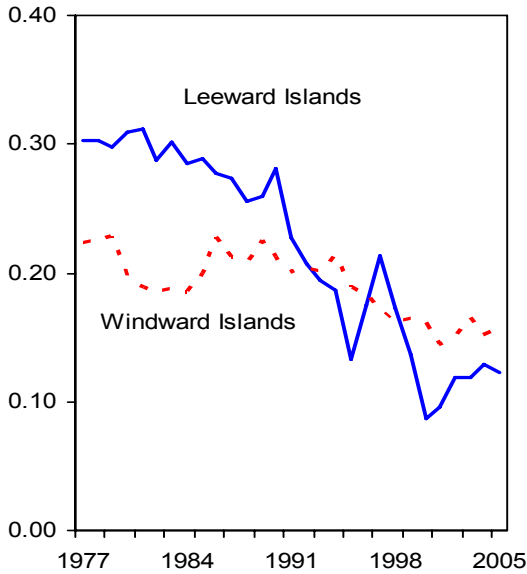


Figure I.4. ECCU: Income Convergence

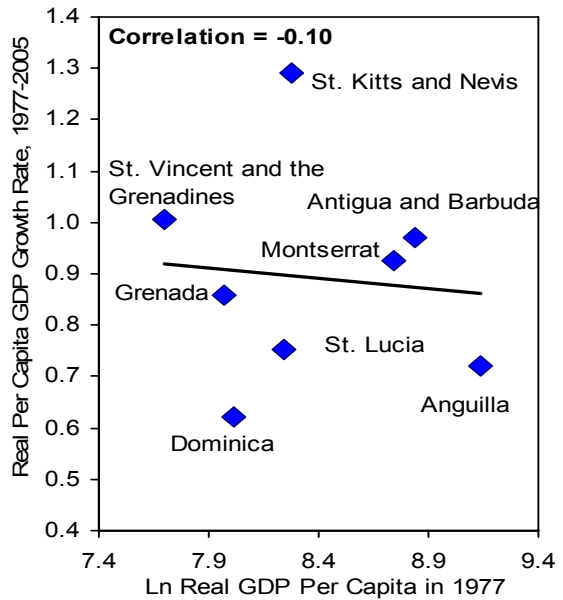


Figure I.5. Leeward Islands: Income Convergence

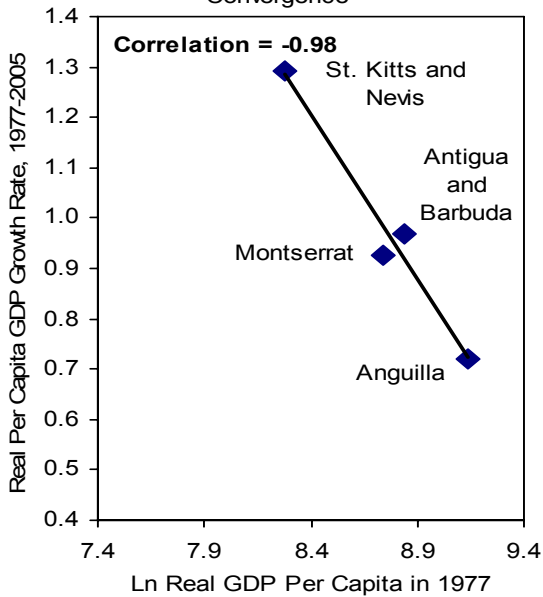
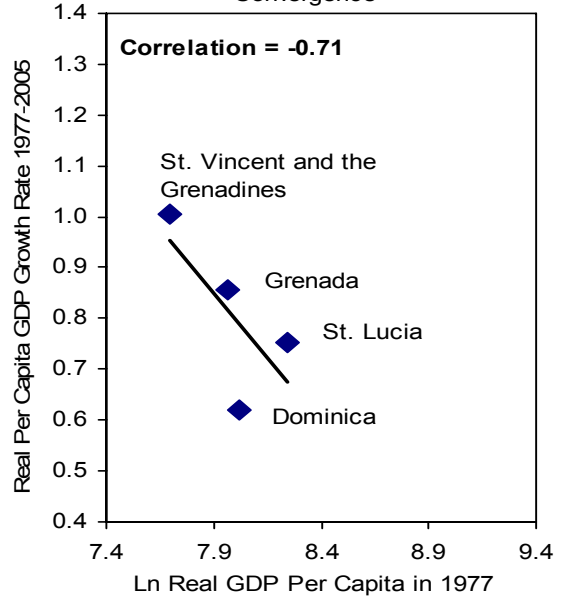


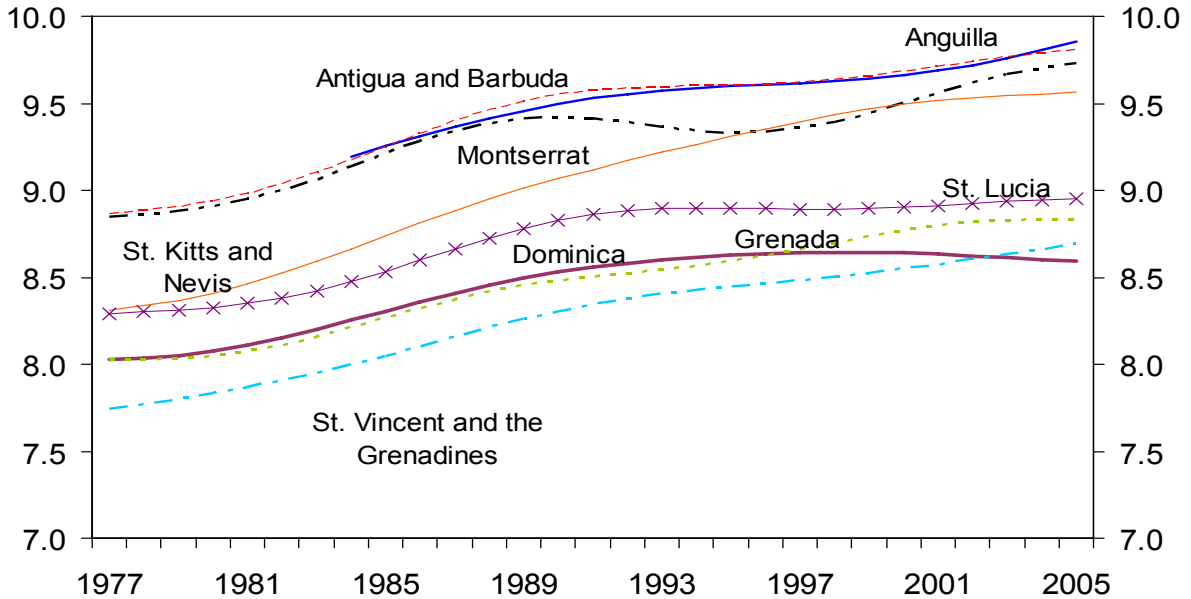
Figure I.6. Windward Islands: Income Convergence



Sources: Eastern Caribbean Central Bank, IMF, International Financial Statistics; and Fund staff estimates.

Note: Leeward Islands consist of Anguilla, Antigua and Barbuda, Montserrat, and St. Kitts and Nevis. Windward Islands consist of Dominica, Grenada, St. Lucia, and St. Vincent and the Grenadines.

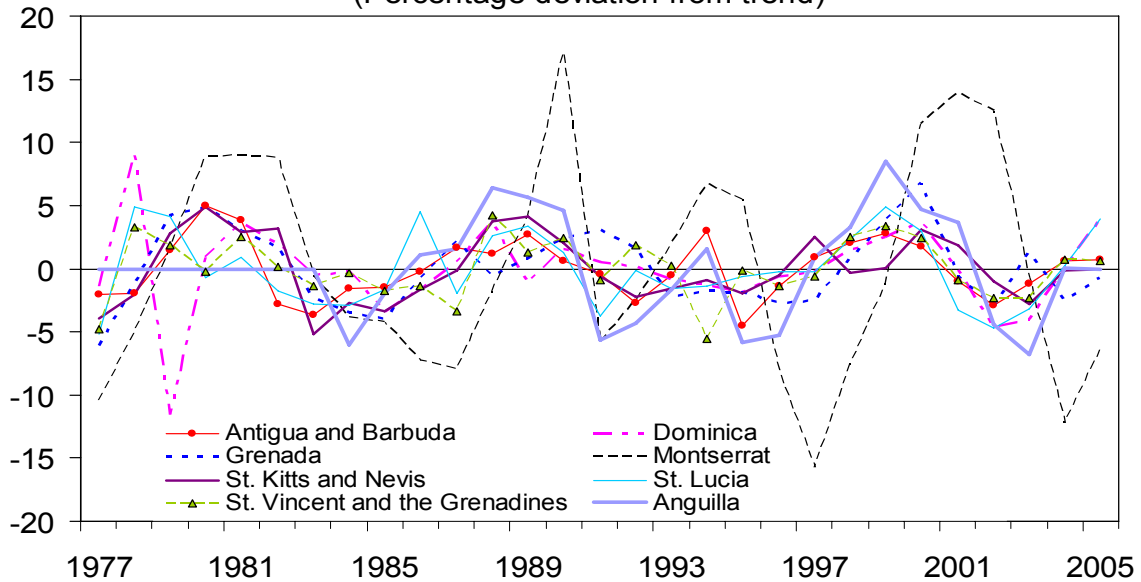
Figure I.7. ECCU: Trend Component of Real Per Capita Income, 1977–2005



Sources: Eastern Caribbean Central Bank; IMF, International Financial Statistics; and Fund staff estimates.

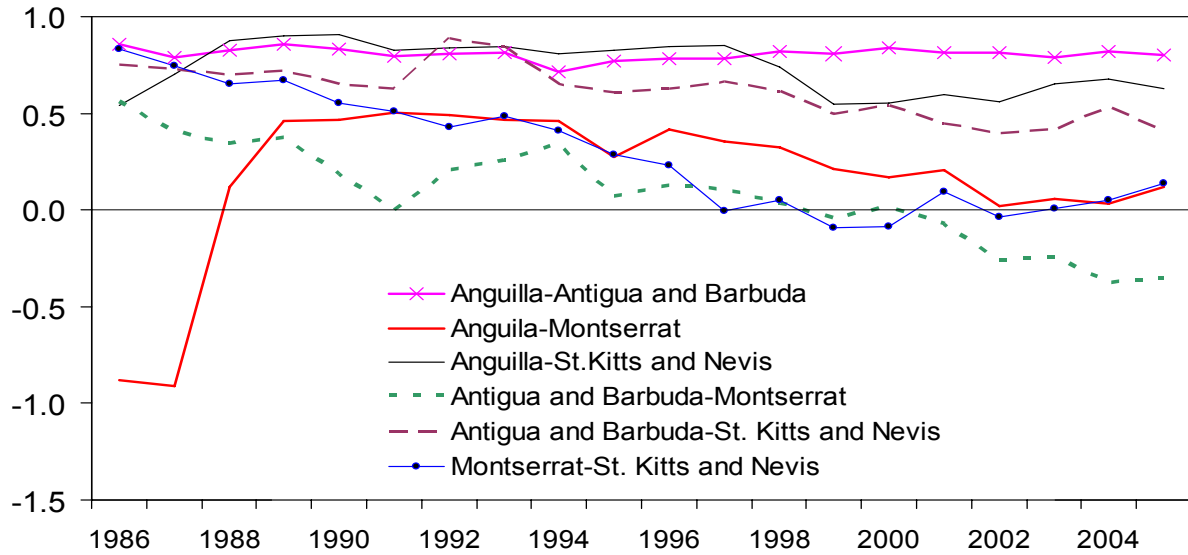
Note: Real GDP is in logarithmic form.

Figure I.8. ECCU: Cyclical Component of Real Per Capita Income, 1977–2005 (Percentage deviation from trend)



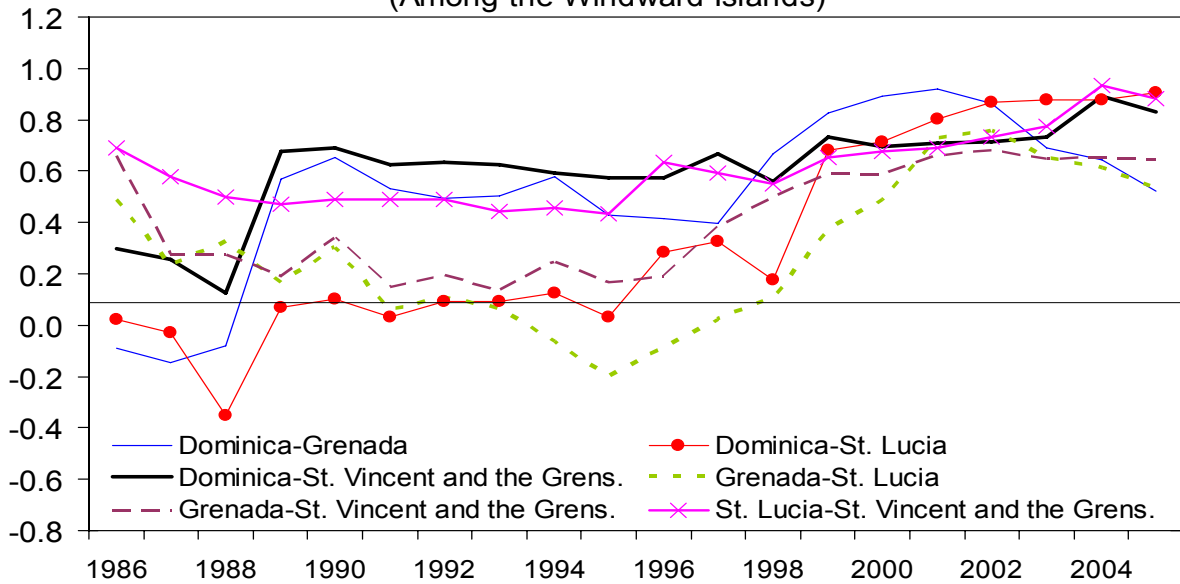
Sources: Eastern Caribbean Central Bank; IMF, International Financial Statistics; and Fund staff estimates.

Figure I.9. ECCU: Rolling Correlation of Real Per Capita Income Cycles
(Among the Leeward Islands)



Sources: Eastern Caribbean Central Bank; IMF, International Financial Statistics; and Fund staff estimates.

Figure I.10. ECCU: Rolling Correlation of Real Per Capita Income Cycles
(Among the Windward Islands)



Sources: Eastern Caribbean Central Bank; IMF, International Financial Statistics; and Fund staff estimates.

Table I.1. ECCU: Correlation Between Cycles of Per Capita Income, 1977–2005

	Anguilla	Antigua and Barbuda	Dominica	Grenada	Montserrat	St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines
Anguilla	1.00	0.78	0.58	0.42	0.20	0.74	0.67	0.49
Antigua and Barbuda		1.00	0.53	0.42	-0.11	0.57	0.54	0.19
Dominica			1.00	0.53	-0.07	0.56	0.61	0.66
Grenada				1.00	0.27	0.39	0.36	0.41
Montserrat					1.00	0.23	-0.14	0.04
St. Kitts and Nevis						1.00	0.43	0.47
St. Lucia							1.00	0.62
St. Vincent and the Grenadines								1.00

Source: Authors' calculations.

Note: Following Agénor, McDermott and Prasad (2000), the approximate standard error of the correlation coefficients, computed under the null hypothesis that the true correlation coefficient is zero, is 0.19 (given $T=28$).

Table I.2. ECCU: Half-Lives of Income Deviations

Country/Territory (1)	ECCU		Leeward Islands		Windward Islands	
	α (2)	Half-life (in years) (3)	α (4)	Half-life (in years) (5)	α (6)	Half-life (in years) (7)
Anguilla	0.36	0.68	0.68	1.80	...	...
Antigua and Barbuda	0.65	1.61	0.93	9.55	...	...
Dominica	0.87	4.98	...	...	0.76	2.53
Grenada	0.79	2.94	...	...	0.82	3.49
Montserrat	0.76	2.53	0.83	3.72	...	...
St. Kitts and Nevis	0.96	16.98	0.96	16.98	...	...
St. Lucia	0.92	8.31	...	...	0.88	5.42
St. Vincent and the Grenadines	0.72	2.11	...	...	0.95	13.51

Source: Authors' calculations.

Note: The results in columns 2, 4 and 6 are based on least-squares estimations of an autoregressive (AR(1)) model. The half-life is the length of time it takes for a unit impulse to dissipate by half. It is derived using the formula: $HLS = \text{ABS}(\log(1/2)/\log(\alpha))$, where α is the autoregressive parameter from the AR(1) model. The dependent variable is: the log difference between national income and ECCU average income (columns 2-3); the log difference between national income and Leeward Islands average income (columns 4-5); and the log difference between national income and Windward Islands average income (columns 6-7).

REFERENCES

- Agénor, P., C. J. McDermott, and E. Prasad, 2000, “Macroeconomic Fluctuations in Developing Countries: Some Stylized Facts,” *World Bank Economic Review*, Vol. 14, pp. 251–85.
- Alexiadis, S., and J. Tomkins, 2004, “Convergence Clubs in the Regions of Greece,” *Applied Economics Letters*, Vol. 11, pp. 387–91.
- Atkins, F., and D. Boyd, 1998, “Convergence and the Caribbean,” *International Review of Applied Economics*, Vol. 12, pp. 381–96.
- Baxter, M., and R. King, 1999, “Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series,” *Review of Economics and Statistics*, Vol. 81, pp. 575–93.
- Borda, P., O. Manioc, and J. Montauban, 2000, “The Contribution of U.S. Monetary Policy to Caribbean Business Cycles,” *Social and Economic Studies*, Vol. 49, pp. 225–50.
- Burns, A., and W. Mitchell, 1946, *Measuring Business Cycles* (New York City: National Bureau of Economic Research).
- Cashin, P., 2006, “Key Features of Caribbean Business Cycles,” in R. Sahay, D.O. Robinson, and P. Cashin (eds), *The Caribbean: From Vulnerability to Sustained Growth* (Washington DC: International Monetary Fund), pp. 83–121.
- Cashin, P., and S. Ouliaris, 2004, “Key Features of Australian Business Cycles,” *Australian Economic Papers*, Vol. 43, pp. 39–58.
- Cashin, P., and P. Wang, 2005, “Macroeconomic Fluctuations in the Eastern Caribbean Currency Union,” in *Eastern Caribbean Currency Union: Selected Issues*, IMF Country Report No. 05/305 (Washington DC: International Monetary Fund), pp. 3–17.
- Corbae, P. D., and S. Ouliaris, 2006, “Extracting Cycles from Non-Stationary Data,” in P.D. Corbae, B. Hansen and S. Durlauf (eds), *Econometric Theory and Practice: Frontiers of Analysis and Applied Research, Essays in Honor of Peter C. B. Phillips* (Cambridge: Cambridge University Press), pp. 167–77.
- Craigwell, R., and A. Maurin, 2002, “Production and Unemployment Cycles in the Caribbean: The Case of Barbados and Trinidad and Tobago,” (unpublished, Research Department, Central Bank of Barbados).

- Fielding, D., and K. Shields, 2005, “Do Currency Unions Deliver More Economic Integration than Fixed Exchange Rates? Evidence from the Franc Zone and the ECCU,” *Journal of Development Studies*, Vol. 41, pp. 1051–70.
- Frankel, J., and A. Rose, 1998, “The Endogeneity of the Optimum Currency Area Criteria,” *Economic Journal*, Vol. 108, pp. 1009–25.
- Hodrick, R.J., and E.C. Prescott, 1980, “Post-War U.S. Business Cycles: An Empirical Investigation,” Discussion Paper No. 451 (Pittsburgh, PA: Carnegie-Mellon University).
- Mamingi, N., 1999, “Testing for Convergence and Common Features in International Output: The Case of the Eastern Caribbean Countries,” *Journal of Eastern Caribbean Studies*, Vol. 24, pp. 15–40.
- Mlachila, M., W. Samuel, and P. Njoroge, 2006, “Integration and Growth in the Eastern Caribbean,” in R. Sahay, D.O. Robinson, and P. Cashin (eds), *The Caribbean: From Vulnerability to Sustained Growth* (Washington DC: International Monetary Fund), pp. 307–48.
- Norman, D., and T. Walker, 2004, “Co-Movement of Australian State Business Cycles,” Research Discussion Paper 2004–09 (Sydney: Reserve Bank of Australia).
- Rasmussen, T., and G. Tolosa, 2006, “Islands of Stability? Determinants of Macroeconomic Volatility in the Eastern Caribbean Currency Union,” in R. Sahay, D.O. Robinson, and P. Cashin (eds), *The Caribbean: From Vulnerability to Sustained Growth* (Washington DC: International Monetary Fund), pp. 122–42.
- Rogoff, K., 1996, “The Purchasing Power Parity Puzzle,” *Journal of Economic Literature*, Vol. 34, pp. 647–68.
- Rose, A., and C. Engel, 2002, “Currency Unions and International Integration,” *Journal of Money, Credit and Banking*, Vol. 34, pp. 1067–89.

II. THE MACROECONOMIC IMPACT OF TRADE PREFERENCE EROSION ON THE WINDWARD ISLANDS¹²

A. Introduction

21. **The banana industry of the Caribbean has enjoyed significant trade preferences for several decades.** Preferential access to protected European markets has afforded Caribbean ACP (Africa, Caribbean and Pacific) producers higher export prices than otherwise, and thus provided them with implicit income transfers. Reforms to the European Union's banana regime over the last 15 years have engendered an erosion of trade preferences, and recent reforms will further erode these implicit income transfers. The erosion of trade preferences has important economic and social effects, given the dependence on banana production and exports among the Windward Islands.¹³

22. **The countries of the Windward Islands are among the most vulnerable to terms of trade losses arising from trade preference erosion.** This vulnerability arises from a large share of bananas in total exports, the high degree of preferential access granted by the European Union, and their dependence on the European Union as an export market.

23. **This chapter complements previous studies by considering the macroeconomic effects of preference erosion.** As a first step, the analysis measures the value of banana trade preferences, illustrating that the value of implicit assistance provided through trade preferences has declined precipitously since the early 1990s. Second, using panel vector autoregression analysis the chapter discusses the macroeconomic impact of the diminution of implicit assistance, particularly on output growth in the preference-dependent Windward Islands.

24. **The remainder of this chapter is as set out below.** Section B provides an historical overview of the evolution of the European Union's banana regime, while Section C examines the results of studies which have attempted to measure the impact of preference erosion on the Caribbean. Section D tracks the movement of banana export prices, volumes and export receipts for the Windward Islands, then Section E estimates the value of implicit assistance provided to the Windwards through banana trade preferences. Section F charts the likely fiscal and external impact of changes to the EU banana regime beginning in 2006, while Section G evaluates the macroeconomic impact of implicit assistance derived from trade preferences. Section H concludes.

¹² Prepared by Montfort Mlachila and Paul Cashin.

¹³ The Windward Islands comprise the countries of Dominica, Grenada, St. Lucia and St. Vincent and the Grenadines, all of which are members of the Eastern Caribbean Currency Union (ECCU).

B. Industry and Historical Overview

25. **The Windward Islands' export banana industry was established in the early 1950s, in order to supply the United Kingdom market and replace unprofitable sugar production in the Caribbean.** While at its peak in the early 1990s the banana industry comprised about 20 percent of Windward Islands GDP, it has subsequently declined to less than 5 percent of GDP in recent years. However, banana exports do remain important, accounting at present for about 15 percent of merchandise export receipts and remaining a key employment source in the rural districts of most of the Windward Islands.^{14 15} Banana production in the Windward Islands is entirely in private hands, with the government providing some financial and other support to producers.¹⁶

26. **Production yields are significantly lower in the Windwards than for other Caribbean and Latin American banana producers.** Banana farms in the Windwards are typically less than ten acres in size, and are mostly located in difficult terrain (characterized by steep hillsides and narrow valleys). The combination of less favorable topography, climate, and labor conditions results in low yields per acre and relatively high production costs (NERA, 2004).¹⁷

27. **For four decades prior to 1993, Windward Islands' producers enjoyed preferential access as traditional suppliers to the United Kingdom market.** Prior to 1993, European Union (EU) members maintained distinct policies for banana imports, including preferential regimes for member states' overseas departments or former colonies (e.g., France imported from Martinique and Guadeloupe, Cameroon and Côte d'Ivoire, while the United Kingdom imported from the Windward Islands and other ACP countries). Historically, Windward Islands bananas had been exported to the United Kingdom under preferential agreements codified in the banana protocol of the various Lomé Conventions (co-operation

¹⁴ Windwards banana growers are typically members of their respective national Banana Growers Association, which purchases all export quality fruit for subsequent sale to WIBDECO (Windward Islands Banana Development and Exporting Company), which markets and distributes the bananas in the United Kingdom. WIBDECO commenced operations in 1994, and is jointly owned by the governments and growers' associations of the four Windward Islands.

¹⁵ The number of registered banana growers in the Windward Islands has fallen from about 24,000 farmers in 1993 to about 5,000 in recent years, yet the industry remains a major employer, particularly in rural regions of the Windwards (IMF, 2002; NERA, 2004).

¹⁶ The governments of Windward Island countries have traditionally promoted banana production by investing in support and transportation infrastructure. They have also extended fiscal incentives to banana growers to aid the industry in becoming more efficient.

¹⁷ For a comprehensive description of problems faced by Windward Islands banana producers, see Sandiford (2000) and Myers (2004).

agreements between the then European Community and ACP countries, which commenced in 1975 and expired in 2000).

28. The European Union's preferential regime for bananas has undergone significant change over the last fifteen years. Along with the implementation of the EU Single Market in 1993 there came a common policy and marketing structure for banana imports. Under the so-called EU Banana Regime, preferential arrangements for ACP bananas were extended under a new import regime that encompassed the entire European Community (Dickson, 1993).

29. The EU banana regime operated on the basis of an annual ACP banana quota for duty-free export to the EU, and an annual quota for bananas from Latin America ('dollar' bananas) subject to a tariff. The importation of bananas into the EU also required a license, and the licensing system allowed the Windward Islands the possibility of sharing in the associated economic rents (Williams and Darius, 1998). As a result, the price of bananas in the EU averaged some 80 percent more than the world (free market) price. Following World Trade Organization (WTO) rulings that the EU's banana import regime discriminated against Latin American exporters, in late 2001 the EU pledged to switch to a tariff-only system by the beginning of 2006, and requested a WTO waiver authorizing tariff preferences for ACP countries under the Cotonou Agreement (successor agreement to the Lomé Conventions) until 2007. Under this compromise, the EU agreed that the waiver would apply only if the new tariff is set at a level that maintains total market access for all WTO member suppliers.

30. Recent reforms to the EU banana regime (away from quotas to a tariff-only system) will erode preferences for Windward Islands' producers. Beginning January 1, 2006, the EU moved to a tariff-only regime (no quotas or licenses) with a MFN tariff of €176 per tonne for Latin American bananas, and a duty-free 0.775 million-tonne quota for ACP countries.¹⁸ The appropriate (quota-equivalent) level of this tariff remains in dispute, and is expected to be challenged by Latin American exporters.¹⁹ While the conversion of quotas into tariffs will afford some protection to ACP banana-exporting countries, Caribbean banana exporters are likely to face strong competition from more efficient African and Latin American producers.

¹⁸ The shift to a tariff-only regime has engendered considerable controversy regarding what level of tariff protection would be equivalent to the previous quota-based regime, particularly as it pertains to maintaining market access for non-ACP suppliers. Previous EU proposals of a single MFN tariff of €230 per tonne and later €187 per tonne were challenged by Latin American banana exporters, and both were rejected by WTO arbitrators, on the grounds that the tariff would not at least maintain total market access for MFN suppliers.

¹⁹ In November 2006, Ecuador (the world's largest banana exporter) formally initiated a process to challenge the current level of the MFN tariff (€176 per tonne) before the WTO.

31. **The European Commission has developed assistance plans to support the adjustment of ACP countries to the reformed banana regime.** Assistance from the European Commission to Caribbean banana-exporting countries is being provided through: (i) the Special Framework of Assistance (1999–2008), which was designed to boost the productivity of producers, encourage diversification (away from agriculture), and provide social protection;²⁰ and (ii) export revenue stabilization schemes, such as STABEX. Under the SFA, since 1999 the EU has committed €157 million for adjustment assistance to Windward Islands ACP countries. However, the disbursement of this assistance has been extremely slow, with the bulk of committed amounts remaining undisbursed (Figure II.1).

C. The Impact of Preference Erosion on Caribbean Countries

32. **The erosion of trade preferences over the last two decades has already had a significant impact on Caribbean banana producers.** During the 1990s exports from the Windward Islands fell dramatically, driven by uncertainty as to the status of the banana regime and the rise of the services sector in Windwards economies. Employment declines were ameliorated by banana growers working on a part-time basis, taking early retirement, seeking employment in the rapidly-growing services sector, or emigration. The Windward Islands have also been successful in diversifying into tourism and financial services, the growth of which has more than offset the decline in banana export earnings.

33. **Most existing estimates show that the loss from trade liberalization for the Windward Islands will be large.** According to the Commonwealth Secretariat (2004), if trade liberalization is aggressively pursued, the result would be a reduction in exports of goods by 23 percent for St. Lucia, 13 percent for Dominica, and 11 percent for St. Vincent and the Grenadines.²¹ On the basis of an EU tariff level close to the current €176 per tonne and individual country supply elasticities, NERA (2004) finds that banana production would decline by between 11–21 percent in Windwards countries.

34. **In a comprehensive review of the literature on banana preference erosion, the FAO (2004) makes a number of interesting observations.** A key finding is that, in moving to a tariff-only regime in 2006, there is no tariff that would maintain the status quo—a central

²⁰ The Special Framework of Assistance (SFA) was established in 1999, when the preferential trade arrangements traditionally enjoyed by ACP banana producers were found to be incompatible with WTO rules, to assist the twelve ACP traditional banana suppliers (including the four Windwards countries) adapt to the new market conditions.

²¹ Under the Secretariat's "ambitious" scenario, there is complete elimination of export subsidies and domestic price supports, and an across-the-board reduction in bound MFN tariffs of about 30 percent and proportionately higher reductions in tariff peaks.

objective among ACP countries, especially in the Caribbean. In particular, a low tariff would benefit Latin suppliers and adversely affect EU domestic and ACP suppliers, and vice versa. However, the studies reviewed by the FAO do not address the specific case of the Windward Islands, as these are lumped together with other ACP countries.

35. **It should be noted that there are virtually no existing studies that document both the value of implicit assistance arising from trade preferences and its evolution over a long period.** Almost all the studies reviewed here take a snapshot of the state of affairs for one year or just a few years. However, in order to understand how countries arrived at their present situations, it is useful to measure the value of preferences over time. In the following sections, we attempt to do that for the Windward Islands over a period of almost three decades.

D. Evolution of Banana Export Prices, Quantities and Values

36. **Real banana export prices have exhibited a secular downward trend over the past three decades.** United Kingdom real banana prices generally remained steady through the early 1990s and declined thereafter, until a sharp, weather-related uptick in prices in 2005 (Figure II.2). An important influence was the decision to partially liberalise the European market from 1993, which increased competition and dampened prices. International (free market) prices also show a steady downward trend, with occasional peaks during the late 1980s and early 2000s—the latter resulting from a weather-induced shortage.

37. **The evolution of banana export volumes from the four Windward Islands over the past three decades displays a bell shape.** Volumes steadily rose by nearly 270 percent between 1977 and the early 1990s to peak at about 275,000 tonnes (Figure II.3). Thereafter there has been a steady decline in export volumes, with the total volume exported in 2005 about half that of 1977. The evolution of production and exports among the different islands is similar to the overall trend, with the exception of Grenada. Grenada's export level was always small (about 8,000 to 12,000 tonnes annually on average), and the country largely ceased to export any meaningful quantities after 1996.

38. **The evolution of export values naturally reflects that of export volumes and prices, and also has a bell shape** (Figure II.4). From a value of about US\$20 million (15 percent of GDP) in 1977, total Windward Islands export receipts peaked at nearly US\$150 million (over 20 percent of GDP) in 1989. Banana exports have been particularly important for Dominica, St. Lucia, and St. Vincent and the Grenadines, accounting for about 40–70 percent of total merchandise exports, depending on the period. Since 1993, the importance of banana exports in the Windward Islands' economy has dramatically diminished. Indeed, by 2005 total exports amounted to less than US\$30 million (about 5 percent of GDP).

E. Estimation of Implicit Assistance from Banana Trade Preferences

39. **The additional export revenue that Caribbean producers derive from preferential access to the European market represents an implicit income transfer.** This preference-generated income transfer constitutes the additional export proceeds received by eligible ACP countries from exporting bananas to the EU on preferential terms, rather than receiving the international (free market) price. The amount of this implicit transfer can be calculated using a price-gap methodology—that is, the difference between the preferential European market price for bananas and the best price that could be obtained on unrestricted markets (the international market). Expressing relevant market prices in free-on-board (fob) terms and scaling the price gap by the actual export volume provides a measure of the value of this implicit transfer.²² In line with Alexandraki and Lankes (2004), we define the preference margin (m) as the proportion by which the average unit price received by a preference recipient j exceeds that received by an MFN exporter (world price):

$$m = (P^j / P^W) - 1 \quad (1)$$

where P^j and P^W are the price received by country j and the world price, respectively. The implicit value of preferences for each producer j at during a time t is simply the product of the difference in prices and the quantity exported Q_t^j :

$$(P_t^j - P_t^W) Q_t \text{ or } (m P_t^W) Q_t. \quad (2)$$

40. **Several assumptions underlie this computation.** First, that there is no product differentiation in terms of quality, size, and origin. Second, a perfectly competitive price is assumed. Finally, all preferential rents accrue to exporters. To the extent that some of these assumptions are not verified in practice means that the computed value of preferences is likely to be somewhat exaggerated. However, this price gap method is considered by the World Trade Organization as the most transparent and objective (Sanchez, 2004).

41. **A key challenge is to find comparable prices for the numerator and denominator.** It is necessary to have prices that reflect as accurately as possible the value of preferential access *per se*, as opposed to other differences among exporters or export markets. From a theoretical perspective, it is virtually impossible to have fully comparable prices, so some element of judgment must be brought bear. This point is further discussed below and in Appendix I.

²² This methodology assumes that the entire rent from the trade preference accrues to the exporting country (which tends to overestimate the implicit transfer) and that world (international) prices are not affected by preferences (which tends to underestimate the implicit transfer).

42. **Implicit assistance was calculated according to the formulation presented above** (in equation (2)). A complication is the prices used in the computation. There are two sets of prices that can be used. In the *first approach*, we can use the wedge between United Kingdom wholesale prices for Windward Islands exports and the international (U.S.) landed prices for ‘dollar’ banana exports. The *second approach* is to use unit export prices for the Windward Islands and compare them with unit export prices for Latin American ‘dollar’ exporters. Both approaches have advantages and disadvantages:

- The first approach has the merit of being rather transparent. More practically for this chapter, the data for this approach are available throughout the period under study (1977–2005). However, this approach will represent the upper bound to the true amount of implicit assistance received by banana-exporting countries, as it assumes that the full margin between European Union and international (free market) prices accrues to exporters.²³
- The second approach is probably closer to the lower bound of the true value of implicit assistance, as the price used is the fob price at the point of export.
- The main drawback of both methods is that they assume that all bananas are of equivalent quality—which may not be the case.²⁴ Ideally, prices for the numerator and the denominator in the margin computation need to be fully comparable in order to accurately allow for the computation of the preferences per se, abstracting from intrinsic differences between exporters and/or export markets.

43. **Regardless of the measure used, the level of implicit assistance delivered through EU trade preferences has been considerable.** There are three stylized facts that emerge from an analysis of the preference calculations (here measured using the first approach). First, the value of implicit assistance has been quite high for all Windwards countries (excepting Grenada), averaging about 8 percent of GDP for the period 1977–2005. Second, the pattern of implicit assistance follows the same bell-shape as the evolution of export volumes, peaking in the late-1980s and early-1990s, and declining to levels below those observed at the beginning of the period by 2005 (Figures II.5 and II.6). Finally, the level of implicit assistance has generally been higher than that of official development assistance (Figure II.7). For instance, preference-based implicit assistance received by St. Lucia over the past three decades is about double that received as official development assistance.

²³ This method will also tend to overestimate the true preference margin, as both price series include transport, insurance and discharging costs, which are typically higher in EU markets relative to those of U.S. markets.

²⁴ In recent years, for example, in order to recapture lost market share, an increasing volume of Windward Island bananas have been sold under the ‘fair trade’ label, which has a premium of about 20–25 percent over other types of bananas.

44. **The implicit value of banana trade preferences (calculated using the second method of fob unit values) are presented in Table II.1 (lower panel).** As expected, the table shows a similar trend to that of the first method (which used wholesale prices), yet as expected the calculated levels of implicit assistance are lower. For instance, using the first method shows that implicit assistance (as a share of GDP) averaged 3.9 percent for the period 1995–2005 for St. Lucia, while the second method calculates average implicit assistance as 1.8 percent of GDP. The true value of implicit assistance probably lies between the two measures. To the extent that the direction of the bias is known, either method could be used to estimate the macroeconomic impact of implicit assistance (*IAID*).

F. Expected Economic Impact of EU Preference Erosion

45. **The impact of preference erosion on the trade balance, output growth, and the overall fiscal balance can be estimated on the basis of a simple partial equilibrium model.** The model is based on a national accounting framework and calibrated using assumptions about the evolution of commodity prices and exchange rates, export supply and import demand elasticities, and consumption multipliers (Box II.1). The impact of the erosion of trade preferences is obtained by contrasting a baseline scenario for trade, output and fiscal outcomes (that assumes no preference erosion) with an alternative scenario (that incorporates the effect of the erosion of EU preferences). Overall, calculations by Fund staff indicate that the new EU banana regime is expected to result in about a 14 percent price reduction for Windward Islands banana exports in 2006, with prices largely unchanged in later years.²⁵ Banana production levels of 2005 are used as the baseline for the projections.

46. **The partial equilibrium estimates show that the decline in EU preferences is likely to have significant implications for the Windwards economies** (Figure II.8). For example, in St. Vincent and the Grenadines the decline in banana preferences is projected to depress annual export revenue by about US\$3 million (0.7 percent of 2005 GDP).²⁶ However, the overall trade balance is expected to weaken less (about 0.3 percent of 2005 GDP), as lower exports will be partially offset by a decline in imports due to slower economic growth. Over the medium term, the erosion of EU preferences could lower nominal GDP in St. Vincent and the Grenadines by 1.8 percent of its 2005 level, while the overall fiscal balance would deteriorate somewhat with the cumulative impact being about one half of one

²⁵ This estimated price change is close to that derived by NERA (2004), which was calculated using price-gap methods.

²⁶ The projections for bananas are based on the assumption of a MFN tariff of €176 per ton from 2006 onward. The projections also assume, implicitly, that transport will remain available at affordable costs. However, below a certain export volume, threshold freight costs may become prohibitive, and this would result in a far sharper contraction of banana exports.

percent of 2005 GDP. Estimates for other Windwards banana producers indicate that export losses range between 0.01 percent (Grenada) and 0.5 percent (Dominica) of 2005 output, with St. Lucia and St. Vincent and the Grenadines experiencing the largest preference-induced output loss.^{27 28}

G. Estimates of the Macroeconomic Impact of Implicit Assistance

Correlation Analysis

47. **The first step in analyzing the macroeconomic importance of implicit assistance is to assess the extent of its comovement with other key macroeconomic variables.** The variables being examined for the period 1977–2005 for the four Windward Islands are: implicit assistance, as calculated above (*IAID*), the current account (*CUR*), gross official reserves (*RES*), gross domestic product (*GDP*), and central government revenues (*REV*). All variables are in real terms (see Appendix I for a full description and derivation of the data). Unit root tests reveal that the macroeconomic variables are non-stationary.²⁹ Accordingly, relationships are analyzed between the first differences of the macroeconomic variables.

48. **The most striking stylized fact is that changes in implicit assistance (*IAID*) are positively correlated with changes in almost all the macroeconomic variables** (Table II.2). The correlation of changes in implicit assistance with real GDP growth is particularly strong for St. Lucia (0.70) and St. Vincent and the Grenadines (0.77), while as expected it is relatively weak for Grenada. The overall correlation of implicit assistance is typically weakest with changes in external reserves.

²⁷ The estimated impact is robust to changes in assumptions. Sensitivity analysis shows that the model returns significant export and output losses under a variety of values for the export multiplier and supply elasticities. It should be noted that the projected macroeconomic implications are static in nature, and as such do not take account of all possible interactions between aggregates beyond first-round effects. In addition, even where projected macroeconomic implications appear modest, there are likely to be important adjustment costs not captured by the partial framework, including adjustment to land and labor markets.

²⁸ The effect of preference loss on export revenues, output and the fiscal balance is likely to be understated for Grenada, given that damage to nutmeg and cocoa trees caused by recent hurricanes has induced more farmers to switch to banana production over the medium term.

²⁹ Augmented Dickey Fuller and the Phillips-Peron unit root tests indicate that the variables are non-stationary, although there are some uncertainties about the current account. Panel integration order was also tested using a range of tests. These tests generally concord with those arrived at using individual country data, confirming that all the variables in first differences are stationary. The results are available on request from the authors.

Vector Autoregression Analysis

49. **To assess the impact of shocks to the level of implicit assistance on key macroeconomic variables, a vector autoregression (VAR) model was estimated.** An advantage of the VAR-type reduced form approach is the ability to exploit historical dynamics observed in the data to assess the likely macroeconomic impact of the erosion of trade preferences (see Deaton and Miller, 1995, which uses this approach to estimate the impact of commodity price shocks on components of GDP in African countries).³⁰ We model a panel VAR of the form:

$$y_{it} = A_0 + A_1 y_{it-1} + \dots + A_p y_{it-p} + \varepsilon_{it} \quad (3)$$

where y_{it} is a k vector of variables in the system to be estimated; $A_0 \dots A_p$ are matrices of coefficients; and ε_t is a vector of innovations that are serially uncorrelated. For our system, the y_{it} is a stacked vector of individual country ($i=1, \dots, 4$) variables: *IAID*, *CUR*, *RES*, *GDP*, and *REV*, in that order. This Cholesky ordering is based on a priori notions about the relative endogeneity of the variables, starting with the least endogenous.³¹ The appropriate lag length for endogenous variables was estimated at five, based on the Akaike information criterion results.³² In what follows, the analysis focuses only on the results of a shock to *IAID* on other variables.

50. **Several stylized facts emerge from the VAR analysis, which are estimated over a pooled sample of Windwards banana-producers for the period 1977–2005.**³³ First, the impact of a positive one standard deviation shock to *IAID* on all variables is positive and significant (Figure II.9). The current account and the reserves growth rate both improve by

³⁰ In a study of the banana industry, Williams et al. (1999) estimated the impact of banana price shocks on the economies of the Windward Islands. They used quarterly data for the period 1984 to 1996 and estimated the impact of banana price shocks on net foreign assets (NFA), narrow money, and government revenues. Their results showed that the impact of price shocks was strongest for Dominica, and that NFA was the most affected variable, while the impact of price shocks on government revenues was negligible.

³¹ Cointegration tests reveal that the no cointegration null hypothesis cannot be rejected (at the five percent level of significance); consequently, a VAR in first differences appears appropriate. In addition, robustness tests involving different ordering of variables did not lead to significantly different results.

³² Given that the variables are logarithms, first differences will give percentage changes. In other words, impulse response functions can be interpreted as the percentage change in a variable following a shock to another variable of interest.

³³ Turning to the impulse response functions, we focus on the dynamic effects of shocks to implicit assistance. All simulations are performed considering a one percent transitory shock to implicit assistance (*IAID*) and its impact on macroeconomic variables in the decade following the shock.

about 4 percentage points on impact, while real GDP and revenue growth rates improve by about 1½ percentage points. Second, the effect of *IAID* on the current account and reserves dies out after one year, while that on GDP and government revenues persists longer and dies out after about three years. Following an initial rise in output growth due to the positive shock to implicit assistance, the persistence of the increase in output growth likely reflects the historical dependence of the Windwards on trade preferences and the export of bananas.

51. **Implicit assistance also explains a large share of the variability of the macroeconomic variables.** Figure II.10 displays the variance decompositions from the estimated VAR model, and show what proportion of the forecast error variance (at different forecast horizons) can be attributed to the *IAID* shock. The variance decomposition shows that the impact of *IAID* shocks is strongest for *GDP* (where it explains about 30 percent of the variance), while for the other variables this peaks at about 20 percent.³⁴

H. Conclusions

52. **European Union trade preferences for banana exports have afforded the Windward Islands considerable—albeit declining—implicit transfers.** Implicit assistance to the Windward Islands peaked at about 15 percent of GDP in the early 1990s, yet with the decline in banana production has fallen to about 3 percent of GDP by 2005. In tandem with dramatic declines in official development assistance, over the last two decades most of the Windward Islands have experienced the loss of annual external assistance flows equivalent to about 10 percent of GDP.

53. **The erosion of EU trade preferences for bananas has had, and will continue to have, an adverse effect on the economies of the Windward Islands.** Using partial equilibrium analysis, this chapter finds a significant adverse effect from preference erosion in 2006 on the trade balance, economic growth, and the overall fiscal balance. Moreover, the erosion of trade preferences is estimated to lower output over the medium term by about 1½ to 2 percent from its 2005 level in St. Vincent and the Grenadines and St. Lucia. The results from a vector autoregressive model suggest that shocks to implicit assistance (derived from trade preferences) have had a significant impact on economic growth in the Windward Islands.

54. **Although much of the macroeconomic impact of preference erosion has already been felt by these economies, the challenge remains to grapple with the social effects.** In particular, incomes and employment prospects for poor rural households, which have limited alternative employment opportunities, have been severely affected. This suggests the

³⁴ The results for individual-country VARs for the impulse response functions and variance decompositions are similar to those obtained for the panel VAR, and are available from the authors.

importance of well-targeted social safety nets and transition measures, such as income transfers, retraining programs, and noncontributory pensions.

55. **Preference-dependent countries should continue in their efforts to raise the efficiency of their banana sectors and allow for the smooth shift of resources into other sectors of their economies.** While significant productivity gains in bananas are unlikely for the Windward Islands, scope lies in orienting production toward fair trade and organic bananas, and in diversifying into non-banana agriculture (which could be encouraged through the provision of limited subsidies on agricultural inputs). There is also a need to facilitate the creation of new sources of income and employment by improving the investment climate and enhancing labor force skills.

Box II.1. Partial Equilibrium Methodology

The methodology is based on the national accounting framework, and predicated upon a small-economy model with constant marginal propensity to consume, export supply elasticity, and income elasticity of the demand for imports. Bananas are assumed to be of homogenous quality and, therefore, perfectly substitutable irrespective of the country of origin. Producers are considered to be price-takers in world markets.

The erosion of trade preferences results in a deterioration of the price received by banana exporters. The resulting impact on the value of exports can be estimated as:

$$\frac{\Delta X}{X} = \frac{\Delta P}{P} + \varepsilon_x \frac{\Delta P}{P} \left(\frac{\Delta P}{P} + 1 \right)$$

where X is the value of exports, P is the unit price of the commodity of interest, and ε_x is the export supply elasticity. The assumption of constant export supply elasticity is only a necessary simplification. Based on the literature, a central elasticity of 1.5 is assumed for the projections, although other values within the range of 0.5 and 3 are also plausible, depending on country circumstances. For presentational purposes, the banana export unit values (in euros) are lowered by about 14 percent at the beginning of 2006, and this price is maintained throughout the projection period. Exports other than bananas are assumed to grow at an exogenously determined rate, and total exports are defined as the sum of banana and other exports ($X = X^{\text{other}} + X^{\text{banana}}$).

GDP growth in the economy is assumed to be driven exclusively by growth in total exports:

$$\Delta Y = \frac{1}{1 - MPC} \Delta X$$

where Y denotes GDP at market prices in U.S. dollars; MPC is the marginal propensity to consume and $1/(1-MPC)$ is a multiplier. Variations in income are expected to affect imports via the following expression:

$$\frac{\Delta M}{M} = \varepsilon_M \frac{\Delta Y}{Y}$$

where ε_M is the income elasticity of imports, assumed to be 0.7. The overall trade balance is computed as a difference between total exports and total imports.

On the fiscal revenues (R) side, the model assumes a constant tax revenue effort in percent of GDP and specifically identifies expected grants (G), which are associated with banana sector restructuring ($R = T + G^{\text{banana}}$). Public sector expenditures (E) are specified similarly, identifying public spending on banana industries and an exogenously determined growth path of other expenditures ($E = E^{\text{other}} + E^{\text{banana}}$). The overall fiscal balance of the central government is computed as a difference between tax revenue and expenditures. What follows is a schematic representation of the model:

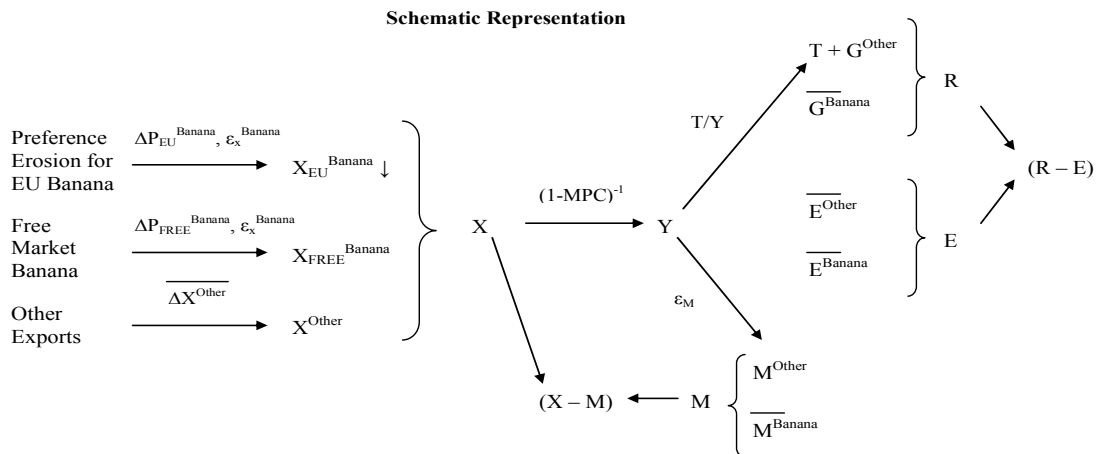
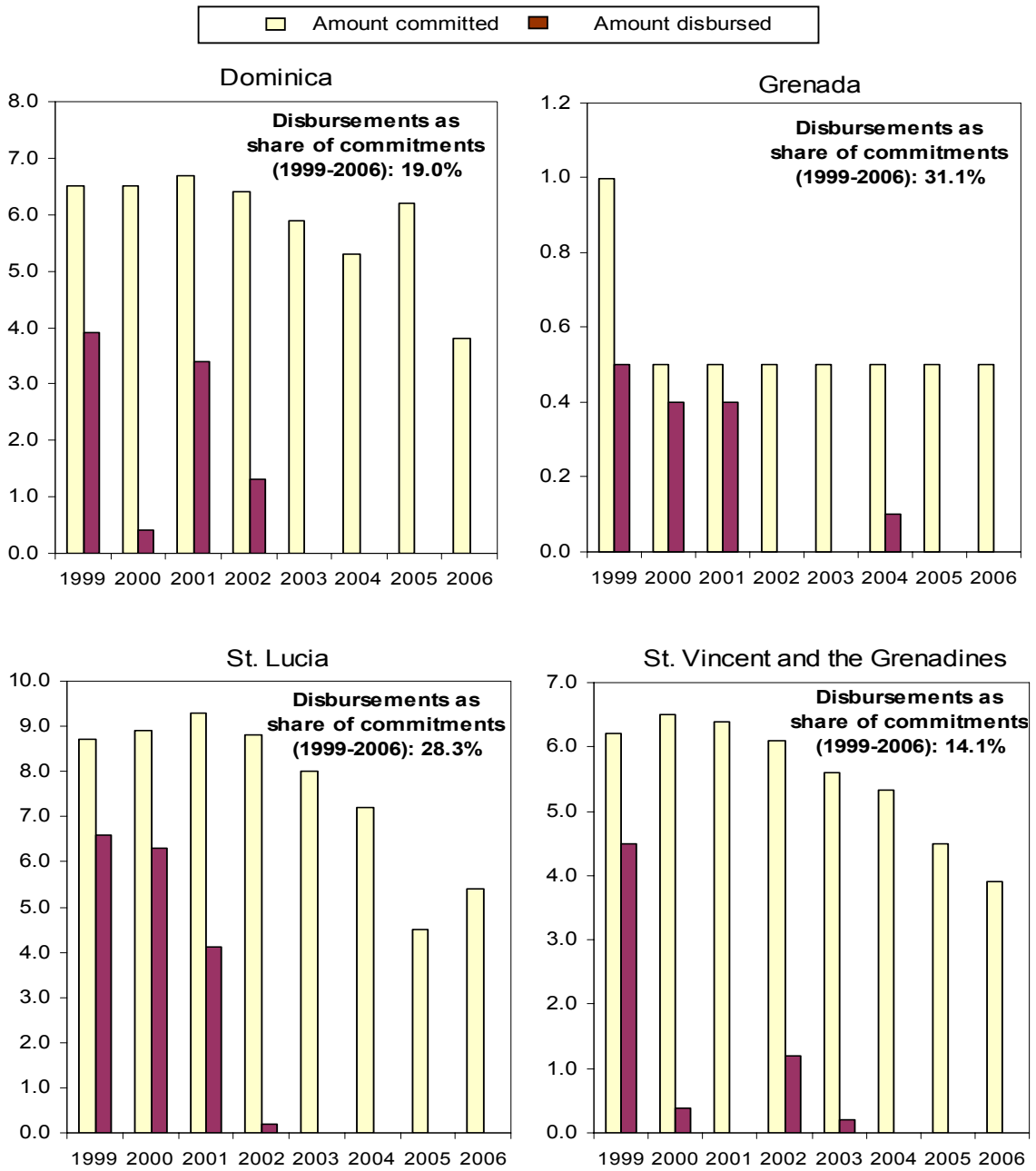
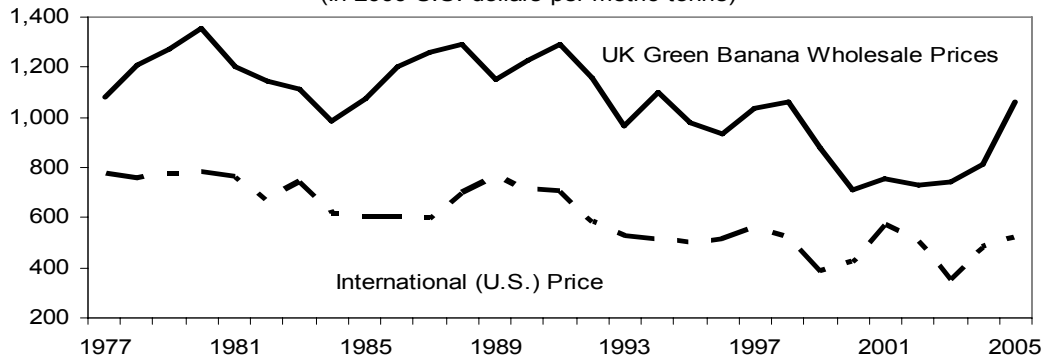


Figure II.1. Windward Islands: Status of EU Banana Support 1/
(In millions of Euros)



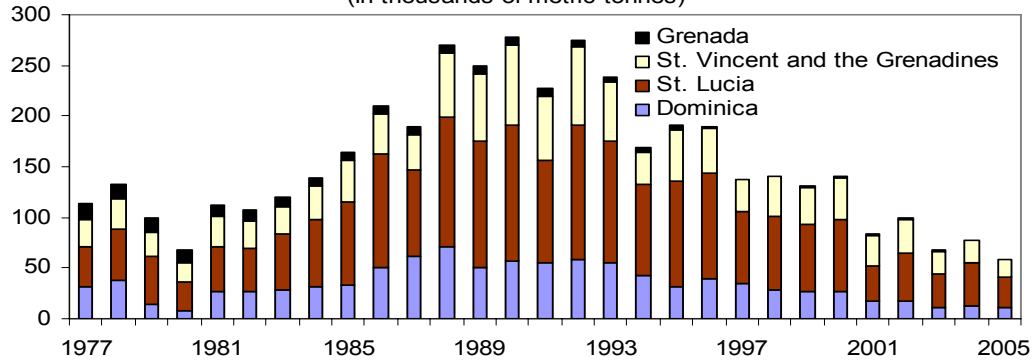
Source: Delegation of the European Commission, Barbados.
1/ Under Special Framework of Assistance, as of end-September 2006.

Figure II.2. Evolution of Real Banana Prices
(In 2000 U.S. dollars per metric tonne)



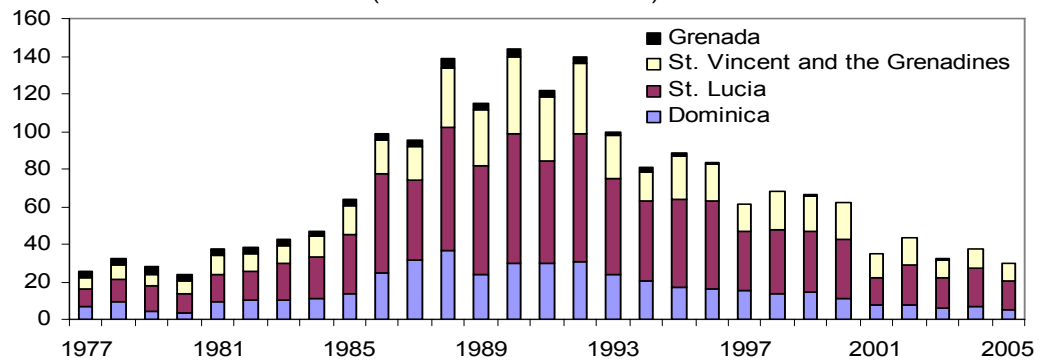
Sources: IMF, World Economic Outlook; World Bank; WIBDECO; U.S. Department of Agriculture; and Fund staff estimates.

Figure II.3. Windward Islands: Banana Export Volumes
(In thousands of metric tonnes)



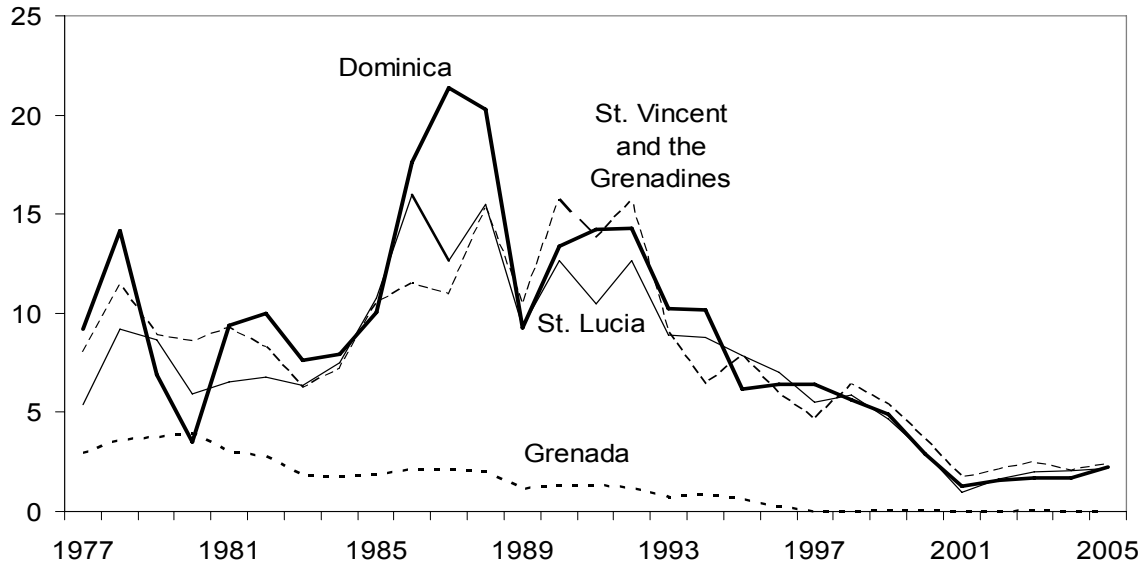
Source: Country authorities; WIBDECO; and Fund staff

Figure II.4. Windward Islands: Banana Export Earnings
(In millions of U.S. dollars)



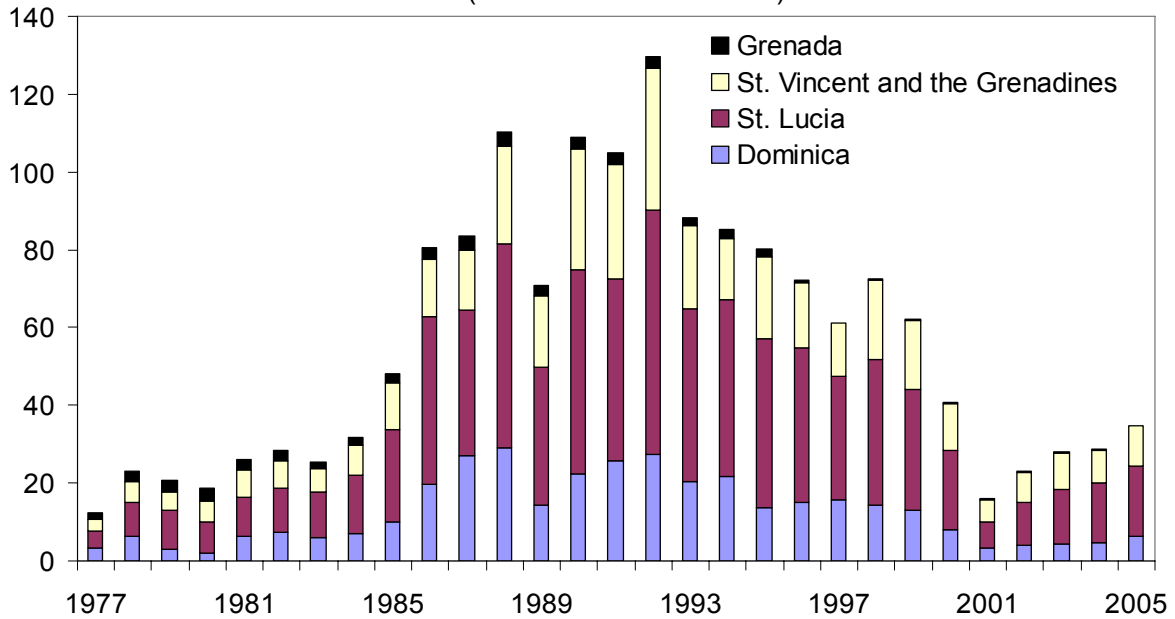
Source: Country authorities; WIBDECO; and Fund staff estimates.

Figure II.5. Windward Islands: Implicit Assistance Derived from EU Banana Trade Preferences
(In percent of GDP)



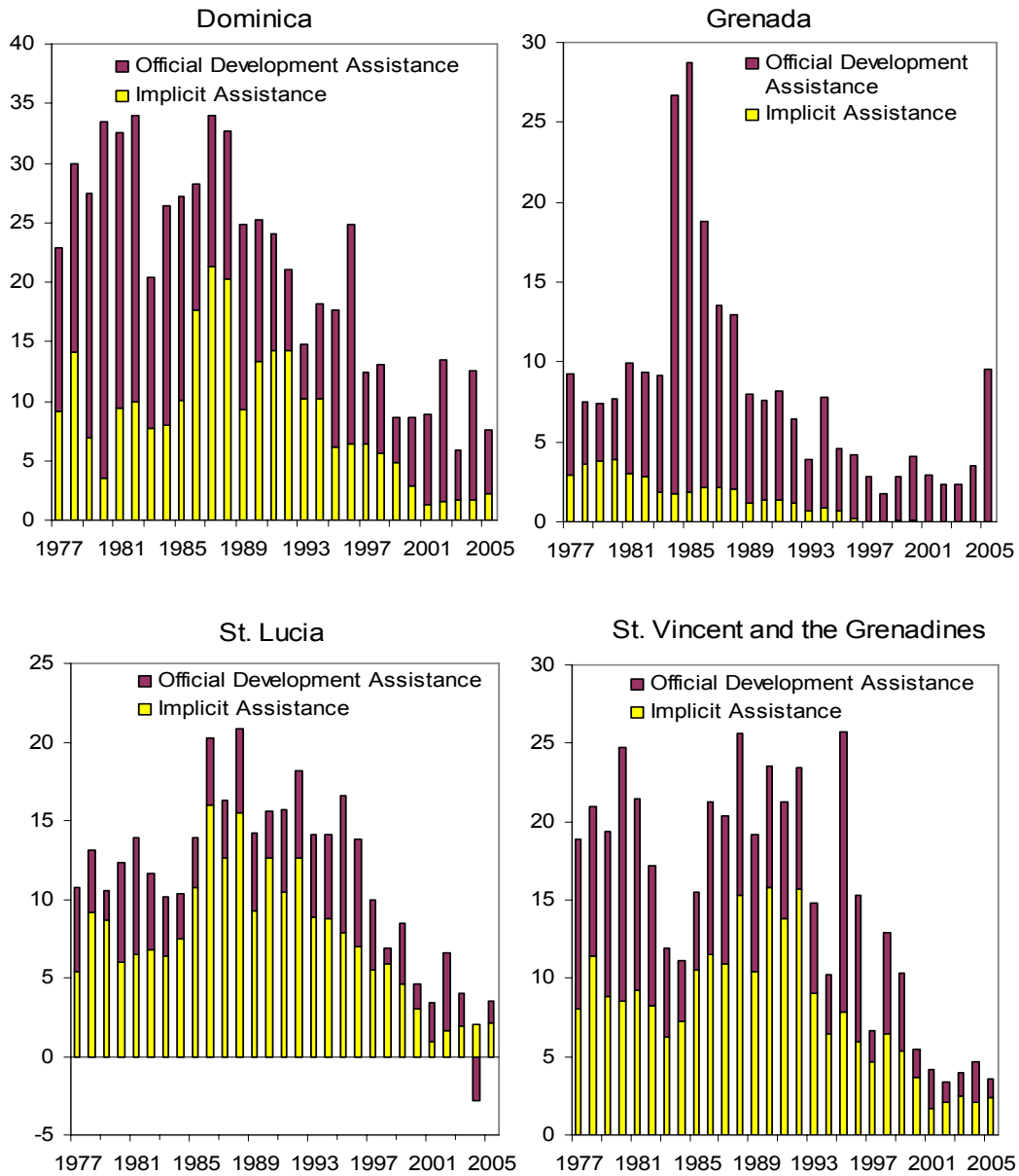
Source: Fund staff calculations.

Figure II.6. Windward Islands: Implicit Assistance Derived from EU Banana Trade Preferences
(In millions of U.S. dollars)



Source: Fund staff calculations.

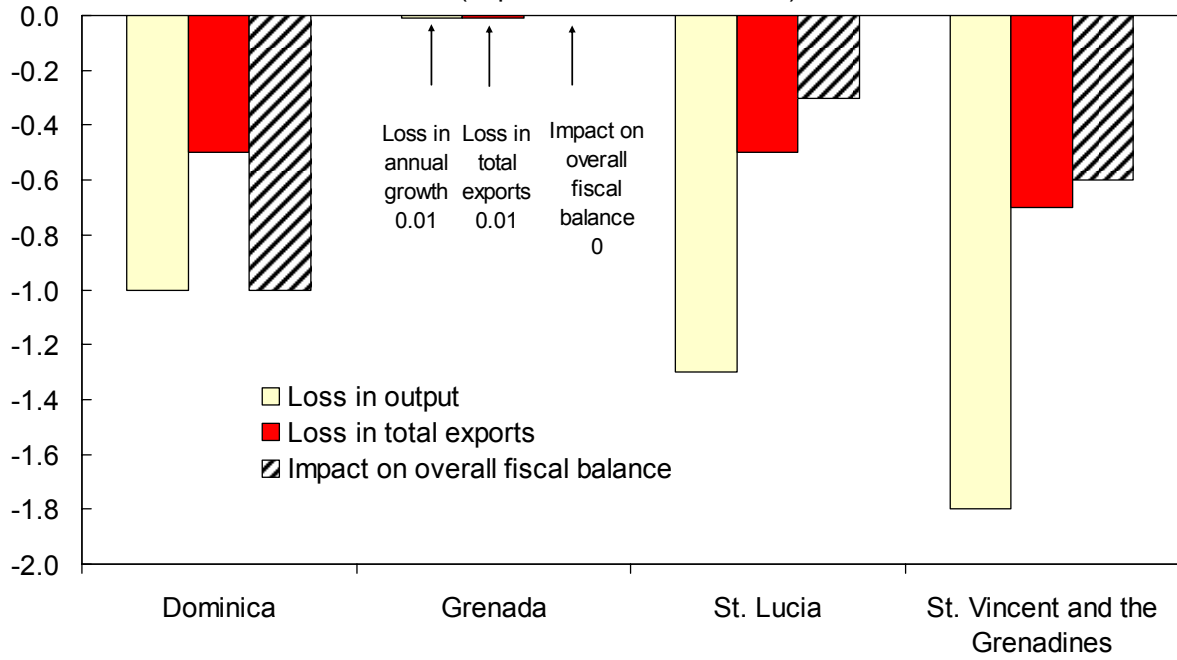
Figure II.7. Windward Islands: Nominal External Assistance (Official and Implicit)
(In percent of GDP)



Sources: OECD, and Fund staff calculations.

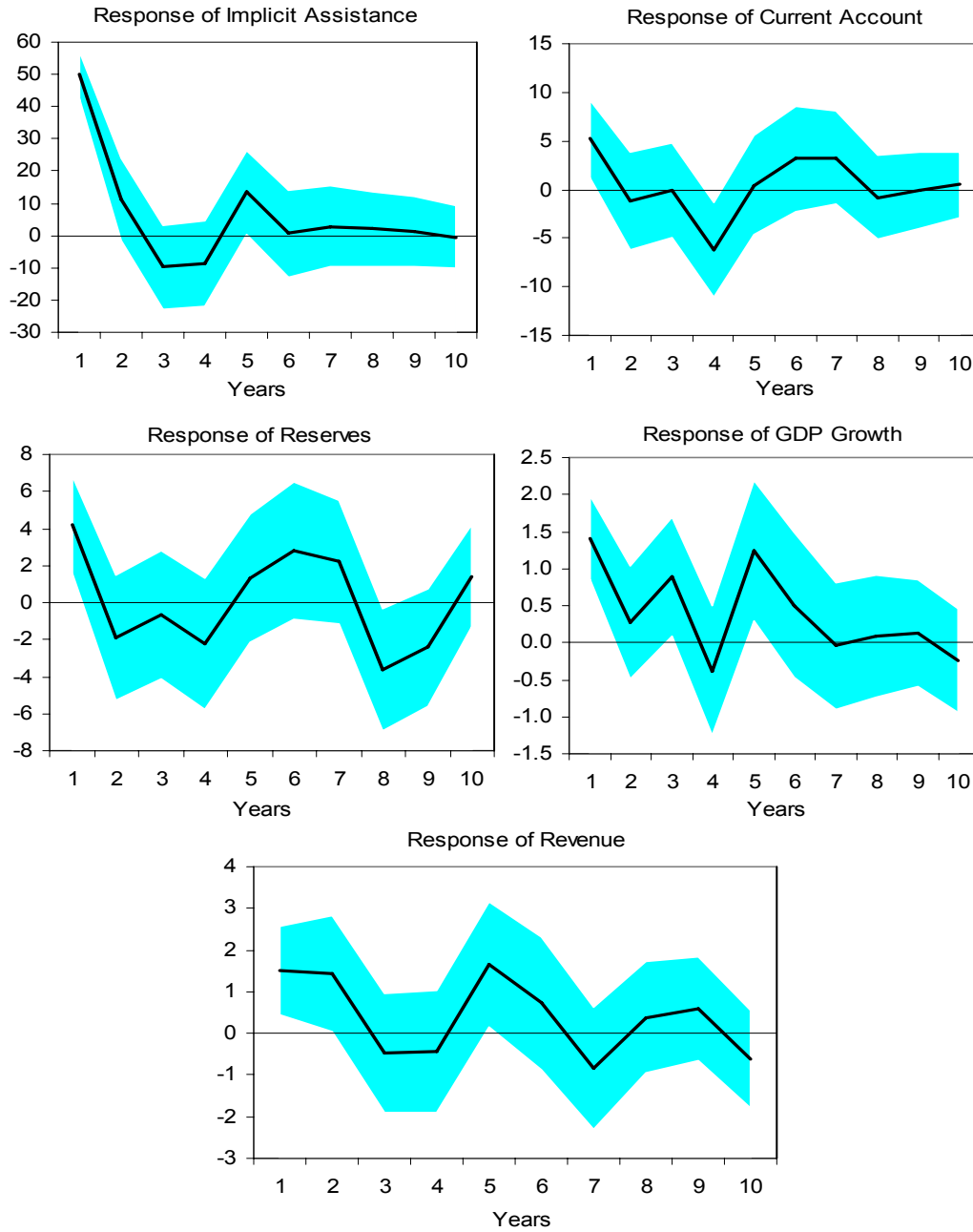
Note: Official Development Assistance (ODA) as defined by the OECD includes: grants, net concessional loans (including amortization payments), and technical cooperation from official agencies (including state and local governments, or by their executive agencies).

Figure II.8. Windward Islands: Impact of Preference Erosion, 2006
(In percent of GDP in 2005)



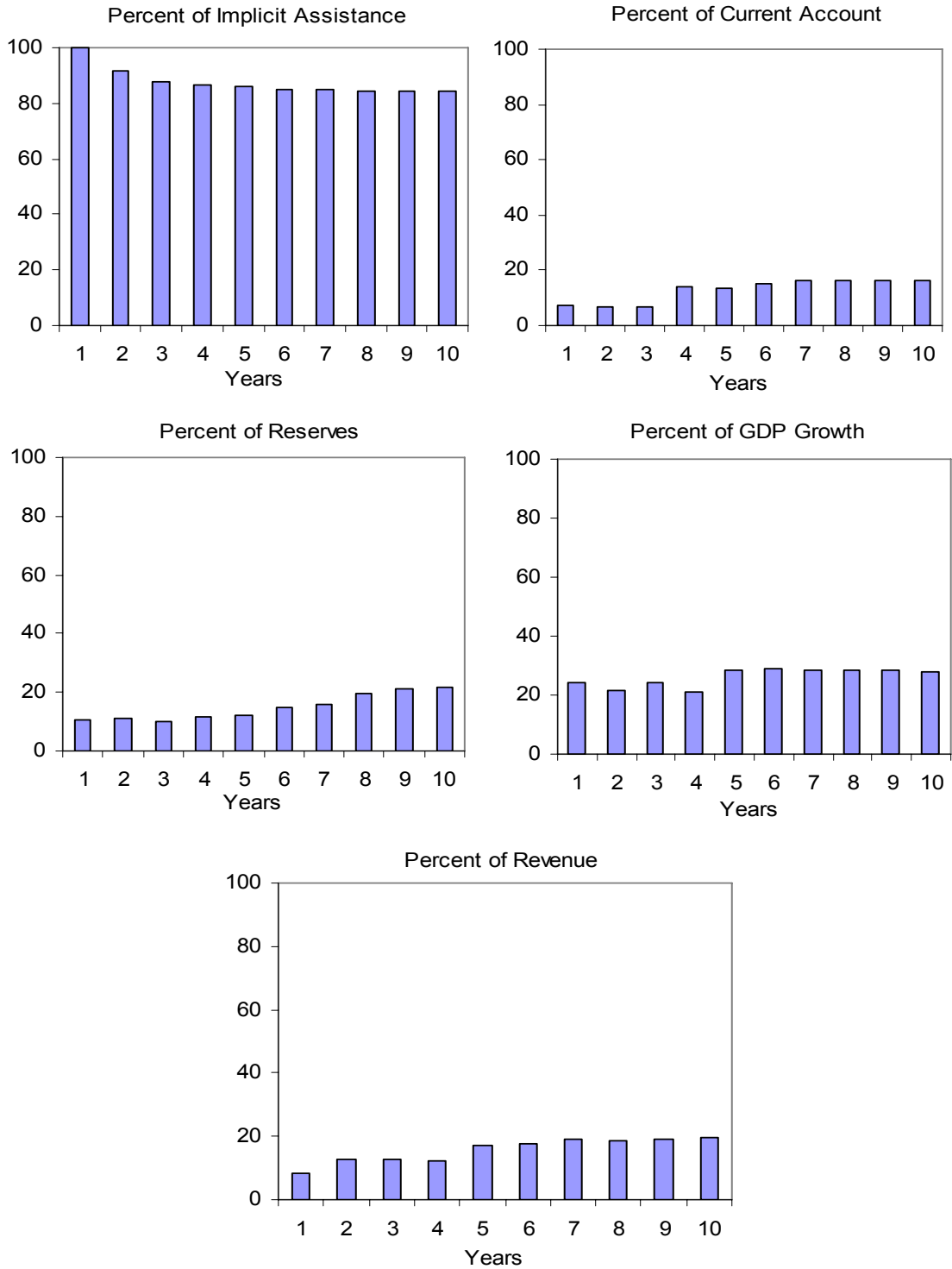
Source: Fund staff calculations.

Figure II.9. Windward Islands: Impulse Response Functions
(Response to Cholesky one standard deviation innovation in
implicit assistance)



Source: Authors' calculations.
Note: The shaded region represents ± 2 standard errors.

Figure II.10. Windward Islands: Variance Decomposition
(Percent of variance explained by implicit assistance)



Source: Authors' calculations.

Table II.1. Windward Islands: Implicit Assistance from EU Banana Preferences, 1995-2005
(In millions of U.S. dollars)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
	(Calculations based on European wholesale and U.S. landed prices)											
Dominica	13.6	15.0	15.5	14.4	13.0	7.9	3.4	3.9	4.3	4.7	6.4	9.3
<i>In percent of total export of goods and services</i>	12.2	12.3	11.3	9.5	8.3	5.5	2.8	3.2	3.6	3.6	4.6	7.0
<i>In percent of GDP</i>	6.2	6.4	6.4	5.6	4.9	2.9	1.3	1.6	1.7	1.7	2.3	3.7
Grenada	1.9	0.7	0.0	0.0	0.3	0.2	0.1	0.1	0.2	0.1	0.0	0.3
<i>In percent of total export of goods and services</i>	1.5	0.5	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.2
<i>In percent of GDP</i>	0.7	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
St. Lucia	43.6	39.8	31.8	37.5	31.1	20.4	6.6	11.2	14.1	15.5	18.0	24.5
<i>In percent of total export of goods and services</i>	11.5	11.3	8.9	9.6	8.5	5.3	1.9	3.5	3.6	3.3	3.6	6.4
<i>In percent of GDP</i>	7.9	7.0	5.5	5.9	4.6	3.0	1.0	1.6	2.0	2.0	2.2	3.9
St. Vincent and the Grenadines	21.0	16.7	13.8	20.5	17.8	12.2	5.9	7.7	9.4	8.3	10.4	13.1
<i>In percent of total export of goods and services</i>	15.4	11.2	9.4	13.0	10.1	6.9	3.4	4.3	5.4	4.7	5.5	8.1
<i>In percent of GDP</i>	7.9	5.9	4.7	6.4	5.4	3.6	1.7	2.1	2.5	2.1	2.4	4.1
	(Calculations based on fob unit export values)											
Dominica	7.4	5.0	5.0	5.8	7.5	5.0	2.3	2.7	2.7	3.4	2.5	4.5
<i>In percent of total export of goods and services</i>	6.6	4.1	3.7	3.8	4.8	3.4	1.9	2.2	2.3	2.7	1.8	3.4
<i>In percent of GDP</i>	3.4	2.1	2.1	2.3	2.8	1.8	0.9	1.1	1.0	1.3	0.9	1.8
Grenada	0.6	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
<i>In percent of total export of goods and services</i>	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
<i>In percent of GDP</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
St. Lucia	17.4	16.2	10.7	13.4	16.2	14.0	5.6	8.7	7.1	9.2	7.2	11.4
<i>In percent of total export of goods and services</i>	4.6	4.6	3.0	3.4	4.4	3.6	1.7	2.7	1.8	1.9	1.4	3.0
<i>In percent of GDP</i>	3.2	2.8	1.8	2.1	2.4	2.0	0.8	1.3	1.0	1.2	0.9	1.8
St. Vincent and the Grenadines	8.2	6.7	4.5	9.4	9.7	8.4	4.0	5.4	2.7	3.1	4.1	6.0
<i>In percent of total export of goods and services</i>	6.0	4.5	3.1	6.0	5.5	4.7	2.3	3.0	2.2	2.6	2.2	3.8
<i>In percent of GDP</i>	3.1	2.4	1.5	2.9	2.9	2.5	1.1	1.5	1.0	1.1	1.0	1.9
Memorandum items												
Average banana unit values for EU exports (U.S. dollars per tonne)	466	437	443	483	506	449	423	441	436	441	508	458
Free market (fob) unit value (U.S. dollars per tonne) 1/	275	280	310	286	266	242	260	266	263	251	261	269
EU export unit values (as a percent of free market prices)	170	156	143	169	190	185	163	166	166	176	195	171

Sources: Country authorities; IMF, World Economic Outlook; U.S. Department of Agriculture; and Fund staff estimates.

1/ Based on Ecuador bananas exported to the U.S.

Table II.2. Windward Islands: Correlation Between Variables (First Differences) 1/

	IAID	CUR	RES	GDP	REV
Dominica					
IAID	1.000				
CUR	0.334	1.000			
RES	-0.016	0.470	1.000		
GDP	0.508	-0.369	-0.615	1.000	
REV	0.265	-0.302	-0.041	0.481	1.000
Grenada					
IAID	1.000				
CUR	0.228	1.000			
RES	0.305	0.073	1.000		
GDP	0.314	-0.245	0.406	1.000	
REV	0.240	-0.078	-0.012	0.460	1.000
St. Lucia					
IAID	1.000				
CUR	0.115	1.000			
RES	0.156	0.135	1.000		
GDP	0.698	-0.030	0.045	1.000	
REV	0.569	-0.165	0.024	0.592	1.000
St. Vincent and the Grenadines					
IAID	1.000				
CUR	0.327	1.00			
RES	0.310	-0.170	1.000		
GDP	0.773	0.423	0.247	1.000	
REV	0.098	-0.289	0.378	-0.130	1.000

Source: Authors' calculations.

Note: Variables are denoted as follows: IAID (implicit assistance derived from banana trade preferences); CUR (current account balance); RES (gross official reserves); GDP (gross domestic product); REV (central government revenues). All variables are in real terms, deflated by the consumer price index and the GDP deflator (for GDP). See Appendix I for further details.

1/ Following Agenor et al. (2000), the approximate standard error of the correlation coefficients, computed under the null hypothesis that the true correlation coefficient is zero, is 0.19 (T=28).

Appendix I: Data Sources and Issues

I. Banana Prices

Computations of implicit assistance (IAID) contained in this chapter are based on price differences between protected market prices (United Kingdom/European Union) and free market international prices—the preference margin from exporting to protected European markets.

1. *Unit wholesale prices for the United Kingdom market*

These are proxied by:

- *For the period 1975–1996:* The unit price for banana exports received by the Windward Islands in the United Kingdom. This is the c.i.f. price at the port after offloading and loading on a truck, that is including the port-handling charges. Prices are available until 1999.
- *For the period 1997–2005:* World Bank unit prices for European Union banana imports (originally sourced from Sopisco News, Food and Agriculture Organization and the World Bank’s own estimates). Specifically, these are the prices of Central and South American bananas—major brands (mainly Dole and Del Monte)—free on truck (f.o.t.) Hamburg, and include discharge costs. Prices also include European Community import taxes. The first year such prices are available is 1997.

As a result, some discontinuity is expected in the series in 1997, due to (a) differences in discharge costs between Hamburg and London; and (b) possible differences in rents captured from bananas between Caribbean ACP (Africa, Caribbean and Pacific) countries and from Latin American banana exporters such as Ecuador, Honduras and Costa Rica.

2. *International unit prices*

These are proxied by:

- IMF data on banana exports, fob, for the four Windward Islands. It is assumed that all banana exports are destined for the United Kingdom (and later the European Union) market. Data on export values and volume are taken from the ECCB and WIBDECO, and are available for the period 1970–2005.
- The unit price data of ‘dollar’ bananas is proxied by the U.S. import price of bananas from Central and South America, f.o.t., and includes upload charges to truck or rail. This data is available from the IMF’s *World Economic Outlook* database.

II. Banana Volumes

To calculate the *value* of implicit assistance (in terms of additional export revenues received by Windward Islands ACP countries), the preference margin for each year is multiplied by the annual volume of exports (in tonnes) for each country. Data on export volumes for the Windward Islands (Dominica, Grenada, St. Lucia and St. Vincent and the Grenadines) are taken from the Eastern Caribbean Central Bank.

III. Macroeconomic Data

All macroeconomic data on gross domestic product (GDP), current account (CUR)³⁵, international reserves (RES), and central government revenues (REV) are from IMF *International Financial Statistics* and *World Economic Outlook* databases, completed by data from the country authorities. For most variables, data for 2005 is based on IMF staff estimates.

To obtain real domestic variables, all nominal variables are deflated by the national consumer price index (CPI), which is taken from the Eastern Caribbean Central Bank. An exception is nominal GDP, which is deflated by the GDP deflator (base 1990=100) and is taken from the Eastern Caribbean Central Bank. Data on international variables expressed in U.S. dollars such as international prices and exports are deflated by the U.S. CPI.

³⁵ In order to avoid logs of negative numbers, to compute the variable *CUR* we use the approximation $\ln(1+\text{current account}/\text{GDP})$.

References

- Agénor, P., C. J. McDermott, and E. Prasad, 2000, “Macroeconomic Fluctuations in Developing Countries: Some Stylized Facts,” *World Bank Economic Review*, Vol. 14, pp. 251–85.
- Alexandraki, K., and H.P. Lankes, 2004, “The Impact of Preference Erosion on Middle-Income Developing Countries,” IMF Working Paper 04/169 (Washington DC: International Monetary Fund).
- Amiti, M., and J. Romalis, 2006, “Will the Doha Round Lead to Preference Erosion?,” IMF Working Paper 06/10 (Washington DC: International Monetary Fund).
- Borell, B., 1999, “Bananas: Straightening Out Bent Ideas on Trade as Aid,” Centre for International Economics (Canberra: Centre for International Economics).
- Commonwealth Secretariat, 2004, “Preference-Dependent Economies and Multilateral Liberalization: Impacts and Options,” (London: Commonwealth Secretariat).
- Deaton, A., and R. Miller, 1995, “International Commodity Prices, Macroeconomic Performance, and Politics in Sub-Saharan Africa,” *Princeton Studies in International Finance*, No. 79 (Princeton: New Jersey).
- Dickson, A., 2003, “The EU Banana Regime: History and Interests,” Commissioned by Banana Link for EUROBAN, mimeo.
- Food and Agriculture Organization (FAO), 2004, “Bananas: Is There a Tariff-Only Equivalent to the EU Tariff Rate Quota Regime? Insights from Economic Analysis,” FAO Trade Policy Technical Notes No. 3 (Rome: Food and Agriculture Organization).
- Food and Agriculture Organization (FAO), 2005, “Small Island Developing Countries: Agricultural Production and Trade, Preferences and Policy,” FAO Technical Paper No. 7 (Rome: Food and Agriculture Organization).
- International Monetary Fund, 2001, “The Restructuring of the Banana Industry in St. Lucia and the Windward Islands,” in St. Lucia: Selected Issues and Statistical Appendix, IMF Country Report No. 02/14, pp. 6–23.
- Myers, G., 2004, *Banana Wars: the Price of Free Trade—a Caribbean Perspective* (London: Zed Books).

National Economic Research Associates (NERA) and Oxford Policy Management, 2004, “Addressing the Impact of Preference Erosion in Bananas on Caribbean Countries,” Report Prepared for Department for International Development, London.

National Economic Research Associates (NERA), 2003, “Banana Exports from the Caribbean since 1992,” Preliminary Report Prepared for the Caribbean Banana Exporters Association, London.

Sanchez, J., 2004, “Obtaining the Tariff Equivalent to the Current Banana Regime in the European Union (25), According to the Attachment to Annex 5 of the WTO Agreement on Agriculture,” mimeo (Madrid: World Trade Organization).

Sandiford, W., 2000, *On the Brink of Decline: Bananas in the Windward Islands* (St. George’s: Cedon Books).

Subramanian, A., 2003, “Financing of Losses from Preference Erosion,” Paper prepared for the World Trade Organization, WT/TF/COH/14, February.

Williams, O., and R. Darius, 1998, “Bananas, the WTO and Adjustment Initiatives in the Eastern Caribbean Central Bank Area”, mimeo, Eastern Caribbean Central Bank.

Williams, O., W. Sandiford, and A. Phipps, 1999, “Banana Price Shocks and Adjustment Within a Unified Currency Area,” *Applied Economics*, Vol. 31, pp. 1455–66.

III. THE SIZE OF THE INFORMAL ECONOMY IN THE CARIBBEAN³⁶

A. Introduction

56. **The existence of large informal sectors is an important characteristic of many developing countries.** The informal economy can have sizeable budgetary implications, and implications for tax incidence and income distribution (Giles, 1999; Dabla-Norris and Feltenstein, 2003). As a result, measuring the informal economy has evoked considerable interest and methodological debate among both academics and policymakers (see Tanzi, 1982; 1999). This chapter extends the empirical literature on the analysis of the size of the informal economy to the countries of the Caribbean.

57. **There is no single definition as to what constitutes the informal economy.** A wide range of similar terms have been used in the literature such as hidden economy, shadow economy, clandestine economy, parallel economy, subterranean economy, unreported economy, cash economy and black economy. More recently, however, there appears to be a growing consensus regarding the definition of several of these terms. Following Feige (1996), the informal economy is defined to comprise those economic activities that circumvent the costs and are excluded from the benefits and rights incorporated in the laws and administrative rules covering property relationships, commercial licensing, labor contracts, torts, financial credit and social systems. Thus, a measure of the informal economy is the income generated by economic agents who undertake the stated activities.³⁷

58. **Measuring the size of the informal economy is important for several reasons.** First, there appears to be strong evidence of a direct link between the size of the informal economy and tax evasion. Table III.1 shows, using data for the early 1990s, that there is a positive relationship between these two concepts. As extreme cases, Bolivia, which had an informal economy of approximately 65 percent of GDP, experienced VAT tax evasion of about 45 percent of GDP; while New Zealand, which had a small informal economy of around 12 percent, had a much lower level of tax evasion at close to 5 percent of GDP (Schneider and Enste, 2000a; Silvani and Brondolo, 1993). Second, employment in the informal economy has an impact on the financial viability of social security and social protection systems, which depend on revenues from the formal sector.³⁸ Third, the magnitude of the informal economy provides an estimate of the potential revenue gain from tax reforms targeted at enhancing compliance and broadening the tax net.

³⁶ Prepared by Guillermo Vuletin.

³⁷ Similarly, Portes, et al. (1989) define the informal economy as "...a process of income-generation characterized by one central feature: it is unregulated by the institutions of society, in a legal and social environment in which similar activities are regulated."

³⁸ For additional details on Caribbean social security systems, see Roache (2006).

59. **This is the first study that estimates the size of the informal economy for a large cross-section of the countries of the Eastern Caribbean Currency Union (ECCU) and the wider Caribbean.** The size of the informal economy in the early 2000s is found to vary considerably—from a low of around 15 percent of measured GDP for The Bahamas to a high of over 50 percent of measured GDP for St. Vincent and the Grenadines. However, the average size of the informal economy for the ECCU and Caribbean countries (around 33 percent of GDP) is lower than that found for Latin American economies (which average about 43 percent of GDP).³⁹

60. **The remainder of the chapter is organized as follows.** Section B describes the different methods used in the literature to estimate the size of the informal economy, and outlines the estimation approach used in this chapter—“Multiple Indicators, Multiple Causes” (MIMIC). Section C presents the set of countries and variables used in the analysis. The empirical results are discussed in Section D, while Section E concludes.

B. Methods of Estimating the Size of the Informal Economy

61. **Different methods have been used in the literature to measure the size of the informal economy.** While some studies use direct methods based on surveys, most studies use indirect methods such as (i) the “electricity consumption” approach of Kauffman and Kaliberda (1996); (ii) the “monetary transaction” approach of Feige (1979); (iii) the “currency demand” approach of Cagan (1958) and others; and (iv) use of the “Multiple Indicators, Multiple Causes” (MIMIC) approach of Frey and Weck-Hanneman (1984).⁴⁰ This paper draws on Loayza (1997) and uses the MIMIC approach to both estimate the size of the informal economy and gauge its effect on the provision of social security, unionization, and school enrollment.

62. **The MIMIC method is based on a structural equation model approach that treats the size of the informal economy as a latent (unobserved) variable with several causes and several indicators (or effects).** The methodology uses associations between the observable causes and the observable effects of a latent variable (i.e., the informal economy),

³⁹ The study is based on data from: Antigua and Barbuda, Argentina, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Cyprus, Dominica, Dominican Republic, Ecuador, El Salvador, Fiji, Grenada, Guatemala, Guyana, Honduras, Jamaica, Malta, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, The Bahamas, Trinidad and Tobago, Uruguay and Venezuela. However, only the findings for the Fund-member countries of the ECCU (Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines) and other Caribbean countries are reported in this chapter. For a complete discussion of the remaining countries, see Vuletin (2007).

⁴⁰ A thorough review of these approaches is discussed in Schneider and Enste (2000a, 2000b) and OECD (2002).

to estimate the unobserved factor itself (Loayza, 1997).⁴¹ Additional details regarding the MIMIC methodology can be found in Appendix I.

63. Several reasons underpinned the choice of the MIMIC method to calculate the size of the informal economy in the Caribbean.⁴² These include:

- Tax auditing and other similar survey based methods are not available for most Caribbean countries in the sample.
- The electricity, transaction and currency demand approaches require country-specific information about the informal economy in at least the base year, which is not available for the ECCU and other Caribbean countries.⁴³ The cross-section MIMIC approach only requires information regarding the absolute value of the informal economy for one country in the sample.
- In addition, the transaction and currency demand approaches would tend to underestimate the relevance of the informal economy in countries subject to a high degree of dollarization in circulating currency (such as in the ECCU).⁴⁴ This occurs because although monetary data is easily obtained for local currency, it is not for the circulation of foreign currency outside the domestic banking system.

C. Data and Methodology

64. Due to constraints in obtaining data on foreign currency in circulation in the ECCU, this study only considers non-financial cause and indicator variables. The variables chosen as cause and indicator variables have been selected according to economic theory on the determinants of the informal economy, and on the basis of data availability. A brief description of the causal and indicator variables, as well as the expected relationship with the informal economy in the context of the MIMIC estimation strategy, is presented in

⁴¹ Loayza (1997) measured the informal economy for 14 Latin American countries for the early 1990s, using variables such as: the tax burden, labor market restrictions and governance variables that capture the strength and efficiency of government institutions as *causal* variables; tax evasion information and the share of labor force contributing to social security schemes as *indicators* of the informal economy.

⁴² A more detailed discussion about the main advantages and weaknesses of each methodology, and the justification for using the MIMIC approach, can be found in Vuletin (2007).

⁴³ See below, however, for a study on Jamaica.

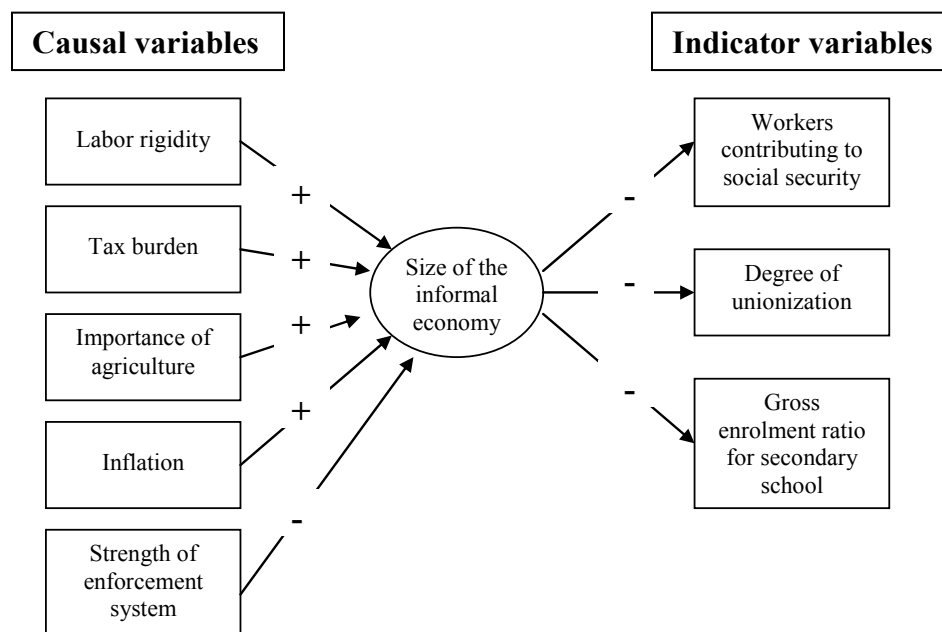
⁴⁴ Recent work (Feige, et al. (2001, 2002) and Feige (1996, 2003)) confirm that dollarization is relevant for both low-inflation countries like the ECCU (because of tourism and currency substitution issues) and for high-inflation countries like Argentina and Mexico (due to asset substitution).

Box III.1 and Box III.2, and in Appendices I and II. The estimation period is the early 2000s, using data on the previously-listed 32 Caribbean, Latin American and island countries.⁴⁵

Box III.1. Representation of the “Multiple Indicators, Multiple Causes” (MIMIC) Methodology

The MIMIC methodology is a structural equation-based modeling approach that treats the size of the informal economy as a latent variable. While the measure of the informal economy is *unobservable*, many of its causes and indicators or manifestations are *observable* variables. This methodology relies on the associations between the causes and indicators to estimate the size of the (unobservable) informal economy itself. For example, if a higher tax burden is believed to (cause) an increase in the size of the informal economy and the latter variable is supposed to (indicate) a likely decrease in the number of workers contributing to the social security system, then there should be a negative relation between the tax burden and workers contributing to the social security system. The MIMIC approach estimates the coefficients linking the cause variables with the informal economy, and those connecting the informal economy with its indicators, based on the *actual* relationships between the cause and indicator variables. If the *actual* correlations strongly match the *expected* ones, then the estimated coefficients should have the appropriate signs and be statistically significant. The coefficients linking the cause variables and the informal economy can then be used to effectively calculate the size of the informal economy. See Appendix I for additional details.

Considering the set of proposed variables (see Box III.2), the MIMIC strategy as well as the expected sign of the coefficients (where + (-) denotes that the former variable is positively (negatively) related to the latter) can be represented by the following diagram.



⁴⁵ Since 2000, several Caribbean countries have introduced market-oriented reforms and tax reforms designed to broaden the tax base and enhance compliance. Accordingly, given that the period of estimation is the early 2000s, the results obtained here may represent an upper bound to the actual size of the informal economy.

Box III.2. Variables Considered in the Analysis

Causal variables:

Tax burden: calculated as the average of the highest statutory corporate and personal tax rate.

Labor rigidities: proxied with two alternative indices that include minimum wage constraints (captured as the ratio of minimum wage to GDP per capita) and mandated benefits (based on social security contribution rates).

Importance of agriculture: measured by agriculture and food exports as percentage of total exports. Included as many studies endorse the idea that informal work is highly segmented by sectors of the economy, with clear prevalence in agriculture and related sectors.

Inflation: included following Giles (1999), to allow for the upward “creep” of taxpayers through the tax brackets induced by it, and the associated incentive for taxpayers to engage in informal activities.

Strength of enforcement system: as in Loayza (1997), is captured by an average of quality of bureaucracy, corruption in government and rule of law, taken from International Country Risk Guide.

Indicator variables:

Workers contributing to the social security system: measured as a percentage of the labor force.

Degree of unionization: percentage of labor force with membership of a labor union.

Gross enrollment ratio for secondary school: most countries in the world have signed the International Labor Organization Convention 138, which made fourteen the minimum working age; however, one of the well-recognized consequences of the informal economy is related to child labor and the effect it has on rates of education enrollment. Due to the lack of data on the primary net enrolment rate, the secondary gross enrolment rate is used.

D. Empirical Results

65. **The correlations between causal and indicator variables match the expected signs, providing preliminary support for the abovementioned hypotheses.** Aside from the relationship between tax burden and degree of unionization (top-right cell) all remaining observed correlations match their expected signs (Table III.2).

66. **The MIMIC estimations strongly validate the expected associations between the causal and indicator variables and the informal economy.** The results from the benchmark MIMIC specification, Model 1, are represented in Figure III.1. Labor rigidity (index #1, proxied by minimum wage constraints), tax burden, importance of agriculture and inflation are the *causal* variables of the informal economy, while the number of contributors to the social security system, the degree of unionization and the gross enrollment ratio for secondary school are the *indicator* variables.⁴⁶ Before analyzing the estimation results it is important to remark that several goodness-of-fit statistics support the underlying model (see box in Figure III.1). The coefficients on the causal and indicator variables have the expected signs and are statistically significant (typically at the 1 or 5 percent level).

⁴⁶ Although most variables are subject to endogeneity, strength of enforcement system is one that has the potential to be most severely affected. For this reason it is not included in the benchmark specification (Model 1).

67. **The size of the informal economy appears to be affected by excessive taxes and labor regulations, high inflation, as well as a dependence on agriculture.** An increase of one standard deviation in the tax burden, labor rigidities, importance of agriculture, and inflation increases the size of the informal economy by 0.27, 0.52, 0.40, and 0.47 standard deviations, respectively. Importantly, the joint influence of the four causal variables explains around 80 percent of the variance of the informal economy (Figure III.1).

68. **The variables identified as key indicators of the effect of the informal sector perform well.** As expected, it is found that an increase in the size of the informal economy reduces the number of contributors to social security, the extent of unionization and education enrollment. An increase of one standard deviation in the size of the informal economy reduces the number of workers contributing to the social security system, the degree of unionization, and the secondary enrollment ratio by 0.87, 0.59 and 0.76 standard deviations, respectively. Importantly, the size of the informal economy explains 76, 35 and 57 percent, respectively, of the variance of social security contributions, unionization and school enrollment.

69. **Alternative MIMIC specifications support the results obtained in the benchmark model.** Models 2 and 3 include an alternative measure of labor rigidity (index #2, including mandated benefits) and the strength of enforcement system, respectively (see Figures III.2 and III.3). Both models confirm the results obtained in the benchmark model, producing very similar estimates for the impact of the size of the informal economy on the indicator variables. Model 3 also presents evidence suggesting that the strength of enforcement system appears to be an important determinant of the size of the informal economy.⁴⁷

Estimation of the size of the informal economy

70. **The standardized values of the (unobserved) size of the informal economy only enable an ordinal ranking of countries in the sample.** In order to determine the absolute value of the size of the informal sector (as a percentage of GDP)—a cardinal measure of informal economies—one requires an exogenously-determined measure of the size of one country’s informal economy, which will then be used to scale the absolute size of all Caribbean informal economies. Hence, we first calculate the “predicted” ordinal values for the informal economy, as listed in Table III.3 (derived using equation (A2) of Appendix I). Then, using information regarding the specific value for the size of the informal economy of Jamaica (see De La Roca et al. (2002), who estimates the size of Jamaica’s informal

⁴⁷ As a further robustness check, for the 15 common countries analyzed here and in the study by Schneider (2002), a rank correlation test is able to reject the null hypothesis of no positive relationship between the sets of rankings of informal economies.

economy at about 35 percent of measured GDP in 2000–01), the within-sample ordinal rankings for the informal economy are converted into a cardinal series.⁴⁸

71. **The size of the informal economy is found to vary widely across the Caribbean.** As a percentage of GDP, the informal economy varies from a low of around 15 percent for The Bahamas to a high of over 50 percent for St. Vincent and the Grenadines (Table III.3 and Figure III.4). The Bahamas, Grenada, St. Kitts and Nevis, and Trinidad and Tobago are among those countries with relatively small informal economies, with values about one-fifth of GDP. These values are among the lowest not only for the Caribbean region, but also in relation to most Latin American countries. On the other hand, St. Vincent and the Grenadines, Belize, and the Dominican Republic are among those countries with relatively large informal economies, with values close to half of GDP. It should be noted that these estimates are smaller than for those countries with large informal economies in Latin America, such as Paraguay and Nicaragua, which have informal sectors measured at around 70 percent of GDP. The remaining Caribbean countries have informal economies similar in size to the most developed countries of Latin America, such as Argentina, Chile, Mexico, and Uruguay (see Vuletin, 2007).

72. **The implied series for the size of the informal economy are robust to alternative specifications.** Table III.4 shows the absolute values of the informal economy for the ECCU and other Caribbean countries, derived using the different specifications employed in Models 1, 2, and 3. The informal economy estimates are similar across these models.

73. **Previous estimates of the size of individual Caribbean underground economies are broadly consistent with those derived in this chapter.** In a currency demand-based analysis, Faal (2003) finds that the underground economy in Guyana averaged about 45 percent of official GDP in the 1990s, and was about 35 percent of official GDP in 2000—this result is close to the 37 percent of official GDP found here for Guyana for the early 2000s (see Table III.3). Again using a currency demand-based model, Maurin, et al. (2006) find that in the late 1990s, the informal economy of Trinidad and Tobago was about 20 percent of official GDP and growing rapidly—a smaller estimate than calculated in this chapter. Finally, Schneider (2004) finds that the informal economy in the Dominican Republic was about 35 percent of measured GDP in the early 2000s, which is close to the results found here.

⁴⁸ Since De La Roca et al. (2002) uses different methodologies and data collected as part of the 2001 *Jamaica Survey of Living Conditions*, it represents a very attractive data source to calculate the absolute series of the informal economy. Since the *order* of countries according to the size of the informal economy is independent of the above-mentioned additional information, but the *absolute* values of the informal economy do depend on this data, caution is advised regarding use of the latter values as accurate measures of the degree of informality.

Relative contribution of each cause variable to size of the informal economy

74. **There is a wide dispersion across Caribbean countries in the relative contribution of each causal variable to the measured size of the informal economy.** On average the tax burden, labor rigidity, importance of agriculture and inflation contribute around 40, 24, 32 and 4 percent to the overall size of the informal economy respectively. However, this profile differs greatly across countries (Figure III.5). Key features are:

- For some countries (such as Antigua and Barbuda and Grenada) the main component influencing the informal economy is the tax burden.⁴⁹ For example, in the late 1990s, Antigua and Barbuda had the ECCU region's highest marginal statutory corporate tax rate of 40 percent.
- For other countries (such as St. Vincent and the Grenadines, St. Lucia, and Belize) the agriculture sector was a key driver of the informal economy, with approximately 75 percent of goods exports consisting of agricultural and food products.
- For countries such as the Dominican Republic, the significance of labor rigidities appears to be decisive, with minimum wages equivalent to about 90 percent of the corresponding GDP per capita.
- Importantly, for most of the Caribbean economies, inflation does not seem to be an important factor in determining the size of the informal economy, most likely due to the relative price stability observed in these countries.

E. Concluding Remarks

75. **There have been several key drivers of the size of informal economies in the Caribbean.** In particular, a burdensome tax system, rigid labor markets, higher inflation and dominance of the agriculture sector are factors that are positively related to the size of the informal economy. Moreover, the relative contribution of each factor varies across countries. For some countries (such as Antigua and Barbuda and Grenada) the most important factor influencing the size of the informal economy is the tax burden. For others (such as St. Vincent and the Grenadines and St. Lucia) the importance of the hard-to-regulate agriculture sector is dominant, while for some economies (like the Dominican Republic) the significance of labor rigidities appears to be crucial. Importantly, inflation does not appear to be an important determinant of the informal economies in the Caribbean. Further, the

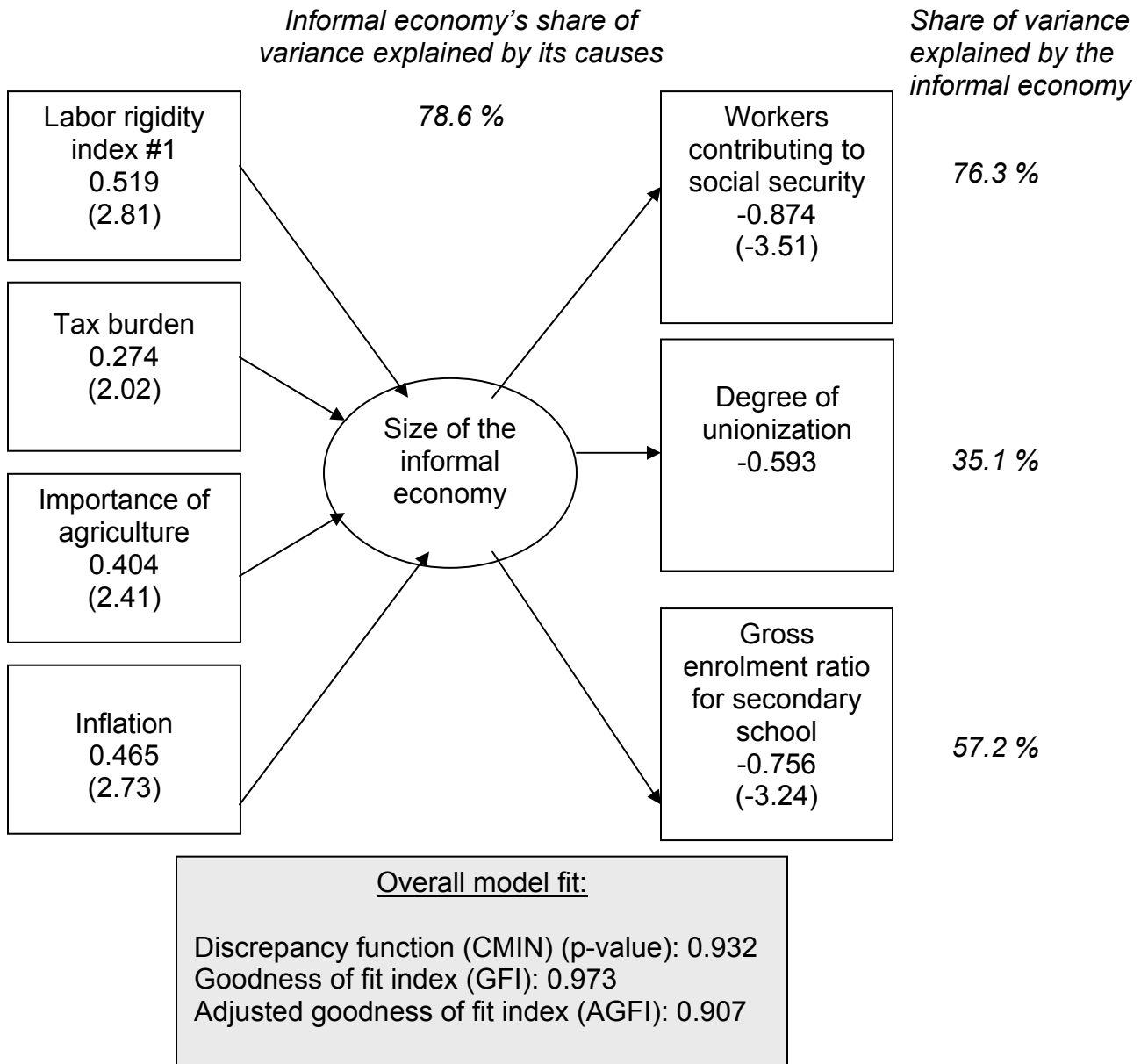
⁴⁹ This result is consistent with work by Giles and Caragata (2001) for New Zealand and Giles and Tedds (2002) for Canada, who found that an expansionary fiscal policy (through a reduction in the effective tax rate) leads to a reduction in the size of the underground economy as a share of measured GDP. In contrast, there is little or no empirical evidence on the relationship between monetary policy and the relative size of the underground economy.

empirical results indicate that a large informal sector tends to reduce labor unionization, the number of contributors to social security schemes, and enrollment rates in education.

76. **The above analysis has several policy implications:**

- In countries where the informal economy is related to the tax burden, the results suggest the advantages of policies to broaden the tax base and reduce marginal tax rates. Several countries in the region are at present moving in that direction by broadening tax bases, introducing value-added taxes (e.g., Dominica, Antigua and Barbuda and St. Vincent and the Grenadines) and income taxes (e.g., Antigua and Barbuda).
- In economies where labor market rigidities are severe, steps need to be taken to accelerate labor market reforms and enhance flexibility. Such reforms are being introduced by all Caribbean countries, in the context of the CARICOM Single Market and Economy, which envisages greater mobility of labor and flexibility of labor markets across CARICOM countries.
- Given the high debt burden borne by most Caribbean countries, a reduction in the size of the informal economy should assist in bolstering fiscal and debt sustainability.
- The large size of the informal economy in many Caribbean countries suggests that official economic indicators (including the size of the official economy and the national tax base) may be understated. All Caribbean countries are endeavoring to improve the coverage, timeliness and quality of their economic statistics, particularly the coverage of the services sector in their national accounts, as most countries are making (or have made) the transition from agriculture-based to services-based economies.

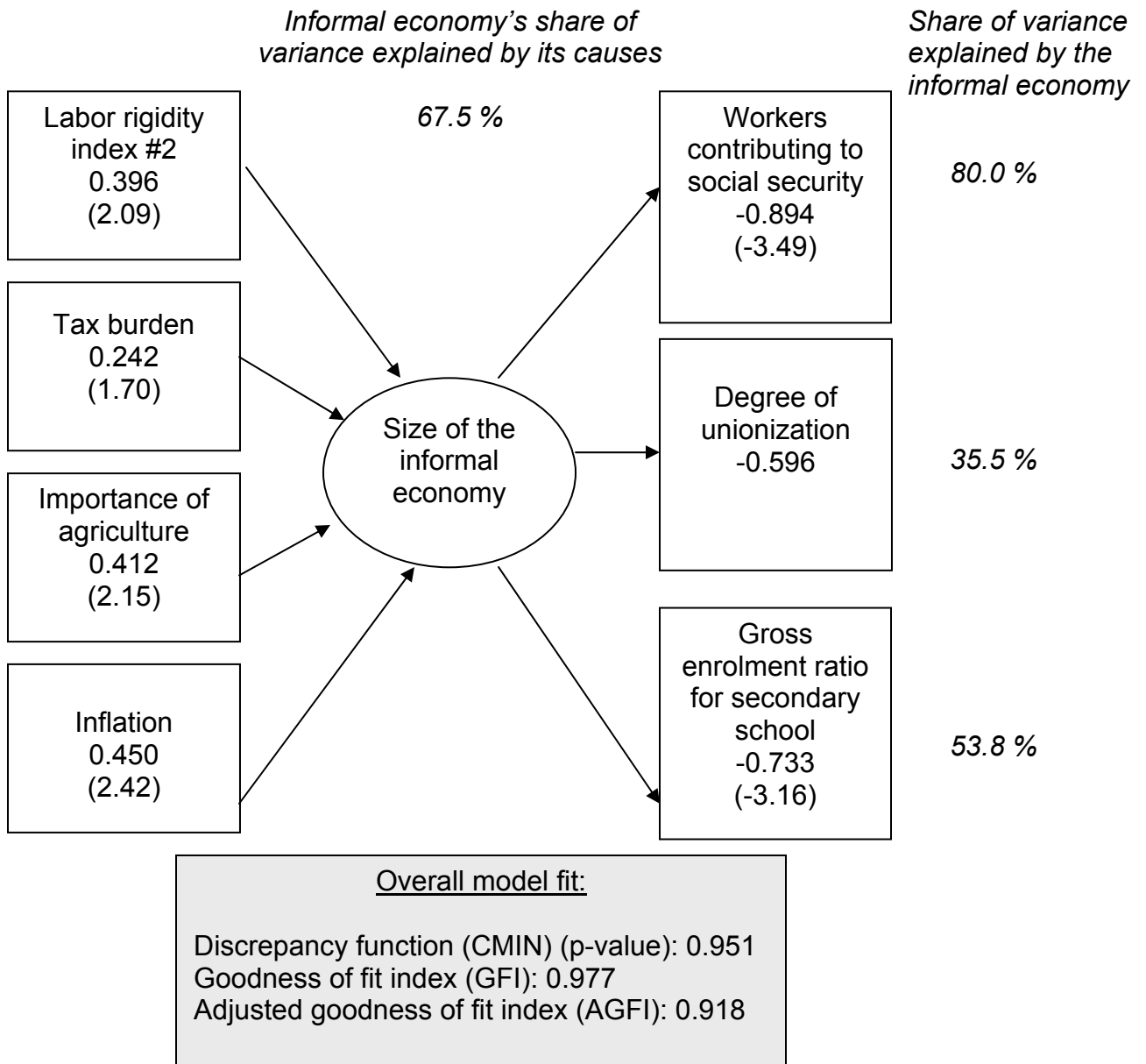
Figure III.1. MIMIC Estimation Results, Model 1 1/



Source: Author's calculation.

1/ The arrow points in the direction of influence of the standardized regression coefficients and their respective *t*-values, indicated in parenthesis. In order to remove the structural indeterminacy of the coefficients, the non-standardized coefficient associated with *Degree of unionization* was set to -1. For this reason a *t*-test cannot be performed on this coefficient. The same standardized coefficients are obtained by setting the coefficient of another indicator equal to -1.

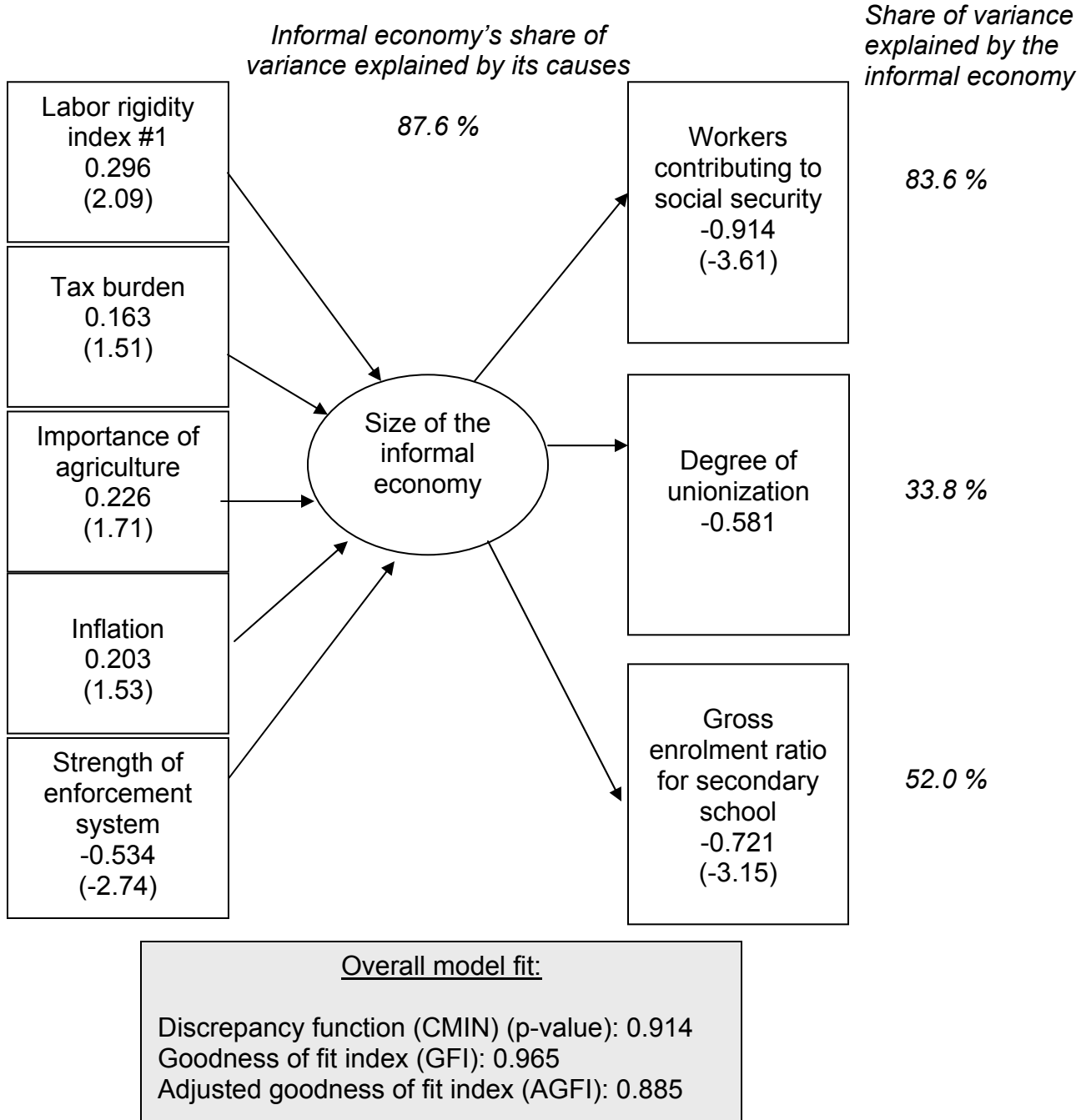
Figure III.2. MIMIC Estimation Results, Model 2 1/



Source: Author's calculation.

1/ The arrow points in the direction of influence of the standardized regression coefficients and their respective *t*-values, indicated in parenthesis. In order to remove the structural indeterminacy of the coefficients, the non-standardized coefficient associated with *Degree of unionization* was set to -1. For this reason a *t*-test cannot be performed on this coefficient. The same standardized coefficients are obtained by setting the coefficient of another indicator equal to -1.

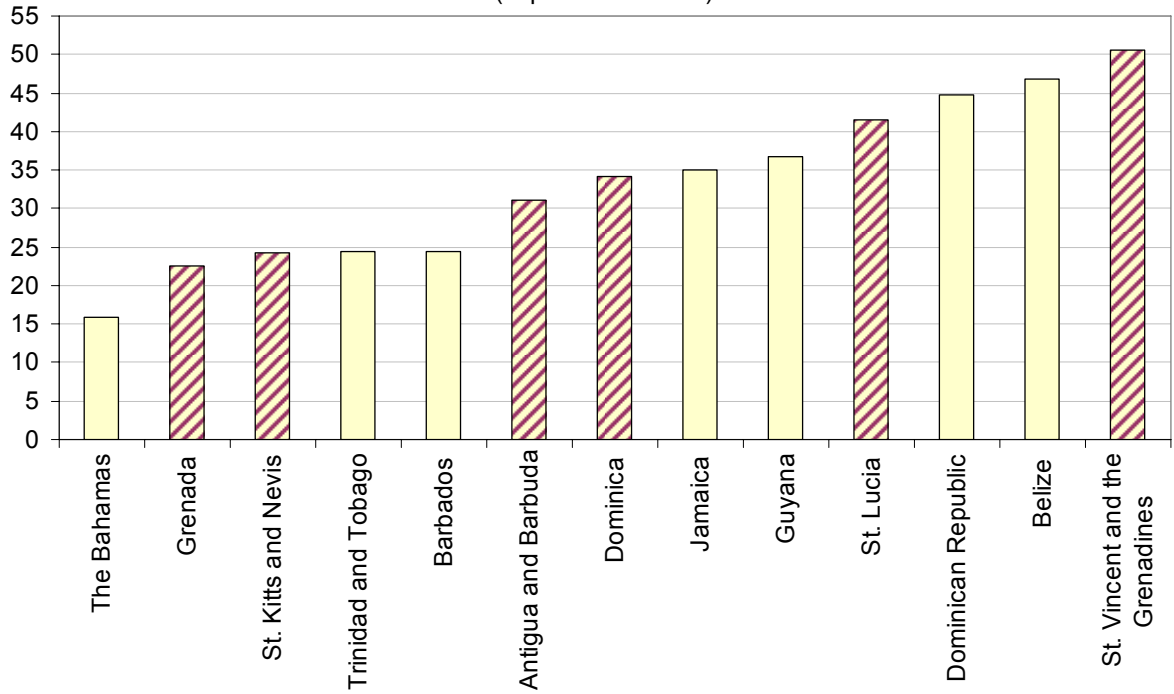
Figure III.3. MIMIC Estimation Results, Model 3 1/



Source: Author's calculation.

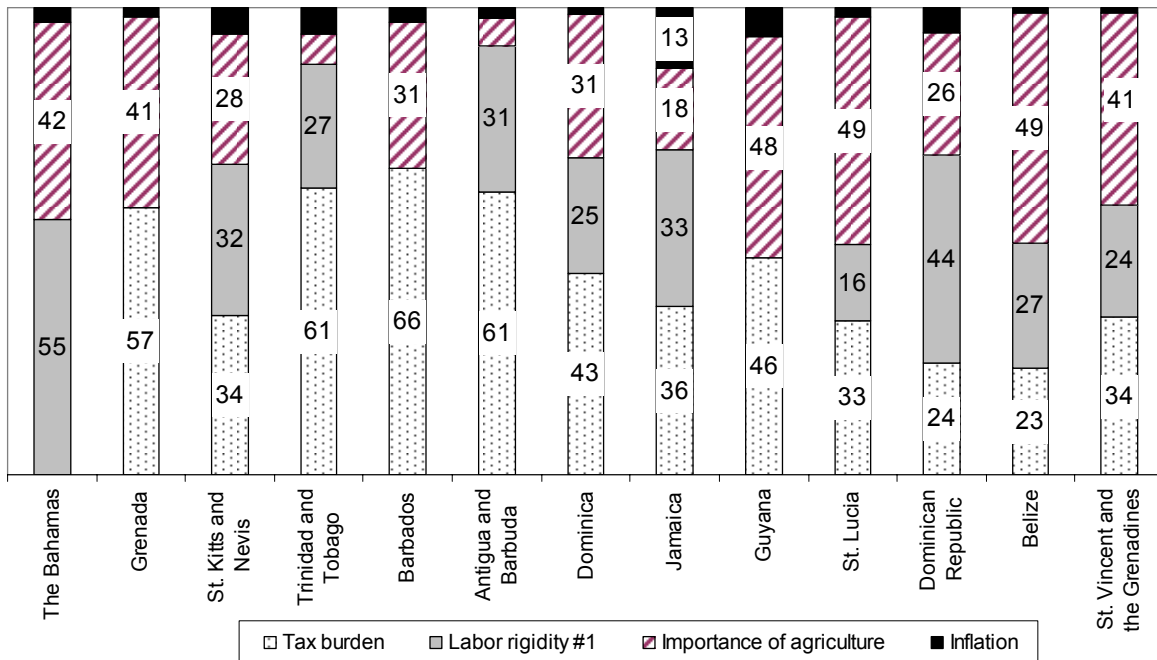
1/ The arrow points in the direction of influence of the standardized regression coefficients and their respective *t*-values, indicated in parenthesis. In order to remove the structural indeterminacy of the coefficients, the nonstandardized coefficient associated with *Degree of unionization* was set to -1. For this reason a *t*-test cannot be performed on this coefficient. The same standardized coefficients are obtained by setting the coefficient of another indicator equal to -1.

Figure III.4. Caribbean: Estimated Size of the Informal Economy, early 2000s
(In percent of GDP)



Source: Author's calculation based on Model 1 MIMIC results.

Figure III.5. Caribbean: Contribution of Causal Variables to Size of the Informal Economy
(In percent)



Source: Author's calculations based on Model 1 MIMIC results.

Note: Only contributions greater than 7 percent display the associated share.

Table III.1. Size of the Informal Economy and VAT Tax Evasion (In percent of GDP)

	Informal economy (early 1990s)	VAT tax evasion (early 1990s)
New Zealand	12	5
Sweden	16	6
Argentina	21	30
Honduras	47	35
Bolivia	66	44

Sources: Schneider and Enste (2000), and Silvani and Brondolo (1993).

Table III.2. Correlations Between Causal and Indicator Variables

	Workers contributing to social security	Gross enrolment ratio for secondary school	Degree of unionization
Tax burden	-0.14	-0.12	0.07
Labor rigidity index #1	-0.59	-0.60	-0.39
Labor rigidity index #2	-0.59	-0.53	-0.36
Importance of agriculture	-0.39	-0.32	-0.31
Inflation	-0.40	-0.29	-0.30
Strength of enforcement system	0.82	0.58	0.49

Source: Author's calculations.

Table III.3. Caribbean: Estimated Size of the Informal Economy, Standardized and Absolute Values, early 2000s

Country	Standardized value	Absolute value (% of GDP)
The Bahamas	-1.766	15.9
Grenada	-1.244	22.5
St. Kitts and Nevis	-1.108	24.2
Trinidad and Tobago	-1.092	24.4
Barbados	-1.087	24.5
Antigua and Barbuda	-0.562	31.2
Dominica	-0.322	34.2
Jamaica	-0.259	35.0
Guyana	-0.122	36.7
St. Lucia	0.251	41.5
Dominican Republic	0.515	44.8
Belize	0.673	46.8
St. Vincent and the Grenadines	0.974	50.6

Source: Author's calculation based on Model 1 MIMIC results.

Note: As detailed in Appendix I, in order to calculate the absolute value of the informal economy, extra information regarding the size of the informal economy of a particular country is required. According to the results of a comprehensive study conducted by the Inter-American Development Bank (De la Roca et. al., 2002), the informal economy in Jamaica accounted for about 35 percent of the total GDP in 2000-01, and is the benchmark study used in this chapter.

Table III.4. Caribbean: Estimated Absolute Size of the Informal Economy, Alternative Specifications, early 2000s (In percent of GDP)

Country	MIMIC Model 1	MIMIC Model 2	MIMIC Model 3
The Bahamas	15.9	11.5	15.1
Grenada	22.5	31.8	22.9
St. Kitts and Nevis	24.2	24.6	24.4
Trinidad and Tobago	24.4	25.2	24.8
Barbados	24.5	36.6	24.3
Antigua and Barbuda	31.2	29.7	31.7
Dominica	34.2	38.8	35.0
Jamaica	35.0	35.0	35.0
Guyana	36.7	57.3	37.3
St. Lucia	41.5	52.0	41.8
Dominican Republic	44.8	46.1	45.3
Belize	46.8	56.5	47.4
St. Vincent and the Grenadines	50.6	58.4	51.4
Average	33.3	38.7	33.6

Source: Author's calculations.

Note: As detailed in Appendix I, in order to calculate the absolute value of the informal economy, extra information regarding the size of the informal economy of a particular country is required. According to the results of a comprehensive study conducted by the Inter-American Development Bank (De la Roca et. al., 2002), the informal economy in Jamaica accounted for about 35 percent of the total GDP in 2000-01, and is the benchmark study used in this chapter.

Appendix I: MIMIC Methodology

The Multiple Indicators, Multiple Causes (MIMIC) approach, initially developed by Zellner (1970), Goldberg (1972) and Joreskog and Goldberg (1975), considers several causes, as well as the multiple effects of the informal economy. This more flexible approach is considered potentially inclusive of all previous indirect methods. The methodology makes use of the associations between the observable causes and the observable effects of an unobserved variable, in this case the informal economy, to estimate the unobserved factor itself. The model for one latent variable can be described as follows:

$$y = \lambda IE + \varepsilon \quad (\text{A1})$$

$$IE = \gamma' x + \nu \quad (\text{A2})$$

where IE is the unobservable scalar latent variable (the size of the informal economy), $y' = (y_1, \dots, y_p)$ is a vector of indicators for IE , $x' = (x_1, \dots, x_q)$ is a vector of causes of IE , λ and γ are the $(p \times 1)$ and $(q \times 1)$ vectors of the parameters and ε and ν are the $(p \times 1)$ and scalar errors. Equation (A1) links the informal economy with its observable, exogenous indicators, while equation (A2) associates the informal economy with a set of observable, exogenous causes. Assuming that these errors are normally distributed and mutually uncorrelated with $\text{var}(\nu) = \psi$ and $\text{cov}(\varepsilon) = \Theta_\varepsilon$ a reduced-form equation is obtained by combining equations (A1) and (A2):

$$y = \pi x + \mu \quad (\text{A3})$$

where $\pi = \lambda \gamma'$, $\mu = \lambda \nu + \varepsilon$ and $\text{cov}(\mu) = \lambda \lambda' \psi + \Theta_\varepsilon$.

Because the system of p equations (A3) has a regressor matrix of rank one and the error covariance matrix is also constrained, it is not possible to obtain *cardinal* estimates of all the parameters. Only certain estimable functions of the parameters can be identified, meaning that the *relative* magnitudes of the parameters can be estimated but not their levels. The estimation of equation (A1) and (A2) requires a normalization of the parameters in equation (A1), and a convenient way to achieve this is to constrain one element of λ to some pre-assigned value. Because both y and x are observable data vectors, equation (A3) can be estimated by restricted maximum likelihood, and the estimates obtained are consistent and asymptotically efficient estimates of the elements of π , and hence of λ and γ . Since the estimation of λ and γ is obtained by constraining one element of λ to some arbitrary value, it is useful to standardize the regression coefficients $\hat{\lambda}$ and $\hat{\gamma}$ as follows:

$$\hat{\lambda}^s = \hat{\lambda} \begin{pmatrix} \hat{\sigma}_{IE} \\ \hat{\sigma}_y \end{pmatrix} \quad \hat{\gamma}^s = \hat{\gamma} \begin{pmatrix} \hat{\sigma}_x \\ \hat{\sigma}_{IE} \end{pmatrix}.$$

The standardized coefficient measures the expected change (in standard-deviation units) of the dependent variable due to a one standard-deviation change of a given explanatory

variable, when other variables are held constant. Using the estimates of the γ^s vector and setting the error term ν to its mean value of zero, the “predicted” *ordinal* values for the informal economy (*IE*) can be estimated using equation (A2). The differences between the ordinal values of each country’s informal economy can then be compared, and each country ranked accordingly.

Then, using information regarding the specific value of the informal economy (*IE*) of some particular country (if it is a cross-country study) or for some particular point in time (if it is a time-series study), obtained from some other source, the *ordinal* within-sample predictions for *IE* can be converted into a *cardinal* series. For this purpose, this chapter uses the information derived from a comprehensive study conducted by De La Roca et al. (2002), according to which, the informal economy in Jamaica accounted for about 35 percent of the country’s total GDP in 2000–01. Since the latter study uses different methodologies and data collected as part of the 2001 *Jamaica Survey of Living Conditions*, it represents a very attractive data source to pin down the absolute series of the size of Caribbean informal economies. Since the *order* of countries according to the size of the informal economy is independent of the abovementioned additional information, but the *absolute* values of the informal economy do depend on this data, caution is advised regarding use of the latter values as accurate measures of the degree of informality.

Appendix II: Data Construction and Sources

Causal variables

1. *Tax burden:* The proxy for tax pressure is the average of statutory corporate and personal marginal income tax rate. The highest rate is used when there is more than one rate. This proxy measure is normalized between 0 and 100. The data corresponds mostly to 2003, and is obtained from the World Bank's *World Development Indicators* and Bain and dos Santos (2004).

2. *Labor rigidity indices:* Two alternative measures of labor rigidity are constructed. The first (labor rigidity index #1) is represented by the ratio of minimum wage to GDP per capita, normalized between 0 and 100. The minimum wage corresponds to the most general minimum wage regime. When minimum wages vary across sectors, the one for manufacturing (or for commerce, if manufacturing is not available) is reported. When minimum wages vary across regions, the value reported is either a simple average or the minimum wage applicable in the main urban centers. A zero indicates that the country has no government-set minimum wage, although minimum wages negotiated at the sectoral level may exist. The second measure (labor rigidity index #2) is the normalized average of two components divided by real GDP per capita. The first component captures minimum wage restrictions and corresponds to labor rigidity index #1, while the second element represents mandated benefits and is measured by the contribution rates (as percentage of salaries) for all social security programs for both the employee and the employer. Only for Belize, where the contributions are flat-rate according to earning classes, the normalized legal number of days of maternity leave with full pay without complications is used. Following Loayza (1997), the normalized average of these components is divided by real GDP per capita in order to account for differences in labor productivity across countries.

The data for minimum wages correspond to 2002 and it is mainly obtained from the U.S. Department of State (2002), "Country Reports on Human Rights Practices." These reports are submitted annually by the U.S. Department of State to the U.S. Congress and cover internationally-recognized individual, civil, political, and worker rights, as set forth in the Universal Declaration of Human Rights. The social security contribution data correspond mostly to 2003, and are obtained from United States Social Security Administration (2002), "Social Security Programs Throughout the World". Maternity leave information corresponds to the average of the period 1999–2002 and it is obtained from several online publications from The Clearinghouse on International Developments in Child, Youth, and Family Policies, Columbia University.

3. *Importance of agriculture:* Measured by agricultural raw material and food exports (as percentage of total exports), mainly for 2000, and is taken from the World Bank's *World Development Indicators*. For the Dominican Republic, information from 2001 and 2002 is used.

4. *Inflation*: Annual average consumer prices inflation for the period 1995–99. Aside for Antigua and Barbuda in which IMF *International Financial Statistics* data is used, the rest of the information is obtained from the World Bank’s *World Development Indicators*.

5. *Strength of enforcement system*: Following Loayza (1997) the strength of enforcement system is proxied by an average of three subjective indicators reported in the International Country Risk Guide (ICRG) for 2002. The three variables considered are quality of bureaucracy, corruption in government and rule of law. Quality of bureaucracy scores high under “autonomy from political pressure” and “strength and expertise to govern without drastic changes in policy or interruption in government services.” Low scores in corruption in government indicate “high government officials are likely to demand special payments” and “illegal payments are generally expected throughout lower levels of government.” The variable rule of law “reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes.” Higher values are associated with “sound political institutions, a strong court system, and provisions for an orderly succession of power.” ICRG is a publication of Political Risk Services of Syracuse, NY.

Indicator Variables

1. *Workers contributing to social security*: Active contributors to old-age pension schemes, in percent of the labor force. It is based on national social security agencies, household surveys and IMF country desk information, predominantly for 2002.

2. *Degree of unionization*: Total union membership considering both public and the private sectors, in percent of the labor force. The data is mainly from U.S. Department of State (2002) “Country Reports on Human Rights Practices,” complemented by information from national authorities.

3. *Gross enrolment ratio for secondary school*: Total secondary enrolment as a percentage of the corresponding official school-age population, mostly for 2001. The sources of information are UNDP (2005) and World Bank (2005).

REFERENCES

- Bain, L., and P. dos Santos, 2004, "CARICOM-Survey of the Caribbean Tax Systems," Prepared for the CARICOM Secretariat (Georgetown, Guyana: CARICOM).
- Cagan, P., 1958, "The Demand for Currency Relative to the Total Money Supply," *Journal of Political Economy*, Vol. 66, pp. 302–28.
- Dabla-Norris, E., and A. Feltenstein, 2003, "An Analysis of the Underground Economy and Its Macroeconomic Consequences," IMF Working Paper 03/23 (Washington DC: International Monetary Fund).
- De La Roca, J., M. Hernandez, M. Robles, M. Torero, and M. Webber, 2002, "Informal Sector Study for Jamaica," Group of Analysis for Development, mimeo (Washington DC: Inter-American Development Bank).
- Faal, E., 2003, "Currency Demand, the Underground Economy, and Tax Evasion: The Case of Guyana," IMF Working Paper 03/7 (Washington DC: International Monetary Fund).
- Feige, E., 1979, "How Big is the Irregular Economy?," *Challenge*, Vol. 22, pp. 5–13.
- Feige, E., 1996, "Overseas Holdings of U.S. Currency and the Underground Economy," in S. Pozo (ed.), *Exploring the Underground Economy: Studies of Illegal and Unreported Activity* (W.E. Upjohn Institute for Employment Research: Kalamazoo, MI), pp. 5–62.
- Feige, E., 2003, "The Dynamics of Currency Substitution, Asset Substitution and *De Facto* Dollarization and Euroization in Transition Countries," *Comparative Economic Studies*, Vol. 45, pp. 358-83.
- Feige, E., V. Šošić, M. Faulend, and V. Šonje, 2001, "Currency Substitution, Unofficial Dollarization and Estimates of Foreign Currency Held Abroad: The Case of Croatia," in Blejer, M. and M. Skreb (eds.), *Financial Vulnerability and the Exchange Rate Regime* (Boston: MIT Press).
- Feige, E., V. Šošić, M. Faulend, and V. Šonje, 2002, "Unofficial Dollarization in Latin America: Currency Substitution, Network Externalities and Irreversibility," in Dean, J.W., D. Salvatore and T. Willett (eds), *The Dollarization Debate* (New York: Oxford University Press).
- Frey, B., and H. Weck-Hanneman, 1984, "The Hidden Economy as 'Unobserved Variable'," *European Economic Review*, Vol. 26, pp. 33–53.
- Giles, D., 1999, "Modeling the Hidden Economy and the Tax-Gap in New Zealand," Working Paper 9905, Department of Economics, University of Victoria, Canada.

- Giles, D., and P. Caragata, 2001, "The Learning Path of the Hidden Economy: Tax and Growth Effects in New Zealand," *Applied Economics*, Vol. 33, pp. 1857–67.
- Giles, P., and L. Tedds, 2002, *Taxes and the Canadian Underground Economy* (Toronto: Canadian Tax Foundation).
- Goldberger, A., 1972, "Structural Equation Methods in the Social Sciences," *Econometrica*, Vol. 40, pp. 979–1001.
- Jöreskog K., and A. Goldberger, 1975, "Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable," *Journal of the American Statistical Association*, Vol. 70, pp. 631–39.
- Kaufmann, D., and A. Kaliberda, 1996, "Integrating the Unofficial Economy into the Dynamics of Post-Socialist Economies: A Framework of Analysis and Evidence," in B. Kaminski (ed.), *Economic Transition in Russia and the New States of Eurasia* (Armonk, NY: M. E. Sharpe, Inc).
- Loayza, N., 1997, "The Economics of the Informal Sector: A Simple Model and Some Empirical Evidence from Latin America," World Bank Policy Research Working Paper WPS 1727 (Washington DC: World Bank).
- Maurin, A., S. Sookram, and P. Watson, 2006, "Measuring the Size of the Hidden Economy in Trinidad and Tobago, 1973–99," *International Economic Journal*, Vol. 20, pp. 321–41.
- Organization for Economic Cooperation and Development, 2002, *Measuring the Non-Observed Economy: A Handbook* (Paris: OECD Publications Service).
- Portes, A., M. Castells, and L. Benton, 1989, "World Underneath: The Origins, Dynamics, and Effects of the Informal Economy," in Portes, A., M. Castells and L. Benton (eds.), *The Informal Economy: Studies in Advanced and Less Developed Countries* (Johns Hopkins University Press: Baltimore).
- Roache, S., 2006, "Social Security in the Eastern Caribbean Currency Union," in *Eastern Caribbean Currency Union—Selected Issues*, Chapter IV.
- Schneider, F., and D. Enste, 2000a, "Shadow Economies: Size, Causes, and Consequences," *Journal of Economic Literature*, Vol. 38, pp. 77–114.
- Schneider, F., and D. Enste, 2000b, "Shadow Economies Around the World: Size, Causes, and Consequences," IMF Working Paper 00/26 (Washington DC: International Monetary Fund).

- Schneider, F., 2002, "Size and Measurement of the Informal Economy in 110 Countries Around the World," mimeo (Washington DC: World Bank).
- Schneider, F., 2004, "The Size of the Shadow Economies of 145 Countries All Over the World: First Results Over the Period 1999 to 2003," Discussion Paper 1431 (Bonn: Institute for the Study of Labor).
- Silvani, C., and J. Brondolo, 1993, "Analysis of VAT Compliance," unpublished mimeo (Washington DC: International Monetary Fund).
- Tanzi, V., 1982, *The Underground Economy in the United States and Abroad* (Lexington, MA: Lexington Book).
- Tanzi, V., 1999, "Uses and Abuses of Estimates of the Underground Economy," *Economic Journal*, Vol. 109, pp. F338–F347.
- United Nations Development Program, 2005, *Human Development Report 2005* (New York: United Nations).
- United States Department of State, 2002, *Country Reports on Human Rights Practices*, Bureau of Democracy, Human Rights, and Labor (Washington DC).
- United States Social Security Administration, 2002, "Social Security Programs Throughout the World: Asia and the Pacific," Social Security Administration and the International Social Security Association (Washington DC).
- United States Social Security Administration, 2002, "Social Security Programs Throughout the World: Europe," Social Security Administration and the International Social Security Association (Washington DC).
- United States Social Security Administration, 2003, "Social Security Programs Throughout the World: America," Social Security Administration and the International Social Security Association (Washington DC).
- Vuletin, G., 2007, "What is the Actual Size of the Pie? The Size of the Informal Economy in Latin America and the Caribbean", forthcoming IMF Working Paper (Washington DC: International Monetary Fund).
- World Bank, 2005, *Organization of Eastern Caribbean States: Towards a New Agenda for Growth* (Washington DC: World Bank).
- Zellner, A., 1970, "Estimation of Regression Relationships Containing Unobservable Independent Variables," *International Economic Review*, Vol. 11, pp. 441–54.

IV. SOCIAL SECURITY IN THE EASTERN CARIBBEAN CURRENCY UNION⁵⁰

A. Introduction

77. **The defined-benefit social security schemes of the Eastern Caribbean Currency Union (ECCU) face major challenges.** Established in the 1970s and 1980s, these schemes are maturing rapidly, as cohorts with a full-career contribution history begin to retire. They also face a rise in the elderly population that is much faster than in many other countries.

78. **The ECCU's social security schemes play an exceptionally prominent role in local economies.** They offer comprehensive benefits to contributors, finance a sizeable share of domestic investment, and are major participants in the banking system. Presently, cash flow surpluses average about 3 percent of GDP per year, and accumulated reserves stand at around 40 percent of GDP, invested mostly in public sector assets and securities of other ECCU governments.⁵¹ Maturation of social security schemes and a rapid aging process underlie projections of a steep increase in expenditures, which are expected to rise at a much faster rate than income. As a consequence, the ECCU faces a significant macroeconomic challenge in managing the projected declines in these surpluses in coming decades.

79. **In response to recent actuarial reviews that have concluded that many schemes are unsustainable, reforms are beginning to be introduced.** St. Lucia has introduced legislation that will gradually extend the retirement age and raise the number of contributions required for eligibility. Other islands are starting to review options and some have discussed action plans with stakeholders.

80. **This chapter provides an overview of the financial situation of the social security schemes in the ECCU, and implications for the broader economy.** The chapter also discusses the role of social security schemes within the financial system, and outlines the challenges implied by current investment practices.

81. **The rest of the chapter is as follows.** Section B provides historical background on the evolution of national social security schemes, while the financial outlook of the

⁵⁰ Prepared by Tobias Rasmussen and Shaun Roache.

⁵¹ Data and projections in this chapter are based upon the most recent actuarial reviews by the International Labour Organization (2005; 2004a; 2004b) for St. Lucia, Grenada, and St. Kitts and Nevis; by Veira (2005) for St. Vincent and the Grenadines; findings by IMF's Fiscal Affairs Department for Antigua and Barbuda and Dominica; Osborne (2004); and Samuel and Velescelu (2003). The ECCU comprises Antigua and Barbuda, Anguilla, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines.

schemes is described in Section C. Section D looks at the investment of social security reserve assets, while Section E examines the linkages between social security schemes and domestic financial systems in the ECCU. Section F compares the administrative costs of the schemes, while policy conclusions and reform options are set out in the concluding section.

B. Background on Social Security Schemes

82. **All ECCU countries have comprehensive social security schemes that were introduced relatively recently** (Table IV.1). Commonly referred to as National Insurance or Social Security, the schemes are similar in design and were, in most cases, preceded by a provident fund that provided lump sums at retirement. Initially focusing on old-age pensions, the schemes have been gradually broadened. They now offer a wide range of benefits, typically including invalid and survivor's pensions, as well as benefits for sickness, maternity, and employment injury. The coverage has also been extended to the self-employed, either on a voluntary or mandatory basis. However, aside from the gradual expansion of scope, the basic structure remains that of a traditional defined-benefit scheme.⁵² There are two regional reciprocal agreements for the ECCU and the wider Caribbean Community and Common Market (CARICOM), the principal objective of which are to ensure regionally-mobile workers receive at least one pension.^{53 54}

83. **From inception, these social security schemes have generated large surpluses, due to minimal expenditure in the early years.**⁵⁵ However, as the number of

⁵² Most Caribbean countries offer basic health care at public facilities, but many are looking to establish more comprehensive national health insurance schemes. Unemployment benefits, currently only offered in Barbados, are also being considered throughout the region.

⁵³ CARICOM has 15 full members (Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago) and five associate members (British Virgin Islands, Turks and Caicos Islands, Anguilla, Cayman Islands, Bermuda). The Organization of Eastern Caribbean States consists of the eight ECCU members and the British Virgin Islands.

⁵⁴ The ECCU is covered by the Convention on Social Security in the Organization of Eastern Caribbean States, signed in 1991. In practice, this Convention has been superseded by the CARICOM Agreement on Social Security, which took effect in 1997. The main feature of these agreements is the ability of workers to aggregate their contribution history across signatory countries, enabling them to more easily meet minimum contribution requirements. Payments of benefits are prorated for each country. Similar agreements have been signed bilaterally with other countries, including Canada and the United Kingdom. See Osborne (2004) for more details.

⁵⁵ There was no unfunded gift to the first generation of retirees, who were typically covered by legacy Provident Funds.

retirees and other benefit recipients grew, the margin between income and expenditure has been eroding. At present, the total of contribution and interest income still exceeds total expenditure in all countries; only in Dominica does expenditure currently exceed contribution income.⁵⁶ Without policy changes, however, all schemes are expected to ultimately run deficits.

84. **The most significant benefit provided by social security schemes is the age or retirement pension, which accounts for roughly 60 percent of total benefits.** In most cases, pensions do not require retirement; plan participants need only meet the required number of contributions and a minimum age. The formula for calculating pensions is similar across ECCU countries. The most common model requires ten years of contributions to qualify for a minimum pension, representing 30 percent of the pensionable wage.⁵⁷ The pensionable wage, in turn, is calculated as the average wage during the 3–5 year period with the highest wages during the last 10–15 years of employment. The rate of benefit accumulation is, in all cases, diminishing over time. The maximum pension, usually attained after 40 years of contributions, ranges from 50 to 70 percent of the pensionable wage.

85. **Social security schemes also commonly offer short-term sickness, maternity benefits, funeral grants, as well as long-term invalidity and survivor’s pensions.** All countries except Antigua and Barbuda offer employment injury benefits, which do not require prior payment of contributions but are restricted to employment-related occurrences (excluding the self-employed). In some cases, government employees receive more limited coverage than the general rule, as civil servants often collect overlapping benefits.

86. **Contribution rates vary significantly across ECCU social security schemes, despite the uniformity of benefits, and are relatively low compared with other CARICOM countries** (Table IV.2). Contributions are shared between employee and employer, with the latter usually paying a higher rate. Contributions are levied on the insurable wage, which encompasses most sources of employment income but is subject

⁵⁶ All data in this paper are on an accrual basis. The implicit assumption underpinning the choice of the accrual presentation is that all obligations to social security will eventually be repaid. Large government arrears mean that the social security scheme in Antigua and Barbuda is already now facing an overall deficit on a cash basis. Dominica was in a similar position, but that situation has recently been resolved and the government is now current on its obligations.

⁵⁷ All schemes offer minimum pensions for qualifying contributors. This is a safety net provision to ensure low wage contributors receive a pension that is, at minimum, some fixed percent of average insurable earnings. This percentage ranges from 7 percent in Dominica to 19 percent in St. Vincent and the Grenadines.

to a ceiling that varies considerably among countries. Contributions are notionally allocated to different branches—short-term, long-term, and employment injury—but they can easily be shifted from one branch to another.

87. **Actuarial reviews point to a number of design flaws of existing social security schemes.** For example, there is a bias in favor those with short contribution histories. Current benefit formulae imply that rates of return on contributions are typically near 20 percent for the minimum participation period. These implied rates of return then fall sharply the longer a participant has contributed. The short 3–5 year period used for calculating the pensionable wage also means that pensions may bear little resemblance to lifetime earnings. Adjustments to the wage ceiling and pensions have been ad hoc, rather than automatic, and often large, leaving the level of pensions subject to uncertainty.

88. **In some cases, the overlap with civil service pensions creates potentially very generous benefits for public sector employees.** Indeed, it sometimes occurs that combined (social security and civil service) age benefits exceed the final wage, or that combined sickness benefits exceed the regular salary.⁵⁸ This chapter does not address issues surrounding civil service pensions; however, it is worth highlighting that, on average, these benefits represented 2 percent of GDP in 2005 and, in some cases, will rise substantially in the years ahead.

C. Financial Outlook

89. **Expenditure on social security schemes will continue to rise in the coming years.** There are two principal causes:

- **Scheme maturation.** Reflecting their longer contribution history, new retirees will receive substantially higher pensions than current pensioners. With a typical 40-year contribution requirement for maximum benefits, this process will continue for another one or two decades, depending on the date of inception of each national scheme.
- **Demographics.** Like many other parts of the world, declining fertility rates and increasing longevity in the Caribbean will cause the number of elderly to grow as a share of the population. Currently, ECCU populations are relatively young compared with those of advanced economies. However, as outlined in Samuel

⁵⁸ In Antigua and Barbuda, for example, a civil servant who retires after 33 years of work would receive a government pension equal to 66 percent of final salary in addition to the social security pension of 49 percent of final salary, for a total replacement rate of 115 percent of final salary.

and Velculescu (2003), demographic change is expected to occur much faster in the ECCU than elsewhere. For example, it is projected that the ratio of people aged 65 and older to those aged 16–64 will rise fourfold and approach that of the United States by 2050 (Figure IV.1).⁵⁹

90. **The latest ECCU actuarial reviews project a rapid increase in scheme expenditure relative to income.** With no change in policy, all schemes are projected to begin incurring cash flow deficits and ultimately exhaust their reserves at some point between 2022 (Dominica) and 2062 (St. Lucia), as shown in Figures IV.2 and IV.3 and the text table below.

ECCU: Key Dates in the Projections of Social Security Finances

	Year when expenditure first exceeds		Year when reserves are exhausted
	Contribution income	Total income	
Antigua and Barbuda	2010	2020	2030
Dominica 1/	2003	2015	2022
Grenada	2019	2037	2050
St. Kitts and Nevis	2020	2036	2053
St. Lucia	2024	2048	2062
St. Vincent and the Grenadines	2013	2021	2033

Sources: Most recent actuarial reviews; and Fund staff estimates.

1/ On policies in place prior to January, 2007. Recently announced reforms are aimed at eliminating unfunded liabilities, and will substantially improve the financial outlook for Dominica Social Security (see Box IV.2).

91. **One way to view the financial shortfall of social security is to consider the “actuarial balance” or net implicit debt.** In this chapter, the net implicit debt is the present value of future expenditures minus the present value of future contributions and current reserves over a 60-year horizon (Figure IV.4).⁶⁰ Estimates range from around zero in St. Lucia to 170 percent of GDP in Dominica, and—reflecting the large cash flow

⁵⁹ See the U.S. Census Bureau’s International Data Base available at <http://www.census.gov/ipc/www/idbnew.html>. Similar demographic developments are assumed in the ECCU actuarial reviews cited below. One major source of uncertainty pertaining to the demographic projections for the ECCU countries is the level of future emigration, as population outflow has been variable and at times extremely high.

⁶⁰ It is calculated on an “open group” basis, which assumes that the scheme is a going concern that will operate indefinitely. The 60-year horizon is arbitrary, but this is the period used in the ILO’s actuarial reviews and provides a good indication of the financial health of the social security scheme over the lifetime of a new entrant to the labor force. Longer horizons would lead to larger actuarial deficits given that the ECCU schemes’ finances are worsening over time. For example, for both Antigua and Barbuda and Dominica the actuarial deficit through 2150 is projected to be almost twice as large as that over the 60-year horizon. There is insufficient data to estimate the 60-year actuarial balance for St. Vincent and

(continued)

deficits that emerge in the coming decade—are even larger if calculated over a longer time horizon.

92. **The existence of very high public debt levels in the ECCU adds to the challenge of underfunded social security schemes.** Since fiscal positions are already stretched and explicit public debt ratios are already very high, there is little scope for governments to fund future social security deficits. Consequently, especially in the countries with both large explicit and implicit debt—Antigua and Barbuda, Dominica, St. Vincent and the Grenadines, and, to a lesser extent, Grenada and St. Kitts and Nevis—far-reaching pension reform is urgently needed to avoid more drastic measures in the future.

D. Investment of Social Security Reserve Assets

93. **Thus far, risk-adjusted returns on reserve assets within ECCU social security schemes have been satisfactory.**⁶¹ Using Sharpe ratio calculations—mean excess return on the asset, divided by the standard deviation—most schemes have delivered returns that compare favorably to global financial asset benchmarks for the 15-year period through 2003 (Figure IV.5).⁶²

94. **However, future performance may be less strong.** Partly reflecting the dominance of domestic public sector assets in social security scheme portfolios, some schemes have begun to experience “underperformance,” in the form of arrears and the restructuring of public debt.⁶³ The current asset allocation profile of ECCU schemes is also a poor match for liabilities, which increases funding risks.

95. **ECCU social security investment policy has broad macroeconomic effects, for three main reasons.** First, scheme reserves account for an average of 42 percent of GDP, larger than many other countries with partially-funded schemes (Figure IV.6). Second, reserves are overwhelmingly invested in domestic assets (Figure IV.7). Third,

the Grenadines, but the 30-year projection in Veira (2005) suggests that the financial situation there may be on par with that in Antigua and Barbuda.

⁶¹ Risk-adjusted returns imply a focus on the volatility as well as the level of return on assets. Although social security obligations are mainly long-term, schemes may also have to meet short-term obligations.

⁶² This is the latest date at which a cross-regional comparison can be made.

⁶³ These cases include the government arrears in Antigua the Barbuda and Dominica mentioned above. In addition, a debt restructuring in one ECCU country has, in at least one instance, led to social security scheme haircuts in other ECCU countries, arising from cross-country exposure.

the nature of these investments—including deposits in local banks and loans to public enterprises—suggests that they can have distortionary effects on domestic capital markets and the broader economy.

96. Most ECCU countries have adopted an investment policy statement (IPS).

This is the formal document that establishes risk-return objectives, constraints, and performance reporting requirements. While these documents typically provide a “benchmark” asset allocation, the discretion of asset managers is often not described in detail. Where an IPS has been adopted, they tend to provide less than comprehensive coverage of these issues, and adherence to its principles is mixed. Indeed, where one exists, the typical IPS falls short of industry best practice and raises the risk of poor governance.

97. The benchmark asset allocation in the typical social security IPS is based on the recommendations of the Eastern Caribbean Central Bank’s (ECCB) Monetary Council, and reflects the priorities outlined by the ILO and ISSA (Table IV.3).

Monetary Council membership is comprised of government ministers from each of the eight ECCU members and is not independent of government; this may be a relevant point if the independence of social security asset allocation is a valued objective. While these guidelines are not explicitly binding, they appear to have had a large influence on actual social security investment behavior.

98. In most cases the duration, or effective maturity, of social security reserve portfolios is very short and this presents an asset-liability mismatch.

Most domestic bonds and loans tend to carry a maturity below 10 years, while the average duration of liabilities is over 30 years (Table IV.4). This means that as interest rates fall, the net implicit debt rises sharply (and vice versa). Diversifying towards ultra-long foreign bonds and equities would help to address this asset-liability mismatch. A number of OECD social security reserve funds have begun to address these issues, principally through a re-weighting of equities. For example, the weight of equities in the portfolios of schemes in Ireland, New Zealand, and Canada are now between 65–75 percent.

99. Actual foreign exposure in reserve portfolios is very low, particularly for small, open economies that are vulnerable to economy-wide exogenous shocks (Figure IV.7). Numerous studies (starting with Levy and Sarnat, 1970) suggest that the optimal share of foreign assets in a diversified portfolio is far higher than that of the ECCU.

100. Liability matching also argues for greater foreign exposure in the portfolio of the ECCU social security schemes. Social security liabilities are denominated in domestic currency, but the typical ECCU country consumption basket is dominated by imports. The ECCU’s quasi-currency board arrangement pegs the Eastern Caribbean

dollar against the U.S. dollar, but fluctuations against other major currencies, particularly the euro, given a relatively high degree of pass-through pricing, may have large effects on prices, wage earnings, and social security liabilities. Domestic fixed-income assets are a poor hedge against this risk.

101. There is inadequate reporting of portfolio risk and return performance.

Given the broad range of objectives for a social security scheme, including “social utility,” a simple risk-return measure may be insufficient to describe performance. However, such measures should form part of a minimum reporting requirement, in line with international best practice. For example, there is scope to enhance the reporting of “tracking errors” which would show how the difference between the value of reserve assets and the present value of liabilities is changing over time. Reporting portfolio performance also allows a comparison against liability-specific, market-standard, or peer group benchmarks. This information should then influence the ongoing revisions to the investment policy statement, with particular regard to the investment process.

E. Linkages of Social Security Schemes with the Financial Sector

102. From their inception in the early 1970s, the ECCU authorities envisaged social security schemes playing a large role in regional capital market development.

Indeed, their investment guidelines were developed in tandem with the regional capital markets initiative and appear to attach a very high weight to the objective of social and economic utility (Nicholls, 2002). Two important features suggest this. First, foreign investments (defined as outside CARICOM) should account for only 5 percent of the portfolio. Second, there is scope for very high exposure to public sector assets. Direct lending (including to public enterprises), can account for over half the recommended portfolio. If fixed deposits are also included, which often implies direct or indirect public sector exposure, this proportion rises to 75 percent of the recommended portfolio.

103. Although nearly two-thirds of social security reserves are held in public or government-backed fixed-income assets, social security involvement in regional capital markets has been limited.

For example, on the regional government securities market (RGSM) social security schemes have accounted for less than 8 percent of successful bids. Bond issues on the RGSM have tended to be oversubscribed and social security funds have not been critical to the markets progress up until now. Instead, social security funds have been increasingly investing in nonmarketable instruments of public enterprises and state-owned banks.

104. The heavy investment reflects the effect of inflexible investment guidelines, which may distort domestic financial flows. ECCB guidelines stipulate around 30 percent of reserves should be lent domestically; in practice, nearly half of this

allocation is taken up by lending to public enterprises. This reflects the fact that the private sector in many ECCU countries does not have the capacity to absorb and productively use social security surpluses.⁶⁴ This has left the social security systems competing with the banks to lend and may mean that access to credit by public enterprises has been much easier than otherwise.

105. Social security systems' heavy investment in bank deposits also raise potential systemic stability concerns. On average, ECCU social security schemes hold around 25 percent of their reserves in deposits with the domestic banking system (based on the most recent 2004 data). These are held almost exclusively in locally–incorporated banks, despite a large foreign bank presence throughout the region and a relatively competitive market for deposits. These banks are also heavily exposed to government on the asset side of the balance sheet—e.g., local banks exposure to the government amounted to 21 percent of total assets in 2005, about three times the level of foreign banks—implying that social security systems' exposure to government is higher than would otherwise be the case. Moreover, banking system vulnerabilities, as reflected in underperforming asset ratios, also appear to be concentrated in local banks (Chai, 2006).

106. There is also the question of the impact on the banking system as social security surpluses dry up and, ultimately reserve assets are withdrawn to fund cash flow deficits. Although gradual, this process could create liquidity problems for particular banks since, in terms of maturity, local banks typically lend at relatively long maturities, with mortgages accounting for a large share of assets. A more developed ECCU interbank market would help to offset these liquidity pressures, but this market has remained fairly inactive.

F. Scheme Administration Costs

107. Administrative costs for ECCU schemes appear relatively high, even taking into account measurement issues (Table IV.5).⁶⁵ An inability of small islands to

⁶⁴ A number of reasons have been put forward for a relative lack of demand for loanable funds from the domestic private sector. One example is the high cost of capital, which lowers the incentive for domestic businesses to invest (see Sosa, 2006; Roache, 2006). High commercial lending rates are prevalent across the region and factors such as a prolonged, uncertain, and costly foreclosure process may be one potential explanation (Chai, 2006). Notably, most investment policy statements state that a government guarantee is acceptable as collateral for a loan, implying the same constraints do not apply to many statutory bodies.

⁶⁵ Comparing administrative costs internationally can be treacherous due to differences in design and the mix of social assistance versus insurance (Mitchell, 1998). There is also no consensus on the appropriate yardstick; for example comparing costs to contributions or reserve assets, due to issues such as the maturity of the scheme (Whitehouse, 2001; Osborne, 2004). For example, as a percent of assets, ECCU costs are relatively low, but costs are likely to rise dramatically in the medium term.

exploit economies of scale is one factor keeping costs high, but other inefficiencies may also be important. In particular, costs could likely be reduced if schemes diversify portfolios toward foreign assets and outsource asset management.

108. **In the longer term, there is the potential to pool administration resources and outsourcing.** As noted earlier, social security schemes in the ECCU and the wider CARICOM area already operate under some reciprocal agreements, designed principally to ensure that workers that have been mobile across the Caribbean receive at least one pension (Henry, 2004). As the CARICOM Single Market and Economy (CSME) integration develops further, greater co-ordination across social security schemes may allow the ECCU to partially overcome the cost disadvantages associated with their size.

G. Conclusions and Reform Options

109. **If ECCU countries want to maintain traditional defined-benefit social security programs, reform is unavoidable.** There are a number of parametric reform options available, the scale and nature of which will vary depending upon the current design of the scheme and the degree of underfunding. Standard parametric reform options that have been pursued by many countries around the world include (Box IV.1): (i) increasing the retirement age; (ii) increasing contribution rates; (iii) streamlining benefits; and (iv) improving benefit predictability. In all cases, the earlier action is taken, the more gradual the changes can be introduced, reducing any potential negative impact on the economy. Two schemes have begun to institute gradual reform—St. Lucia and Dominica (see Box IV.2).

110. **Reforms should also seek to broaden coverage.** A large segment of the population typically falls outside the primary social safety net and increasing participation in social security should be a priority. This problem is well recognized but hard to tackle given the often informal nature of employment among nonparticipants. Still, making reporting and other requirements more suited to the self-employed and enforcing participation requirements more strictly could help boost coverage. This, in turn, would help ensure that the social safety net reaches the neediest and could lessen demand for government assistance in other areas.

111. **There is scope to increase regional coordination.** With increasing regional integration under the CSME and other initiatives, the scope for labor mobility between CARICOM countries is increasing. To underpin this beneficial development, the current agreements that provide for the portability of accumulated pension rights should be rigorously enforced. Greater harmonization, including any future policies that aim to increase coverage, could further facilitate labor mobility, while sharing of administrative structures could exploit economies of scale and lower costs.

Box IV.1: Parametric Reform Options for ECCU Social Security Schemes

Increasing the retirement age. Participants would pay contributions for longer and receive pensions for a shorter period. Retirement ages in the ECCU average close to 61 years, and in all cases are quite low by both regional and international standards. Instituting a gradual increase, a process that has recently begun in St. Lucia, should be considered in all countries.

Increasing the contribution rate. Contribution rates are very low compared to many other countries with similar social security schemes. Barbados provides a regional example of a social security scheme reform that incorporated a large increase in the contribution rate, to a current level of 16.25 percent.

Streamlining benefits. While the replacement rate is not too high in an international context, reform in other countries has tended towards a lower rate. Also, there are many distortions, such as a bias in favor of those with short contribution periods and an excessive weight placed on the last few years of income when calculating benefits. A model with a linear accumulation of pension rights based on career indexed earnings would be more equitable and less distortionary. Steps should also be taken to eliminate excessive coverage, such as cases where sickness or age benefits for public sector workers can exceed the previous wage.

Increase benefit predictability. The common practice of irregular and large stepwise changes in wage ceilings and pensions in payment creates uncertainty. Instead, adjustments should be made on a regular and predictable basis, for example by indexing these amounts to aggregate earnings or CPI inflation. However, the benefits of predictability have to be balanced against the drawbacks from making the rules too rigid, as the government may need some flexibility to generate savings if an urgent need arises. A solution could be to have regular annual adjustments but leave some margin—e.g., +/- 2 percent relative to the benchmark index—to create a range for the required outcome.

Box IV.2: Social Security Reforms in Dominica

In October 2006 the Government of Dominica approved an Action Plan of reforms that aims to eliminate all unfunded liabilities of Dominica Social Security (DSS). It proposes the gradual but steady implementation of reform measures, which will distribute the burden of reform across generations and minimize potential disruptions to the economy. These reforms will be reviewed regularly over time, as part of the regular actuarial review process, to ensure that they remain sufficient to eliminate underfunding. The Plan also seeks to ensure that pensions remain relevant, particularly for those likely to be most financially vulnerable in old age.

This Plan benefited from FAD technical assistance and actuarial reviews completed by the ILO.

Most importantly, it also benefited from an open and comprehensive consultation process with stakeholders. The DSS report on these consultations suggest that, due in part to an active effort on behalf of the DSS to engage with stakeholders, the challenges facing social security were well understood. As a result, there was widespread consensus on the need for reform.

Reforms are wide ranging and those with the largest impact on financial sustainability include:

Increasing the employee and self-employed contribution rate from 3 percent and 7.65 percent respectively by 1 percent in 2007 and 2009. The eventual target is to raise total contributions, including those of the employer, from the current 9.75 percent to 15 percent.

- Increasing the contribution ceiling by EC\$1,000 to EC\$6,000 per month, starting in 2008.
- Reducing the pension accrual rate, i.e. the rate at which benefits are earned, from 2 percent to 1 percent per year for the contribution period between 10 to 20 years and reducing the maximum benefit from 70 percent to 60 percent of the final insurable wage, starting in 2008.
- Increasing the number of highest earning years used in the calculation of the final insurable wage from 3 to 10 years, starting in 2008.
- Increasing the minimum pension age by 1 year every 3 years to 65 years starting in 2009.

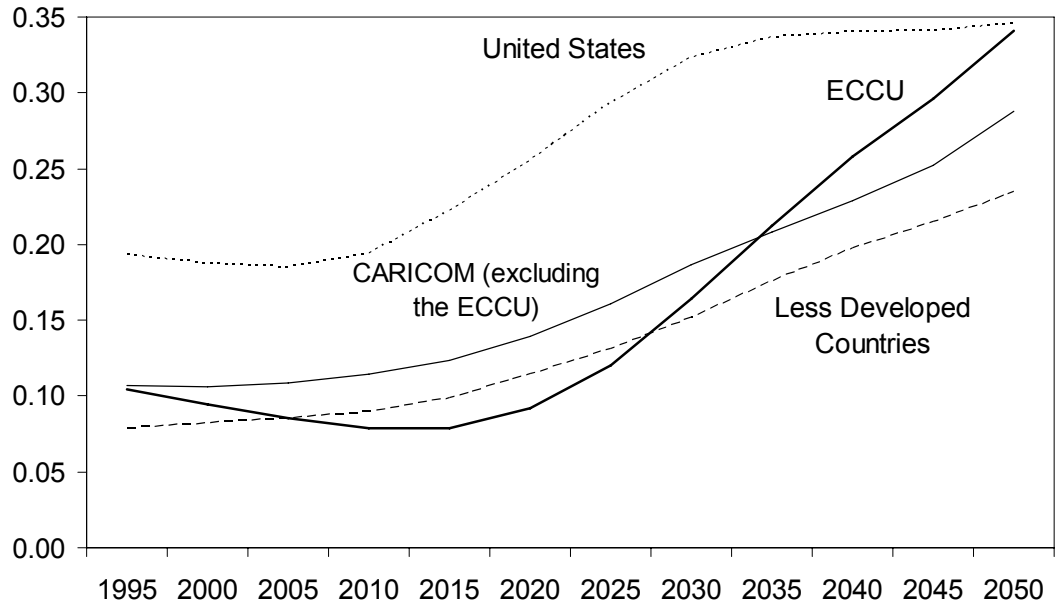
112. **Potential gains from international diversification are large, implying a higher weight for international assets.** This would also be consistent with a higher weighting for equities, which would improve asset-liability matching by extending asset duration and hedging against the earnings-indexed growth of liabilities. Limited domestic capacity implies that international assets be managed externally, perhaps passively tracking a benchmark to offset otherwise high administration costs.

113. **Domestic investment policies could be narrowed to reduce distortions.** Allowable social security investments in the domestic public sector could be limited to government bonds, as is the case in the United States. This would lower administrative costs, provide more space for private sector financial institutions in the domestic capital

market, and reduce the scope for mismanagement. Moreover, social security-funded investments with social or developmental objectives could be allocated more transparently via the regular budget process.

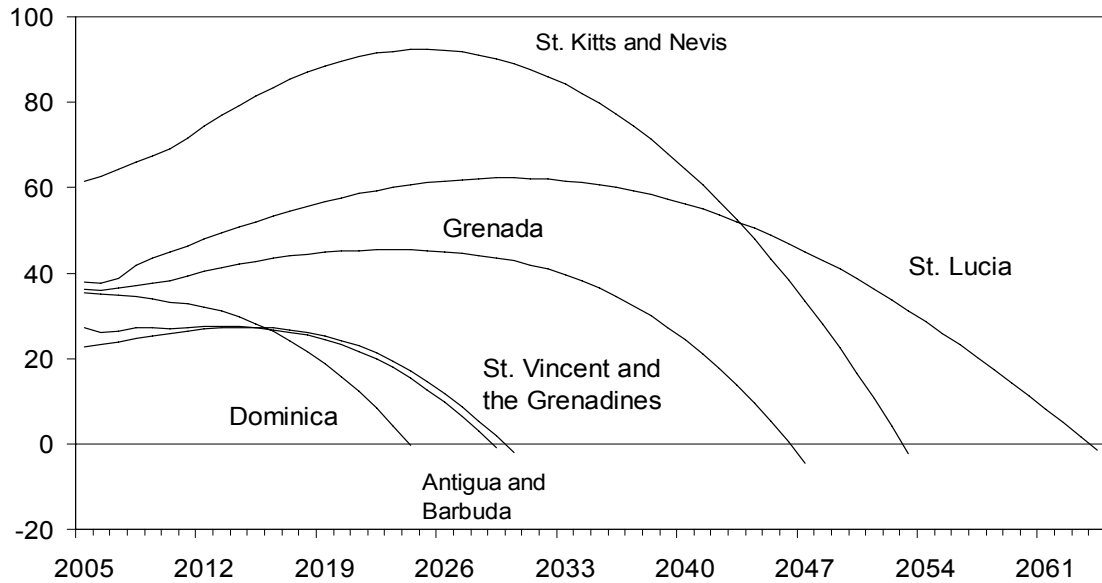
114. **There are a number of reform options available, and the need for reform is critical.** All ECCU social security schemes have one aspect in common—the earlier that appropriate reforms are implemented, the less drastic the ultimate reform effort that is required, and the more smoothly it may be implemented. This will be important to limit the potentially disruptive impact of reforms on the broader economy, and ensure a degree of burden sharing across generations.

Figure IV.1. ECCU: Population Aged 65+ to 15-64 Years Compared (Ratio)



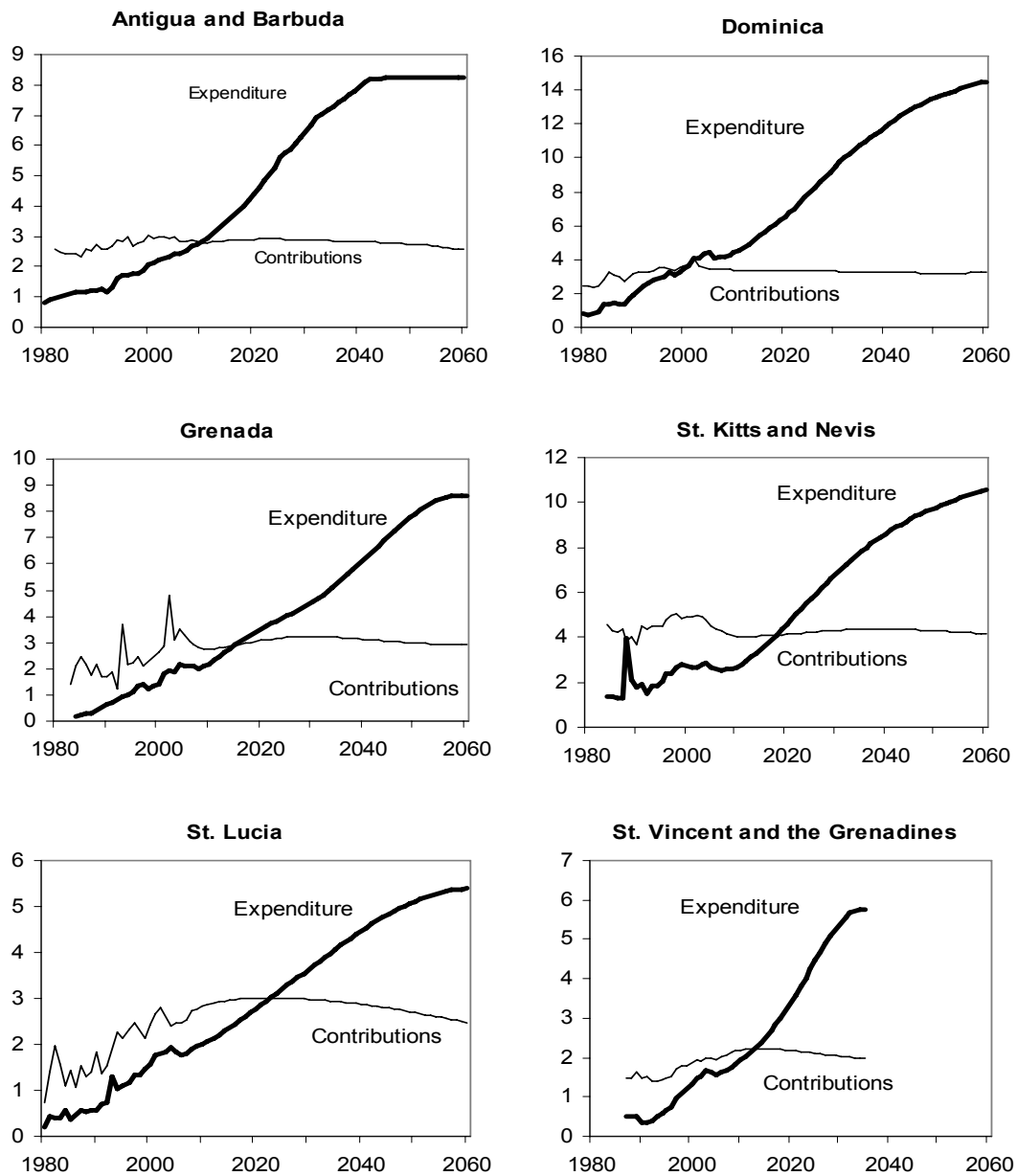
Source: U.S. Census Bureau International Database.

Figure IV.2. ECCU: Social Security Reserve Asset Projections (In percent of GDP)



Source: Fund staff estimates and projections.

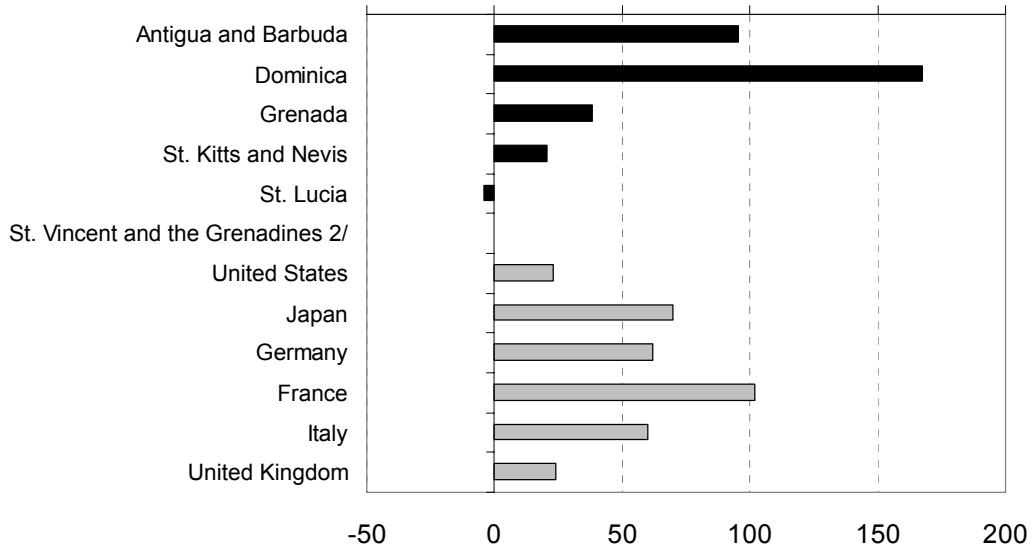
Figure IV.3. ECCU: Social Security System Expenditures and Contributions, 1980-2060 (In percent of GDP)



Sources: Osborne (2004), ILO (2005, 2004a, 2004b); Veira (2005); and Fund staff estimates.

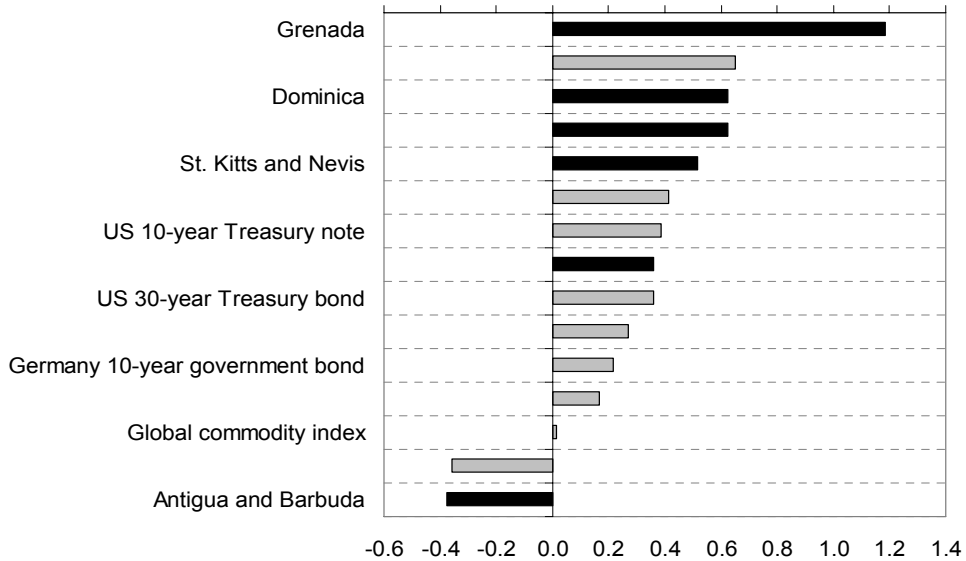
1/ For the purposes of these charts, it was assumed that nominal GDP will grow at an equivalent rate to contributions, as projected in the actuarial reports. This implicitly makes the assumption that, for constant contribution rates and a constant share of the workforce participating in the social security scheme, that wages as a share of GDP remain stable over the long-term.

Figure IV.4. Net Implicit Pension Debt
(In percent of GDP) 1/



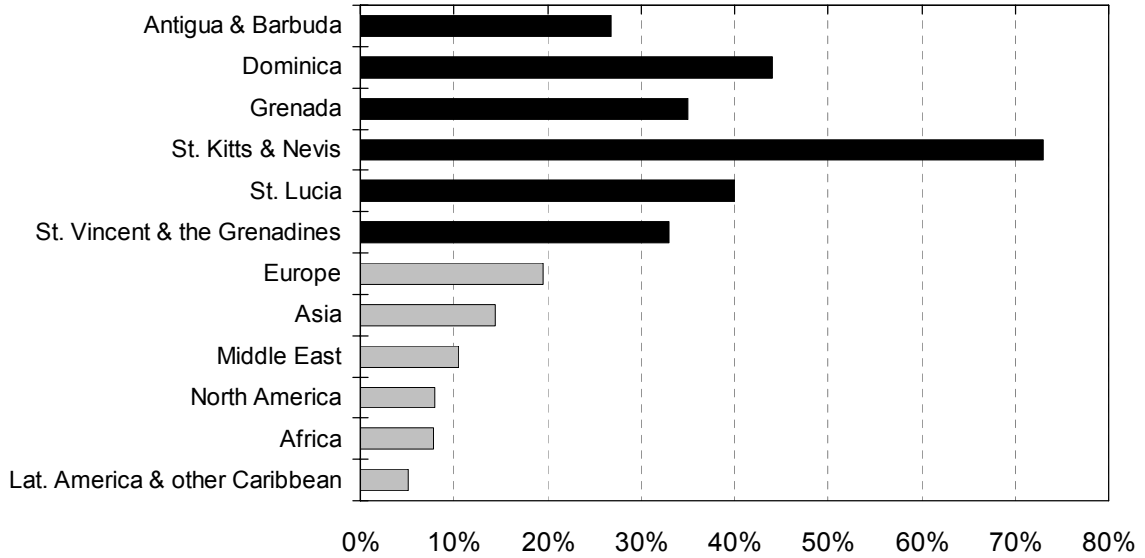
Sources: ILO (2005, 2004a, 2004b); Roseveare et al. (1995); and Fund staff estimates and projections.
 1/ Figures for ECCU based on a 60-year horizon and a 5.5 percent discount rate. Figures for OECD countries refer to the baseline from Roseveare et al. (1995) and assume a 5 percent discount rate with a 75-year horizon.
 2/ Data unavailable.

Figure IV.5. Reserve Portfolio Risk-Adjusted Performance
(Sharpe ratio, 1988-2003) 1/



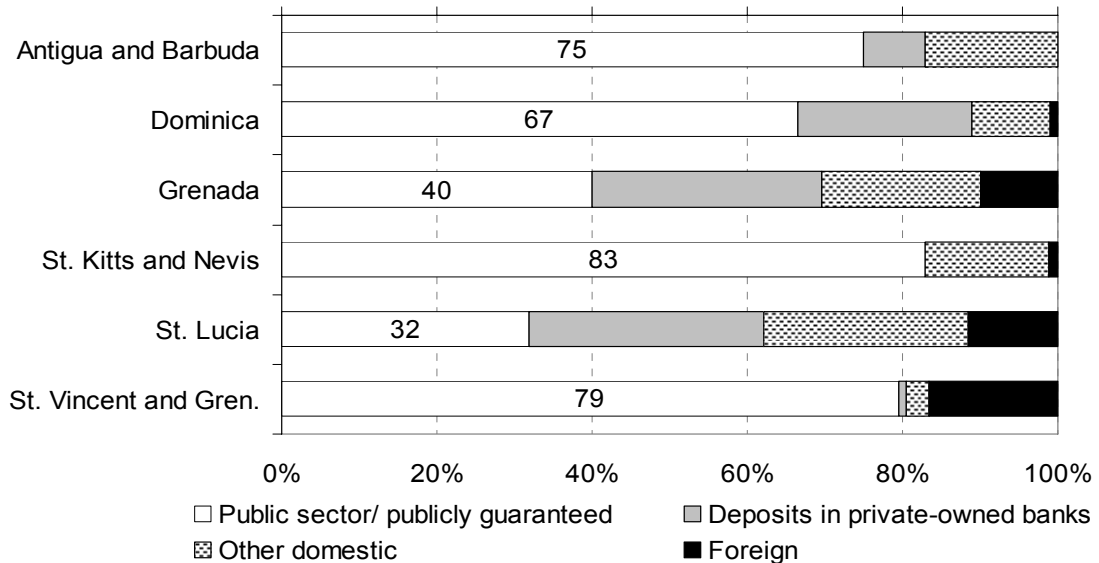
Sources: Osborne (2004); Datastream; and Fund staff estimates and projections.
 1/ Mean excess return (over the US three-month risk-free rate) divided by standard deviation.

Figure IV.6. Publicly-Mandated Social Security/Pension Fund Reserves
(In percent of GDP) 1/



Sources: Palacios and Pallares (2000); Osborne (2004); and Fund staff estimates.
1/ Regions include countries that run partially-funded defined benefit social security schemes.

Figure IV.7. ECCU: Social Security Reserve Portfolio Asset Allocations
(Percent of portfolio)



Sources: The base year taken from the most recent actuarial reports, financial statements, and Fund staff estimates: Antigua and Barbuda (2004), Dominica (2004), Grenada (2002), St. Kitts and Nevis (2002), St. Lucia (2004), St. Vincent and the Grenadines (2004).

Table IV.1. ECCU: Selected Indicators for Social Security Systems 1/

	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines
Year established	1973	1976	1983	1978	1979	1987
Number of contributors per pensioner	7.6	4.4	7.1	7.7	11.0	8.0
Contributors (in percent of population)	43.5	24.4	31.3	48.5	24.5	19.6
Minimum retirement age	60	60	60	62	61	60
Pensions received (as percent of insurable wage)						
Average insurable wage (best x / last y years)	5/10	3/10	3/10	3/15	5/12	3/15
Minimum for 10-yrns of contributions (12 for St. Lucia)	25	30	30	30	40	30
30-years of contributions	45	55	50	55	58	50
Maximum	50	70	60	60	60	60
Remaining life expectancy at statutory retirement age (females)	21.6	20.7	20.1	19.3	21.9	n.a.
Contribution rate (in percent of insurable earnings)	8	10	9	11	10	6
Average old-age pension (in percent of average insurable earnings)	22	28	24	28	39	29
Financial position (accrual basis, in percent of GDP)						
Income	3.8	5.8	6.7	8.3	4.8	3.4
Contributions	2.9	3.5	4.8	4.9	2.6	2.0
Interest and other	0.8	2.3	1.9	3.4	2.2	1.5
Expenditure	2.3	4.4	1.9	3.0	1.8	1.6
Net income	1.5	1.4	4.8	5.3	3.0	1.8
Asset reserve	26.8	36.0	31.3	57.9	37.5	22.4
Economic and demographic assumptions for actuarial review						
Long-term real GDP growth (percent per year)	2.50	2.00	1.50	1.00	1.25	3.50
Long-term yield on reserves (percent per year)	5.58	6.00	5.50	5.00	5.00	5.50
Long-term total fertility rate	1.85	1.85	1.90	1.85	1.90	2.10
Increase in ratio of pensioners to contributors (in percent)						
Over next three decades	242	113	132	187	176	221
Over next six decades	347	339	400	343	408	n.a.
Increase in life expectancy (in years for females at age 60)						
Over next three decades	3.5	1.5	3.7	3.5	2.3	n.a.
Over next six decades	5.0	4.2	5.4	3.5	3.5	n.a.
Year when						
Expenditure first exceeds contribution income	2010	2003	2019	2020	2024	2013
Expenditure first exceeds total income	2020	2015	2037	2036	2048	2021
Reserves are exhausted	2030	2022	2050	2053	2062	2033
Actuarial balance (in millions of EC\$) 3/	-2116	-1225	-420	-198	79	n.a.
			(In percent of annual GDP)			
Actuarial deficit (60-year horizon)	96	167	38	21	-4	n.a.
Actuarial deficit (30-year horizon)	14	42	-23	-50	-45	12
Total public debt (2004)	102	116	130	177	68	79
Total public debt including implicit social security liabilities	198	284	168	198	64	n.a.

Sources: National authorities; most recent actuarial reviews; and Fund staff estimates.

1/ Unless otherwise indicated, figures refer to the year forming the basis for the most recent actuarial review—Antigua and Barbuda (2004), Dominica (2004), Grenada (2002), St. Kitts and Nevis (2002), St. Lucia (2003), and St. Vincent and the Grenadines (2004). Where applicable, projections refer to an intermediate scenario.

2/ St. Kitts and Nevis and St. Vincent and the Grenadines include deposits held at banks majority-owned by the government.

3/ Asset reserve plus present value of contribution income less expenditure calculated over the next six decades assuming a 5.5 percent annual discount rate.

Table IV.2. ECCU: Social Security Contributions

	Contribution Rates (Percent)			Ceiling 1/
	Employee	Employer	Total	
ECCU				
Antigua and Barbuda 2/	3	5	8	1.9
Dominica 3/	3	7	10	3.2
Grenada	4	5	9	2.1
St. Kitts and Nevis	5	6	11	3.1
St. Lucia	5	5	10	3.4
St. Vincent and Gren.	2.5	3.55	6.05	3.0
Other CARICOM				
Barbados	7.75	8.50	16.25	2.1
Jamaica	2.5	2.5	5.0	na
Trinidad and Tobago	2.9	5.8	8.7	1.2
ECCU average	4	5	9	2.8
CARICOM average 4/	4	6	10	2.4
OECD average 5/	9	17	26	1.8

Sources: ECCU national authorities; Osborne (2004); OECD (2005).

1/ As multiple of average insurable wage.

2/ The contribution rate for public sector employees is 2 percent.

3/ The contribution rate for public sector employers is 6.75 percent.

4/ Includes all countries above plus Belize and Guyana.

5/ This is the average of all contribution rates below the wage ceiling for 2005.

Table IV.3. ECCU: Recommended Investment Guidelines of the Eastern Caribbean Central Bank for Regional Social Security Systems 1/

	Percent of Total Assets	Allowed Public Sector Exposure 2/
Cash	1	...
Fixed-term deposits	20	20
Direct lending	34	34
Government lending	25	25
Real estate	10	...
Equity	5	...
Foreign	5	...
Total	100	79

Sources: Nicholls (2002); and Fund staff estimates.

1/ The guidelines were established in 1993.

2/ Assuming deposits in state-owned indigenous banks are a form of public sector exposure.

Table IV.4. ECCU: Social Security Cashflow Duration (Years)

	Duration		Change in Implicit Debt-to-GDP Ratio from a Decline in Discount Rates 1/
	Contributions	Expenditures	
Antigua and Barbuda	25	31	+21
Dominica	25	32	+34
Grenada	26	34	+14
St. Kitts and Nevis	26	33	+15
St. Lucia	47	43	+3
St. Vincent and the Grenadines 2/	...	...	...

Sources: ILO (2005, 2004a, 2004b); and Fund staff estimates.

1/ Assumes that the duration of reserve portfolios is five years and that the discount rate declines by 50 basis points.

2/ Calculations are unavailable.

Table IV.5. ECCU: Social Security Administrative Costs Compared (In percent) 1/

	Costs as a Percent of 2/ 3/			Charge Ratio 4/
	Benefit Expenditures	Contribution Income	Reserve Assets	
Antigua and Barbuda	30	16	1.9	35
Dominica	17	16	1.7	31
Grenada	26	12	1.2	24
St. Kitts and Nevis	37	15	1.2	25
St. Lucia	24	13	0.9	20
St. Vincent and the Grenadines	26	17	1.5	21
Caribbean excl. ECCU	19	12	2.1	...
Latin America	11	...	...	...
United States	...	...	1.5	...
OECD	3	...	...	...
Whitehouse (2001) sample	...	...	...	17

Sources: Mitchell (1998), Whitehouse (2001), James (2005), ILO (2005, 2004a, 2004b); Veira (2005); and Fund staff estimates.

1/ Non-ECCU data taken from Mitchell (1998) and ECCU data for 2003.

2/ Data taken from Osborne (2004) with other Caribbean restricted to CARICOM countries.

3/ Latest actual year available from actuarial reports and Osborne (2004) for non-ECCU. Figure for the United States is for the average retail mutual fund.

4/ The charge ratio assesses the reduction in net asset value assuming that funds earn the market rate of return (which will not hold precisely in a partly funded scheme). Assumptions are consistent for the non-ECCU sample in Whitehouse (2001), which are individual earnings growth of 3 percent, annual investment returns of 5 percent and a 40-year contribution history. The non-ECCU sample includes funded schemes in Chile, Colombia, Mexico, Australia, Sweden, and the United Kingdom.

References

- Chai, J., 2006, “The Eastern Caribbean Currency Union Banking System in a Time of Fiscal Challenge,” in R. Sahay, D.O. Robinson, and P. Cashin (eds), *The Caribbean: From Vulnerability to Sustained Growth* (Washington DC: International Monetary Fund, pp. 143–80).
- Henry, V., 2004, “An Investigation into the Structure, Governance and Performance of the Social Security Organizations in the Caribbean,” (Toronto: University of Toronto Press).
- Holzmann, R., 2000, “The World Bank Approach to Pension Reform,” *International Social Security Review*, Vol. 53, pp. 11–34.
- International Labour Organization, 2005, *St. Lucia: Eighth Actuarial Review of the National Insurance Fund as of 30 June 2003* (Geneva: International Labour Organization).
- International Labour Organization, 2004a, *Grenada: Seventh Actuarial Review of the Social Security Fund as of 31 December 2002* (Geneva: International Labour Organization).
- International Labour Organization, 2004b, *St. Kitts and Nevis: Seventh Actuarial Review of the Social Security Fund as of 31 December 2002* (Geneva: International Labour Organization).
- International Labour Organization, 2004c, *Antigua and Barbuda: Seventh Actuarial Review of the Social Security Fund as of 31 December 2002* (Geneva: International Labour Organization).
- International Labour Organization, 2003, *Dominica: Eighth Actuarial Review of the Social Security Fund as of 31 December 2002* (Geneva: International Labour Organization).
- James, E., 2005, “Reforming Social Security: Lessons from Thirty Countries,” NCPA Policy Report No. 277 (Washington DC: National Center for Policy Analysis).
- Levy, H., and M. Sarnat, 1970, “International Diversification of Investment Portfolios,” *American Economic Review*, Vol. 60, pp. 668–75.

- Longin, F., and B. Solnik, 2001, “Extreme Correlation of International Equity Markets,” *The Journal of Finance*, Vol. 56, pp. 649–76.
- Mitchell, O., 1998, “Administrative Costs in Public and Private Retirement Systems,” in M. Feldstein (ed), *Privatizing Social Security* (Chicago: University of Chicago Press), pp. 403–56.
- Nicholls, G., 2001, “Emerging Issues for the Eastern Caribbean Currency Union’s Social Security Schemes,” *Journal of Eastern Caribbean Studies*, Vol. 26, pp. 35–73.
- Nicholls, G., 2002, “Is there a Case for Foreign Investment by the Eastern Caribbean Currency Union’s Social Security Schemes?,” *Savings and Development*, Vol. 26, pp. 301–24.
- Organization for Economic Cooperation and Development, 2005, “Pensions at a Glance - Public Policies Across OECD Countries,” (Paris: OECD Publishing).
- Osborne, D., 2004, “Social Security in the CARICOM Single Market and Economy,” *CARICOM Secretariat* (Georgetown: CARICOM).
- Pallacios, R., and M. Pallares, 2000, “International Patterns of Pension Provision,” World Bank Social Protection Discussion Paper Series, No. 0009 (Washington DC: World Bank).
- Roache, S., 2006, “Domestic Investment and the Cost of Capital in the Caribbean,” IMF Working Paper, No. 06/152 (Washington DC: International Monetary Fund).
- Roseveare, D., W. Leibfritz, D. Fore, and E. Wurzel, 1995, “Ageing Populations, Pension Systems and Government Budgets,” OECD Economics Department Working Paper No. 168 (Paris: OECD).
- Samuel, W., and D. Velculescu, 2003, “Social Security Issues in the Caribbean,” *Eastern Caribbean Currency Union—Selected Issues*, IMF Country Report 03/88 (Washington DC: International Monetary Fund), pp. 97–116.
- Sosa, S., 2006, “Tax Incentives and Investment in the Eastern Caribbean,” IMF Working Paper No. 06/23 (Washington DC: International Monetary Fund).
- Veira, J., 2005, *National Insurance Services of St. Vincent and the Grenadines: Actuarial Valuation as of January 1st 2005* (St. Vincent and the Grenadines: Board of the NIS of St. Vincent and the Grenadines).

Whitehouse, E., 2001, "Administrative Charges for Funded Pensions: Comparison and Assessment of 13 Countries," in *Insurance and Private Pensions Compendium for Emerging Economies, Book 2, Part 1:6* (Paris: Organization for Economic Cooperation and Development).

V. DOMESTIC INVESTMENT AND THE COST OF CAPITAL⁶⁶

A. Introduction

115. **Despite relatively high levels of investment, economic growth has been disappointingly low in many Caribbean countries** (Figure V.1).⁶⁷ There are many possible explanations, including that the linkages between foreign direct investment (including in the tourism sector) and the rest of the economy are weak, or that the return on public investment is less than on private investment (Khan and Kumar, 1997; Bouton and Sumlinski, 2000). Alternatively, there may be crowding out of domestic private investors.

116. **While the role of foreign direct investment has been much debated in the region, private domestic investment could prove to be one important factor to unlock growth.** If private domestic investment (PDI) were to increase, then the returns to capital spending by public agencies may also increase.⁶⁸ PDI could also improve the linkages between the domestic economy and foreign-owned capital. If PDI could potentially play an important role in driving growth, what factors might cause it to increase?

117. **Against this background, this chapter assesses the factors that have affected private domestic investment in the Caribbean.** The main focus is on the cost of capital, which includes the cost of debt, equity, and the impact of taxes. The analysis suggests that private domestic investment is sensitive to the cost of capital in the region, yet is unresponsive to public investment or foreign direct investment (FDI). The results suggest that public policy should focus on the cost of capital (CoC) as a means of raising PDI rather than tax concessions that can be opaque, highly discretionary, and penalize domestic investors (Chai and Goyal, 2006; Sosa, 2006).⁶⁹

118. **The structure of this chapter is as follows.** Section B presents the investment model and data. Estimation issues and empirical results are then discussed in the following sections, and Section E contains some concluding comments.

⁶⁶ Prepared by Shaun Roache.

⁶⁷ CARICOM (Caribbean Community and Common Market) comprises 15 member states and five associate members. The subjects of this study are seven CARICOM member states: Antigua and Barbuda, Barbados, Jamaica, St. Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, and Trinidad and Tobago.

⁶⁸ The interaction between private and public investment in developing countries is complex. The empirical literature has provided ambiguous results. For example, a survey by Everhart and Sumlinski (2001) shows that the literature is almost evenly split on whether public investment crowds in or crowds out the private sector.

⁶⁹ The ECCU in this paper refers to the six independent countries that comprise the Eastern Caribbean Currency Union: Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines.

B. The Model and Data

119. **The basic model derives from the Hall-Jorgenson approach in which firms invest in order to maximize the present value of all future cash flows.** In this simple model, there are no capital stock adjustment costs, and the optimal capital stock (k , in logs) is defined as a simple function of the firm's output (y , in logs), the post-tax cost of capital (ρ) and the elasticity of capital to labor as σ (also defined as the user cost elasticity of capital):

$$k_t = a + y_t - \sigma \rho_t. \quad (1)$$

Box V.1 provides a brief overview of the data construction, with the key challenge being the creation of capital stock and cost of capital series. To measure the cost of capital, the OECD STAN database was used to construct investment deflators and depreciation rates for the capital used by sectors across countries, which were then weighted by the sector's real value added in each country to obtain country-specific aggregates. The capital stock was estimated using the standard accumulation identity and the method first developed by Nehru and Dhareshwar (1993), taking into account the effect of natural disasters.⁷⁰

120. **Table V.1 illustrates that investment-to-GDP ratios across the ECCU region have been relatively high, particularly in the smaller ECCU countries.** This reflects the strength of foreign direct investment, due in large part to global growth in the tourism sector, which has offset stagnant or declining PDI as a share of GDP. Figure V.2 also illustrates that the private investment rate in the region has been exceptionally volatile, partly reflecting the effect of natural disasters, but also that the rate has been stagnant or declining in many countries over the past decade.

⁷⁰ The effect of natural disasters, an important factor for the region, was included using estimates from the EM-DAT database of CRED (2006). These are clearly subject to measurement error. However, account has to be taken of disasters as they are a factor that, in the ECCU region, have caused damage equivalent to around 2 percent of GDP annually in recent years (Rasmussen, 2006). Dummy variables for the year of the disaster, plus the following year, were also included, although for the most extreme outliers, the observations were removed.

Box V.1. Data Used in the Regression Analysis

The regression analysis estimated the impact of various factors on the level of the real private domestic capital stock. Theory suggests that the optimal level of capital should be fully determined by just two variables: real output and the real cost of capital. Other variables were included as controls. See Roache (2006) for more details.

Private capital stock: estimated using techniques described in Nehru and Dhareshwar (1993). This is based on the perpetual inventory method, with capital stock in any year equal to the amount of undepreciated capital in the previous year, plus new investment. In almost all cases, only nominal investment is provided by the authorities. The OECD STAN database was used to estimate an investment goods deflator for each country. This was also used, together with the EM-DAT natural disasters database, to estimate real depreciation.

Cost of capital: estimated using the cost of debt, equity, and the burden of taxation. The cost of debt was based on commercial bank lending rates as published in *International Financial Statistics*. The cost of equity was estimated from a capital asset pricing model, largely based on the required risk premium for the tourism sector. The weights of debt and equity were estimated by calculating the proportion of the capital stock that was financed by outstanding credit to the domestic private sector. The tax factor represents the overall corporate tax burden on the marginal unit of investment, including the present value of future allowance for depreciation. Tax data was sourced from international tax surveys conducted by global accounting firms, and from the International Bureau of Fiscal Documentation. In all cases, the published statutory rates of taxation were used in the calculation of effective marginal rates.

Other variables: Output, public investment, foreign direct investment (FDI), the real effective exchange rate, external debt-to-GDP ratio, and credit to the private sector: sourced from the authorities and IMF staff reports, where appropriate. The public investment and FDI deflators were estimated using the OECD STAN database.

Correlation statistics are presented in Table V.2 below. All variables are given in log first differences multiplied by 100 (as used in the regression) and, with the exception of the real effective exchange rate and the external debt-to-GDP ratio, are deflated.

121. **The financing cost of capital appears to have been rising in many countries, reflecting debt, equity, depreciation, and taxation (Figure V.3).** In the absence of a deep and liquid corporate debt and stock market, estimates for the cost of debt and equity from standard approaches, such as the capital asset pricing model (CAPM), are difficult to obtain. There is also no consensus on what assets should be used when estimating the cost of equity.

To overcome the lack of financial markets, weighted average country CAPM betas were constructed using global asset prices (see Roache, 2006, for details).⁷¹

122. **The cost of capital has been rising across much of the region in recent years.** The increase in the depreciation rate (largely related to an increasing weight for technology equipment) has not been offset by a reduction in interest rates or the cost of equity. The average financing cost of capital for the sample countries in 2004 was 15.2 percent. Using the same methods, the approximate cost of capital for U.S. corporations in 2004 was 8.2 percent.⁷²

123. **To construct CAPM betas for each country, the share in GDP of what might be regarded as global industries, such as tourism, mining, and energy, were used to weight the betas from the global sector equity index on the world equity market.** The remainder was accounted for by the beta of the global emerging markets index. This downplays the role of country-specific factors in determining the risk premium. This approach reflects the opportunity cost of equity capital when investors face an open capital account and are considering projects in certain industries.⁷³ Investment opportunities in these small countries are often related to expectations regarding a key sector (e.g., tourism or energy), and this is likely to outweigh country-specific issues in many cases.

124. **One interesting development in the regional beta has been the increasing weight of tourism and the effect this has had on risk.** After the crises during 1997–99 in several emerging markets, the systemic risk has subsequently declined. However, this has not fully fed through to all areas of the Caribbean. One reason is that the beta of the global tourism sector rose sharply after the terrorist attacks of September 11, 2001. Equity assets in this sector are now performing as highly leveraged plays on the overall stock market cycle.⁷⁴

⁷¹ The CAPM beta represents the undiversifiable systemic risk of the investing in the country. Given that the sample countries run open capital accounts, it is assumed that all idiosyncratic risk may be diversified away.

⁷² This used the S&P 500 debt-to-assets ratio, an average BAA corporate bond yield of 6.4 percent, the statutory 35 percent corporate tax rate, an approximate tax factor of 1.14, and an equity risk premium over the U.S. ten-year treasury note of 2.8 percent.

⁷³ For example, Caribbean investors could replicate a global sector investment by purchasing an exchange-traded fund that is indexed to a global sector benchmark.

⁷⁴ To assess whether the September 11 effects influenced the results, estimations included a common post-September 11 dummy variable.

125. **Compared with industrial country standards, the estimated level of equity funding in the Caribbean is high.**⁷⁵ Figure V.4 shows the private sector business debt-to-capital ratio for each country. The highest is in St. Kitts and Nevis (likely influenced by the sugar company, a public enterprise) and the lowest is Jamaica, which has suffered from long periods of intense real interest rate volatility. The average across the sample countries is 38 percent. This compares with an 80 percent ratio among the companies in the U.S. S&P 500.

126. **Figure V.5 shows how the overall CoC using this method compares across countries.** The figures for each country have been weighted by the average source of finance. For example, the weighted cost of debt in Jamaica is very low because almost all PDI is estimated to be financed from equity (e.g., retained earnings).

C. Estimation Issues

127. **An unbalanced panel of seven countries using annual data with a maximum span of 1980 to 2004 was used for the estimation of equation (1).** For all specifications, two samples were used: (i) the full sample of seven Caribbean countries; and (ii) the sample excluding Trinidad and Tobago, because of the very heavy weight of the energy sector in Trinidad's economy.^{76 77}

128. **The strategy is to estimate equation (1) as a structural model, relating the long-run level of capital to output and the cost of capital.** Two drawbacks of this approach are that it does not take into account shorter-run adjustments, and the regressors (output and the cost of capital) may be endogenous. To address the latter issue, an instrumental variables approach is taken.

129. **Equation (1) was estimated in first differences using the generalized method of moments (GMM).** Lagged values of the endogenous variables—such as the capital stock,

⁷⁵ In the case of debt financing, with most business sector borrowing in CARICOM taking the form of bank loans rather than tradable bonds, the nominal book value of these loans is taken as the level of debt funding. The share of equity is then the residual.

⁷⁶ Over the sample period, it was estimated from national authority and IMF data that the value added of the energy sector averaged 28 percent.

⁷⁷ Standard panel unit root and cointegration tests suggest that most sample variables are non-stationary and not cointegrated—the results are available from the author. The absence of cointegration could reflect the possibility that factors outside the neoclassical model also determine the long-run capital stock.

output, and the cost of capital—were used as instruments.⁷⁸ The GMM weighting matrix was chosen to account for cross-equation correlation.

D. Empirical Results

130. **Equation (1) was initially estimated in first differences including only output and the cost of capital as regressors** (Table V.3, columns 1 and 2). While consistent with the theory, the null that the instruments were valid was rejected for most sets of instruments chosen. When the set of regressors was expanded to include the change in the level of external public debt to GDP and the real exchange rate (both considered as endogenous and instrumented for using lagged values), the model's performance improved significantly (Table V.3, columns 3–10).

131. **The estimates showed that the user cost elasticity (UCE), which represents the sensitivity of private capital to the cost of capital, was negative and significant.** The *GMM* estimated UCE for the full sample is shown in Table V.3 (columns 3–10). The UCE was estimated to be around -0.12, compared to the most recent estimates in the literature, which range from -0.18 to -0.03, and was stable across alternative specifications of the equations. Moreover, the model using the cost of capital also outperformed those using real interest rates (Roache, 2006).

132. **The effects of output, public investment and foreign direct investment were insignificant.** This suggests there is little evidence that a rise in aggregate demand brings forth additional private sector capital. It also points to weak linkages between the domestic private sector and the public and foreign-owned capital stock (Table V.3, columns 5–8). Multicollinearity may, to some extent, be dampening coefficient estimates for the latter two factors, particularly for public investment. As Table V.2 shows, public investment is correlated with output and the external debt ratio.

133. **The coefficient on the change in the external public debt-to-GDP ratio was negative but statistically insignificant** (Table V.3, columns 3–10). This provides some weak evidence of a public debt overhang, with large changes in the external debt ratio depressing the growth in the domestic capital stock. Caution is warranted in interpreting these results, particularly given the role of natural disasters. For example, when an island is

⁷⁸ The cost of capital was treated as endogenous, since the large real interest rate component is likely to be contemporaneously correlated with output shocks. Although, for a small open economy, the interest rate is typically regarded as exogenous, interest rates in the region have shown a lack of sensitivity to the nominal anchor, the U.S. dollar, in recent years. Other instruments used included FDI, central government investment, and credit to the private sector.

hit by a hurricane it is likely that the capital stock will decline through damage. Meanwhile, the debt ratio will increase as the authorities attempt to smooth consumption. This is partly controlled for by dummy variables, the removal of extreme outliers, and the instrumenting of the debt ratio change using lagged changes.

134. **There is little evidence of credit rationing.** Following Lederman and others (2003), real credit to the private sector was included in a number of specifications; under credit rationing, the coefficient on this variable should be positive and significant, while that on the cost of capital should remain negative. The coefficients were actually negative and insignificant and there was no meaningful impact on the estimates of the user cost elasticity (Table V.3, columns 9–10).

E. Conclusions

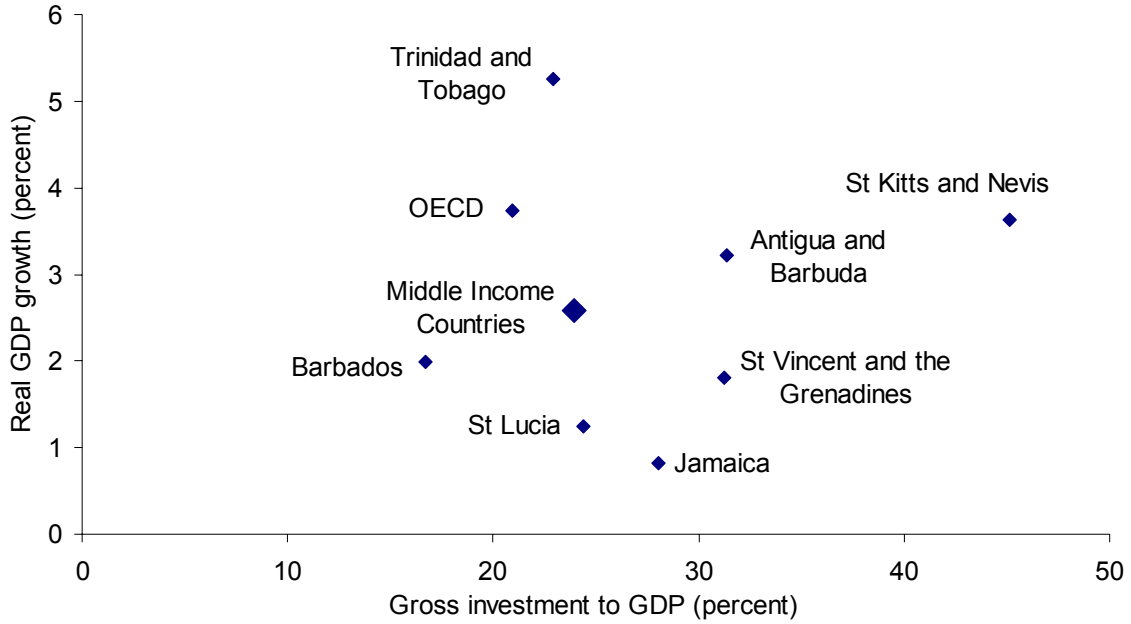
135. **This chapter has three main conclusions:**

- *Private domestic investment is sensitive to the user cost of capital.* Local real interest rates, the corporate tax burden, and global financial market conditions all have a major influence on the private domestic capital stock.
- *Real output does not affect private domestic investment (PDI).* In addition, the multiplier effects of public investment and FDI for private domestic investment are weak.
- *Public policy designed to raise private domestic investment levels should focus on creating the conditions for a lower cost of capital.* Policy should focus less on relying on public investment or FDI to stimulate domestic private sector growth.

136. **These results suggest that policies to reduce the cost of capital could help raise private domestic investment across CARICOM countries.** Currently, policy in some parts of the region may be based too heavily on the presumption that only public investment and the attraction of more FDI, through costly tax concessions, can jumpstart economic growth. The evidence suggests that public investment and FDI have had little impact on stimulating private domestic investment.

137. **Public policy is likely to be more effective in reducing the cost of capital by creating conditions that allow the pre-tax financing cost to decline.** Reducing the role for the public sector might ease crowding out effects, particularly in the domestic banking system. Structural financial sector reform measures might also be considered, such as easing foreclosure laws. This would reduce risks for financial institutions and allow banks to provide credit at lower rates to domestic businesses.

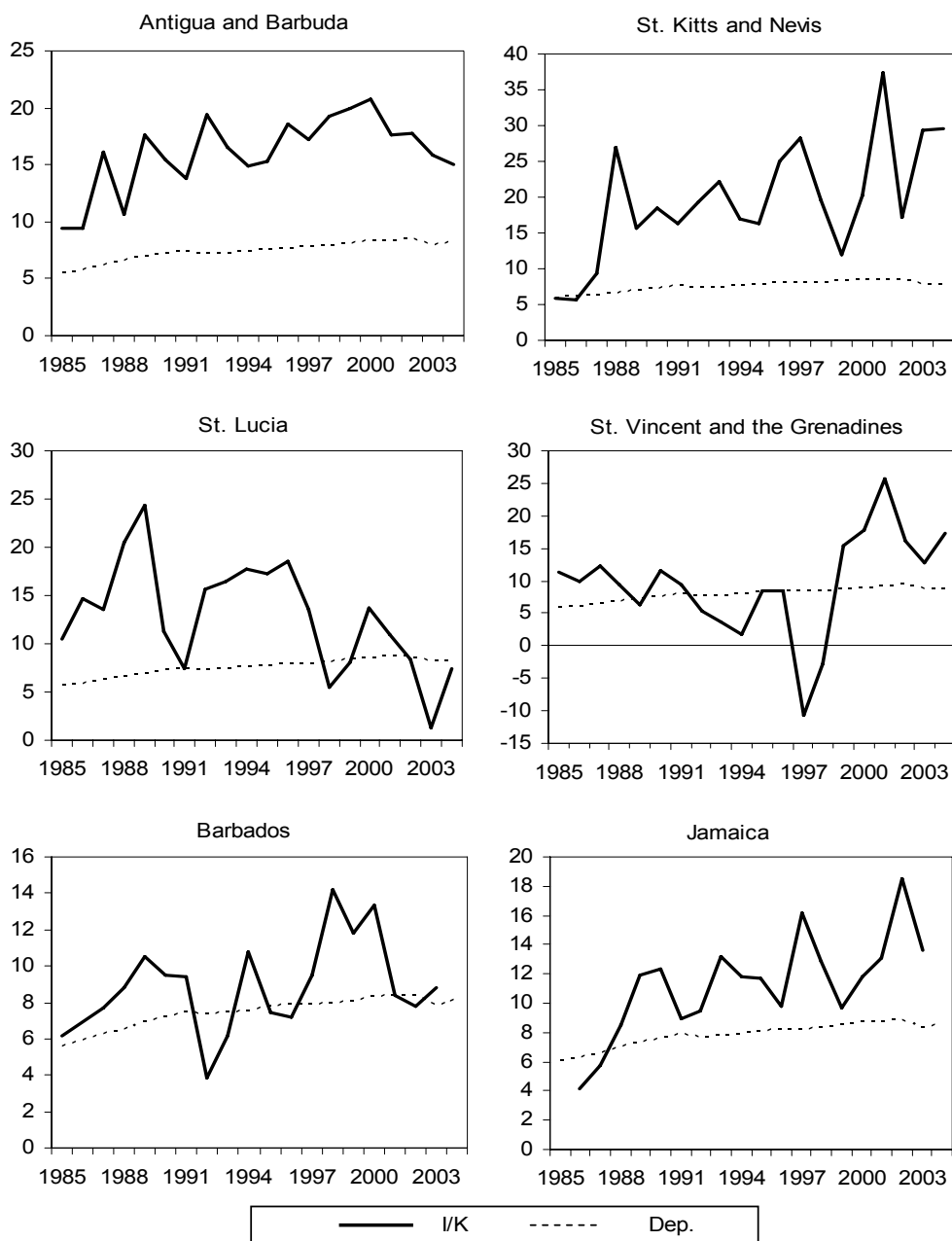
Figure V.1: GDP Growth and Gross Investment-to-GDP, 1995–2004 1/



Source: IMF, International Financial Statistics.

1/ Unweighted arithmetic average of constant price GDP annual growth rates.

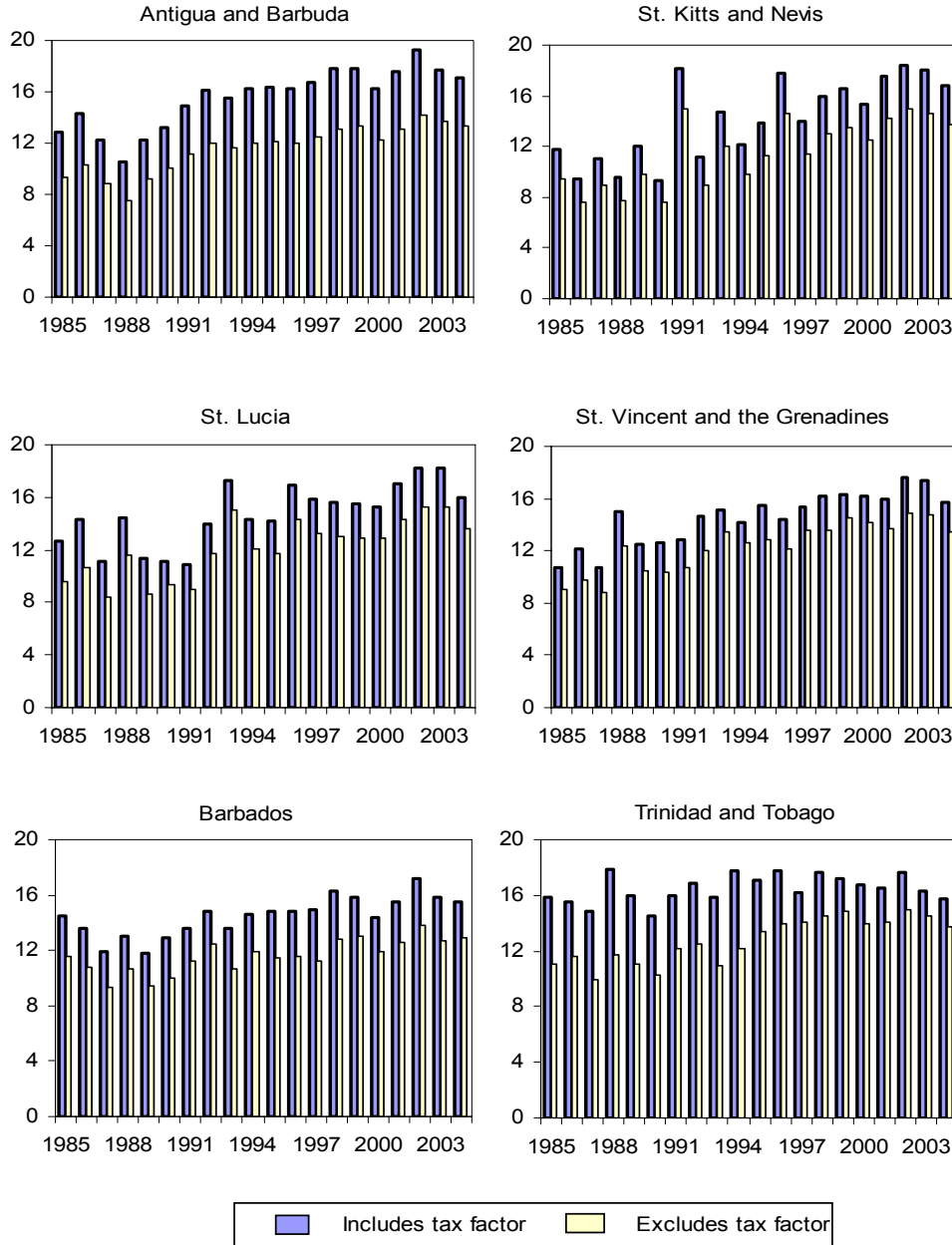
Figure V.2. Private Investment Rate (I/K) and Economic Depreciation (Dep.)
(Local currency 2000 prices, percent per annum) 1/



Sources: National authorities; Organization for Economic Cooperation and Development; and author's calculations.

1/ I and K deflated by the local currency capital goods deflator. Excludes effects of natural disasters.

Figure V.3. Financing Cost of Capital, 1985–2004 1/ 2/
(Percent per annum)

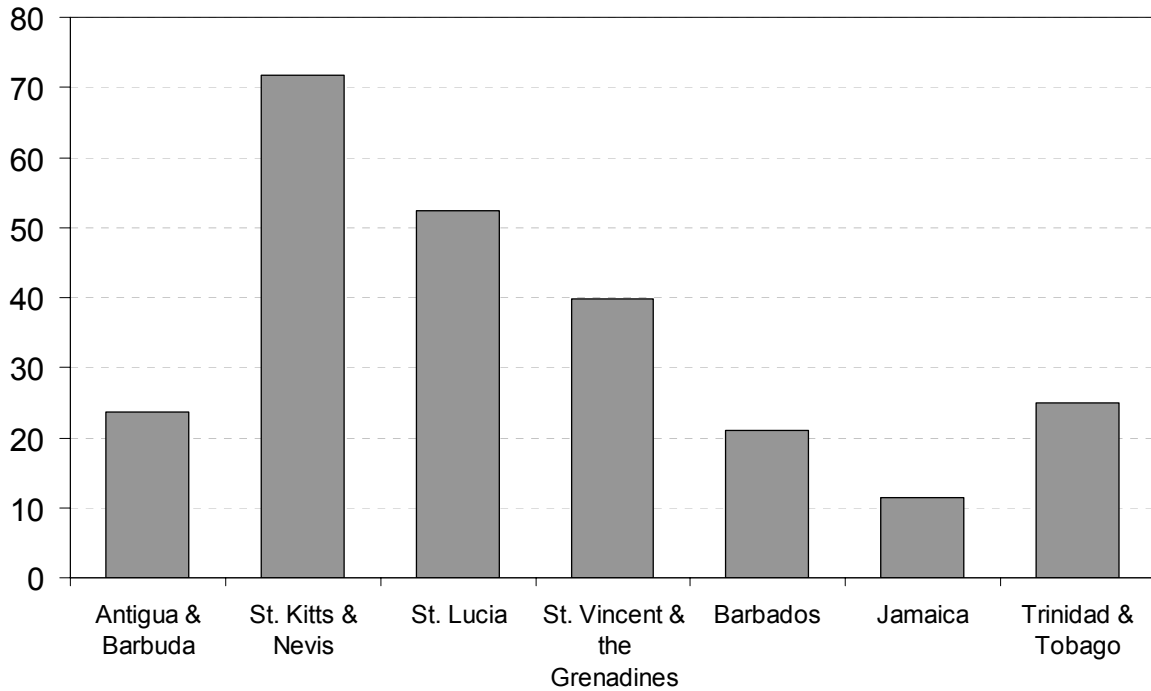


Sources: National authorities; IMF; Organization for Economic Co-operation and Development; Datastream; Price Waterhouse; and author's calculations

1/ Includes the cost of debt, equity, and depreciation. Trinidad and Tobago is presented in place of Jamaica as extreme country-specific volatility in Jamaica makes it difficult to compare to regional peers.

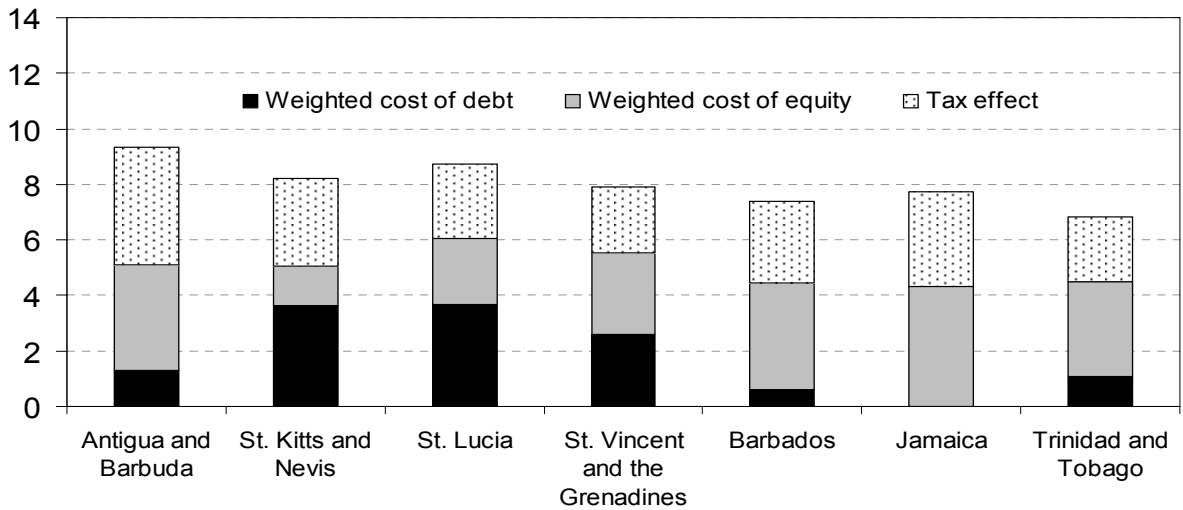
2/ The tax factor represents the overall corporate tax burden on the marginal unit of investment including the present value of future allowances for depreciation.

Figure V.4. Debt-to-Capital Ratios (In percent)



Sources: National authorities; ECCB; OECD; and author's calculations.

Figure V.5. Components of the Weighted Average Real Cost of Capital (Average percent cost for 2000–04) 1/



Sources: National authorities and Fund staff estimates.

1/ Contributions weighted by the proportion of capital financed from each source, with the percentage financed by debt being: Antigua and Barbuda 25%; St Kitts and Nevis 76%; St. Lucia 56%; St. Vincent and the Grenadines 42%; Barbados 21%; Jamaica 11%; and Trinidad and Tobago 25%. The three-year average cost of debt for Jamaica is used due to significant volatility. Depreciation and capital prices are excluded.

Table V.1. CARICOM:Gross Investment, 1985–2003 1/ 2/
(Percent of GDP)

	Period average			
	1985–89	1990–94	1995–99	1999–2003 3/
Middle-income countries				
Gross investment	23.3	23.7	24.0	23.7
Barbados, Jamaica, Trinidad & Tobago				
Gross investment	18.5	19.2	23.5	21.8
Central govt	4.1	3.2	4.4	2.8
FDI	0.7	3.0	4.9	6.3
PDI	13.8	13.0	14.2	12.5
ECCU countries				
Gross investment	32.9	33.2	35.4	38.1
Central govt	7.1	6.2	6.2	6.6
FDI	9.3	9.8	11.7	12.4
PDI	16.5	17.2	17.5	17.0

Sources: National authorities; IMF; World Bank; and author's calculations.

1/ Unweighted averages of the current price investment ratios for the countries in each group.

2/ Private domestic investment (PDI) also includes investment by public enterprises.

3/ Data end at 2003 as this is the last year in which data was available for all countries.

Table V.2. Correlation Matrix (First Difference)

	Capital	Output	Cost of Capital	Real interest rate	External debt-GDP	Real exchange rate	FDI (real)	Public investment (real)	Credit to private sector (real)
Log levels									
Capital	1.00								
Output	0.98	1.00							
Cost of capital	0.55	0.54	1.00						
Real interest rate	0.14	0.17	0.26	1.00					
External debt-GDP	0.15	0.08	0.27	0.11	1.00				
Real exchange rate	-0.17	-0.15	0.30	0.05	-0.22	1.00			
FDI (real)	0.70	0.75	0.44	0.27	0.21	-0.19	1.00		
Public investment (real)	0.86	0.90	0.63	0.23	0.10	-0.01	0.71	1.00	
Credit to private sector (real)	0.96	0.98	0.48	0.25	0.12	-0.14	0.76	0.89	1.00
Log first differences									
Capital	1.00								
Output	0.12	1.00							
Cost of capital	-0.10	-0.06	1.00						
Real interest rate	-0.09	0.14	0.53	1.00					
External debt-GDP	0.04	-0.07	0.08	0.03	1.00				
Real exchange rate	-0.05	-0.17	0.01	0.06	-0.39	1.00			
FDI (real)	-0.30	0.01	-0.02	-0.15	0.03	-0.19	1.00		
Public investment (real)	-0.16	0.20	0.05	-0.01	0.10	0.06	0.17	1.00	
Credit to private sector (real)	0.15	0.24	-0.30	-0.03	-0.11	0.09	-0.09	0.08	1.00

Source: Author's calculations.

Note: See Box V.1 for variable source and definitions.

Table V.3. GMM Regression Results: Dependent Variable is Private Domestic Capital Stock 1/

	GMM 1	GMM 2	GMM 3	GMM 4	GMM 5	GMM 6	GMM 7	GMM 8	GMM 9	GMM 10
Output	-0.54 0.85	-1.53 1.03	0.10 0.29	0.15 0.89	0.69 1.57	0.19 0.94	0.13 0.33	0.40 1.08	0.38 1.34	0.04 1.70
Cost of capital	-0.03 0.02	-0.03 0.05	-0.11 ** 0.05	-0.12 * 0.06	-0.14 ** 0.06	-0.12 * 0.06	-0.12 ** 0.06	-0.12 ** 0.06	-0.12 ** 0.05	-0.12 0.13
Real exchange rate			0.22 0.32	0.25 0.34	0.12 0.29	0.06 0.54	0.24 0.44	0.24 0.35	0.10 0.71	0.32 0.47
External debt			-0.05 0.14	-0.05 0.12	-0.08 0.17	-0.06 0.13	-0.07 0.14	-0.06 0.12	-0.11 0.39	-0.03 0.16
Foreign direct investment					0.00 0.05	-0.02 0.05				
Public investment							0.01 0.08	0.01 0.03		
Credit to private sector									-0.04 0.11	-0.02 0.09
Sargan test p -value 2/	0.0000	0.0026	0.0563	0.6176	0.7588	0.3111	0.3221	0.3364	0.0887	0.1078
Durbin-Watson	1.3570	1.6332	1.0713	1.0062	1.0711	0.9094	1.1396	1.0241	1.14	1.08
Q-test lag-order 2 p -value	0.0150	0.3940	0.1340	0.1290	0.0910	0.0890	0.2320	0.1360	0.1270	0.1440
Q-test lag-order 4 p -value	0.0710	0.7310	0.3690	0.3550	0.2410	0.2420	0.5000	0.3210	0.3320	0.3980
Sample size	98	82	99	84	98	84	99	84	101	84
Sample 3/	Full	ex-TTO	Full	ex-TTO	Full	ex-TTO	Full	ex-TTO	Full	ex-TTO

Source: Author's calculations.

1/ * and ** denote significance at the 10 percent and 5 percent levels respectively, using standard errors that are robust to serial correlation. The Generalized Method Moments (GMM) weighting matrix accounted for cross-sectional heteroscedasticity. Estimates include dummy variables for the year of, and the year following, a natural disaster (taken from the EM-DAT database of CRED, 2006).

2/ The Sargan test p -value shows the probability that the instruments are valid; i.e. uncorrelated with the residuals.

3/ Full denotes all sample countries, ex-TTO denotes excluding Trinidad and Tobago.

Appendix I: Model of Aggregate Investment

Despite a large literature, there is no consensus on the appropriate form of an empirical investment equation, particularly for developing economies. Much of the focus in this chapter is on the cost of capital and the Jorgenson approach allows explicit derivation of a cost term. We start with the representative firm's problem, which is to maximize a value function:

$$V_t = E_t \left\{ \sum_{s=t}^{\infty} (1+r)^{t-s} \left[(1-u)p_s F(K_s^P, K_s^G, K_s^F, N_s) - w_s N_s - (1-\Gamma)(1+\tau)p_s^K I_s^P \right] \right\} \quad (A1)$$

This is subject to the usual capital accumulation constraint. It is assumed that private investment (I^P) only becomes useful private capital (K^P) with a one-period lag:

$$K_{s+1}^P = I_s^P + (1-\delta)K_s^P \quad (A2)$$

It is assumed that the firm's production function includes both public (K^G) and foreign (K^F) capital as arguments. This model is being applied here to small, open economies. Consequently, the effect of personal taxation of dividend flows and capital gains is ignored since for a small open economy, the savings and investment decisions may be assumed to be separable, implying that personal taxation affects the incentive to save, but has no relevance for the investment decision. Across most of the region, the tax authorities apply the capital allowance to a capital base that is eroded exponentially. Then the present value of tax benefits may be written as:

$$\Gamma = \eta + u\tilde{\alpha} + (1-\theta\eta - \omega\tilde{\alpha}) \sum_{v=t+1}^{\infty} (1+r+\alpha)^{t-v} u\alpha \quad (A3)$$

There are some examples, such as Barbados, where the tax authorities apply the allowance to a capital base that is subject to straight-line erosion. Present value of deductions may then be written as:

$$\Gamma = \eta + u\tilde{\alpha} + (1-\theta\eta - \omega\tilde{\alpha}) \sum_{v=t+1}^T (1+r)^{t-v} uT^{-1} \quad (A4)$$

where in the above equations: $r \equiv$ nominal weighted average financing cost of capital (debt and equity); $u \equiv$ corporate tax rate; $p \equiv$ output price; $p^K \equiv$ capital goods price; $w \equiv$ nominal wage; $N \equiv$ labor; $\Gamma \equiv$ present value of tax benefits for investment; $\eta \equiv$ investment tax credit rate, in the form of a rebate/direct grant; $\theta \equiv$ proportion of tax credit that reduces the tax-depreciable capital base; $\tilde{\alpha} \equiv$ immediate capital allowance rate; $\omega \equiv$ proportion of the immediate capital allowance that reduces tax-depreciable capital; $\tau \equiv$ tariff on imported

capital equipment; $\delta \equiv$ economic (real) depreciation rate; $\alpha \equiv$ tax depreciation/ capital allowance rate; and $T \equiv$ assumed useful life if capital equipment for tax deduction purposes.

It is assumed that the firm's production function is linearly homogeneous and that it is using the optimal labor input and faces competitive output markets. Firms will choose capital to maximize this value. Rearranging the first-order condition and denoting the real percent change in the price of capital as q and the inflation effect π , this can be written as:

$$E_t \{p_{t+1}\} F_K = \frac{(1-\Gamma)(1+\tau)}{(1-u)} [p_t^K (r + \delta(1 + E_t q)(1 + E_t \pi)) - p_t^K (1 + E_t q)(1 + E_t \pi) + p_t^K].$$

It is common in the literature to let the expected real change in the capital goods price be equal to zero. This implies that the first-order condition can be expressed as the marginal product of capital equal to the post-tax user cost of capital, denoted by P :

$$F_K = \frac{p_t^K}{p_t(1 + E_t \pi)} \frac{(1-\Gamma)(1+\tau)}{(1-u)} (r - E_t \pi + \delta(1 + E_t \pi)) = P_t \quad (\text{A5})$$

The final stage is to assume a CES form for the production function so that we may solve for K . This produces the basic equation used as the foundation of the empirical work that follows. Denote the log of the post-tax cost of capital as ρ and the user cost elasticity of capital (UCE) as σ . Then the first-order condition can be expressed as:

$$k_t = a + y_t - \sigma \rho_t.$$

References

- Bouton, L., and M. Sumlinski, 2000, “Trends in Private Investment in Developing Countries, 1970–98,” *IFC Discussion Paper*, Number 41 (Washington DC: International Finance Corporation).
- CRED, 2006, “EM-DAT: The OFA/CRED International Disaster Database 1990–2005,” <http://www.cred.be/emdat>, Centre for Research on the Epidemiology of Disasters.
- Chai, J., and R. Goyal, 2006, “Tax Concessions and Foreign Direct Investment in the Eastern Caribbean Currency Union,” in R. Sahay, D.O. Robinson and P. Cashin (eds), *The Caribbean: From Vulnerability to Sustained Growth* (Washington DC: International Monetary Fund), pp. 258–84.
- Everhart, S., and M. Sumlinski, 2001, “Trends in Private Investment in Developing Countries 1970–2000,” *IFC Annual Report*, Number 44 (Washington DC: International Finance Corporation).
- Khan, M., and M. Kumar, 1997, “Public and Private Investment and The Growth Process in Developing Countries”, *Oxford Bulletin of Economics and Statistics*, Vol. 59, pp. 69–88.
- Lederman, D., A. Menendez, G. Perry, and J. Stiglitz, 2003, “Mexican Investment after the Tequila Crisis: Basic Economics, ‘Confidence’ Effects, or Market Imperfections?,” *Journal of International Money and Finance*, Vol. 22, pp. 131–51.
- Nehru, V., and A. Dhareshwar, 1993, “A New Database on Physical Capital Stock: Sources, Methodology and Results,” *Revista de Analisis Economico*, Vol. 8, pp. 37–59.
- Rasmussen, T., 2006, “Natural Disasters and Their Macroeconomic Implications”, in R. Sahay, D.O. Robinson and P. Cashin (eds), *The Caribbean: From Vulnerability to Sustained Growth* (Washington DC: International Monetary Fund), pp. 181–205.
- Roache, S., 2006, “Domestic Investment and the Cost of Capital in the Caribbean,” IMF Working Paper No. 06/152, (Washington DC : International Monetary Fund).
- Sosa, S., 2006, “Tax Incentives and Investment in the Eastern Caribbean,” IMF Working Paper No. 06/23, (Washington DC: International Monetary Fund).