A Quantitative Analysis of the Performance of the Windward Islands Banana Industry:
Measuring Total Factor Productivity Growth, 1965-1995

by

Diane E. Francis (IICA)
and
Patrick A. Antoine (IICA)

for the

**Study on the
"Competitiveness of the Agricultural Sector
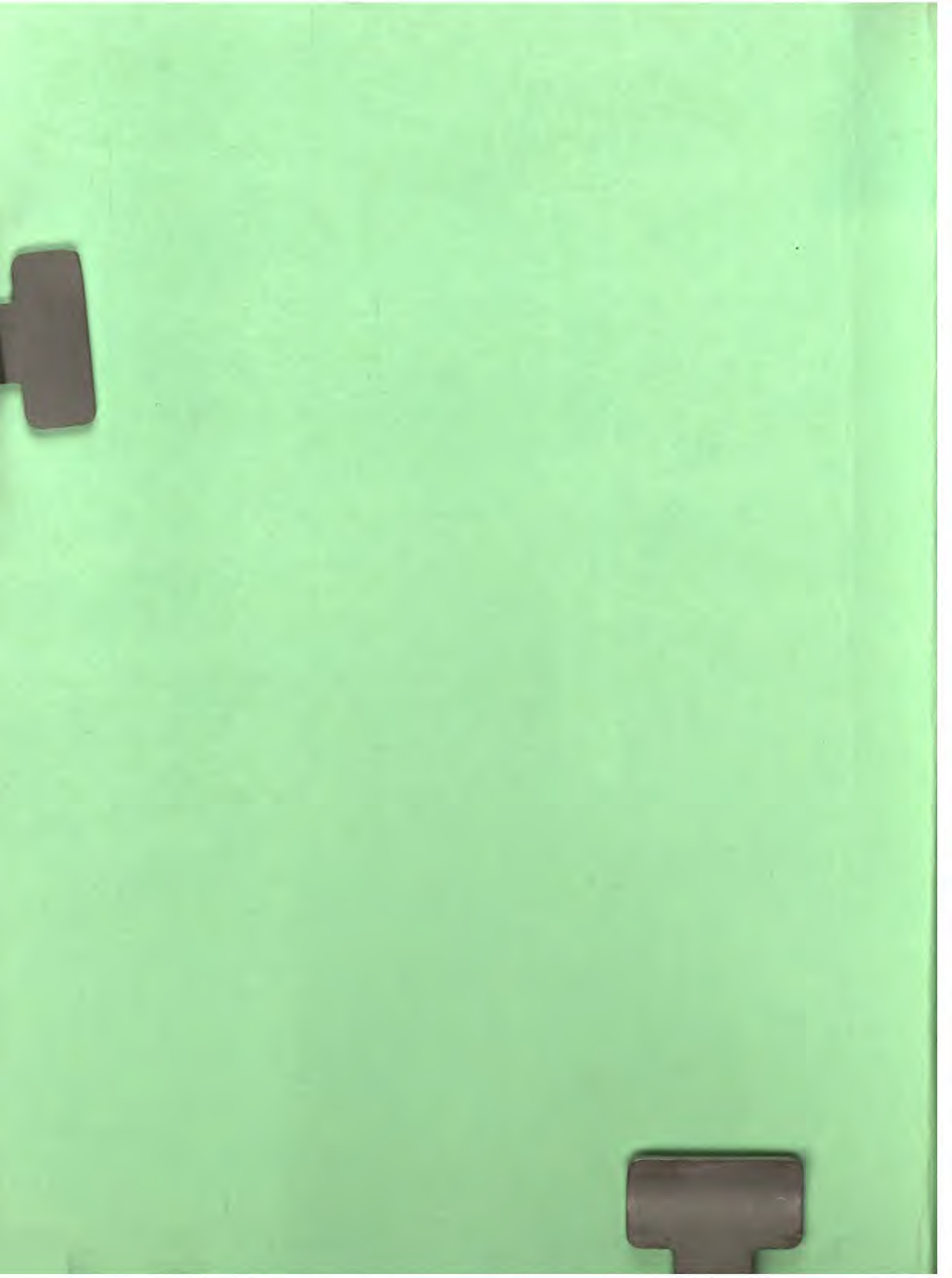in the Lesser Antilles"**

undertaken jointly by the

**Inter-American Institute for Cooperation
on Agriculture (IICA)**

and the

**French Mission for Technical Cooperation
(FMTC)**

@ June 1997

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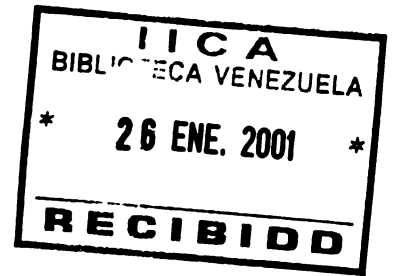Inter-American Institute for Cooperation
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A Quantitative Analysis of Performance:
<u>Productivity Growth In the Windward islands</u>
<u>Banana Industry</u>

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A QUANTITATIVE ANALYSIS OF PERFORMANCE:
PRODUCTIVITY GROWTH IN THE WINDWARD ISLANDS BANANA INDUSTRY

INTRODUCTION

The economic significance of the banana industry in the Windward Islands is well understood both in and outside of the Region. In the post-1990 period, however, concerns about export competitiveness in reaction to the formation of the Single European Market in 1992, the conclusion of the 1994 GATT Agriculture Agreement and the creation of the World Trade Organisation have dominated virtually every discussion on the future of the industry. Several critical issues have been highlighted, including the industry's performance record and its capacity, or lack thereof, to speedily adjust to the demands of the emerging environment. Against this backdrop, the industry's prospects in a liberalised environment will depend entirely on factors such as firm strategy and productivity growth.

Productivity growth is a necessary, but not sufficient factor for the sustained growth and development of the banana industry. Other on-factor considerations such as fruit quality, the quality of the farmers' managerial expertise and skills, industry institutional, management and marketing efficiency play a critical role in industry development. Increased productivity in banana production is also an important factor for improving the performance of other crops. Banana has been the centre-piece of a multicrop system in the Windward Islands for over four decades, hence, the fortunes of the industry exert great influence on other crop development and agricultural diversification in general.

The importance of productivity growth appears to be well appreciated among Caribbean professionals working in the field of economic development. Yet there has been a noticeable absence of total factor productivity growth indicators among the numerous studies, strategy documents and other writings which seek to guide the development of the banana industry. In fact, the lack of empirical estimates of productivity growth has invariably affected the quality of discussions regarding the performance of the Windward Islands banana industry.

Indeed, much confusion remains regarding productivity, productivity growth and the determinants of the two. In the banana industry for example, this is borne out by the convention to equate productivity to the absolute levels of and increases in banana output and yields. These various output-based measures, hold little or no implication for industry or farm-firm efficiency. This misconception not only leads to erroneous conclusions about the industry, but also results in mis-leading inferences and often to inappropriate recommendations.

This paper seeks to address these various deficiencies by firstly defining productivity and productivity growth and providing a brief discussion of some relevant theoretical and measurement issues in Section I. Section II develops theoretically based estimates of total factor productivity growth for the Windward Islands banana industry. The paper concludes with a discussion on the overall industry output performance and future prospects.

I: THEORETICAL ISSUES IN MEASURING PRODUCTIVITY GROWTH

Defining Productivity

Productivity is measured as quantities of output divided by quantities of inputs and is a well accepted economic measure of industry or sectoral performance and efficiency. Productivity growth (popularly referred to as growth accounting) arises when the rate of growth in output exceeds the rate of growth in input and is an important factor in enhancing the competitiveness of an industry.

Why Measure Productivity Growth ?

Measurement of productivity growth is considered to be fundamental to production economics and particularly so, to industries such as the Windward Islands banana industry. This is because fully or semi-regulated and market protected industries as the banana industry, are not pressured to develop according to the economic fundamentals of production efficiency, productivity growth and market competitiveness.

Growth in the banana industry (as proxied by increased banana output and exports) over the last forty years has been led primarily by extensive production and increased utilisation of imported material, fertiliser and agro-chemical inputs. The heavy reliance of the industry on inputs has also been a cause of increasing concern. In measuring the industry's productivity, an important issue for the banana industry is to assess the impact of increased input utilisation vis a vis other sources of industry output growth, such as improvements in total factor productivity. This is important since mere increases in inputs not accompanied by an increase in the efficiency with which input are utilised, will eventually result in diminishing returns; alternatively stated, input-driven growth is inevitably limited. [1]

A 1980 USDA report listed the most important uses of productivity statistics as:
1. identifying the sources of economic growth;
2. justifying the appropriation of agricultural research funds;
3. estimating production relations;
4. serving as an indicator of technical change;
5. comparing inter-sectoral economic performance; and
6. justifying price changes. [2]

How is Productivity Measured ?

There are two general approaches to measuring productivity; the partial and the total factor productivity approaches. Partial productivity measures usually refer to the ratio of output to a single input (usually labour or an intermediate input), while total factor productivity refers to the ratio of aggregate output to the aggregate quantity of inputs. The weakness of the partial productivity approach is that it assigns too much weight to the single factor in question and does not account for the role of other factors. Partial productivity therefore is an incomplete measure of overall productivity changes. This study employs the measure of total factor productivity (TFP).

Measuring TFP requires quantity data on the output (s) and all inputs. Once all the outputs and inputs are identified, then they must be lumped or aggregated into one output and one input. Quite often, input quantity data are either unavailable or difficult to measure at the industry level. In most instances, cost and price information is more accurate and easily obtained than data on quantities of input use. Due to the practical difficulties encountered in aggregating different inputs in physical terms, aggregation is usually done in terms of expenditures. [3]

This aggregating process is conventionally done using the index number approach. An index number is defined as a percent of a quantity expressed as a number without a percent sign. Various economists agree that the use of index numbers to measure productivity has the advantage of ease of computation.[4] There is some disagreement, however, on the choice of an appropriate index number for aggregating outputs and inputs. Denny, Fuss and Waverman (1981) and Diewert agree that from a conceptual point of view, one of the most defensible and widely used methods of aggregation for use in productivity analysis is the Divisia index number. The Divisia indexing method has also been advocated by Christensen (1975), among others, for productivity studies in agriculture because it uses a flexible weighting procedure and takes into consideration factor substitution. It also differs from the traditional fixed-weight Laspeyres indexing procedure which treats all sub-components as perfect substitutes.

In order to measure changes in outputs and inputs in physical terms each year, it is necessary to deflate the respective annual individual output or input nominal values or expenditures by their respective price indices. These price indices are calculated in terms of a common base year (usually equal to 1.00 or 100), with changes each year according to the changes in price per unit. This results in annual constant dollar values in terms of the base year for each individual input or output as a measure of the relative change in units of physical output or input use each year (ie. an index). Each individual "constant total dollar value" quantity must be aggregated to form the corresponding aggregate output or input quantity. These aggregate totals in turn are converted to the respective aggregate output or input indices by dividing the yearly totals by a constant base year.

Growth in TFP is traditionally interpreted as the change in total output minus the total contribution of factor inputs. The balance or residual, if any, is allocated to technological progress and changes in technical efficiency. Farrell, (1976) defines technological progress as the change in the 'best practice' production frontier, or as a consequence of innovation or adoption of new technology. Technical efficiency change encompasses all other productivity change such as learning by doing, diffusion of new technological knowledge, improved managerial practices and external economies. The standard index measure of productivity includes the effects of scale economies.

This analysis measures total factor productivity growth as the rate of growth of output not explained by the growth of inputs. Griliches (1963, 1964) noted that this unexplained portion of output growth which is usually allocated to technological progress and technical change may, alternatively, be allocated in fairly equal proportions to input quality changes, improved managerial expertise and public investment in research and extension. While the measure may not reveal their role, the effect of these factors on overall productivity growth is equally significant.

Divisia indices of aggregate output (Q) and aggregate inputs (X) are constructed for the individual Windward Islands Banana Industries (the Divisia equations and a discussion of same are provided in Annex I). Scaling the index to 1.00 for 1971, the Divisia quantity output and input indices are computed using aggregate data on output, intermediate, fertiliser and energy-based inputs and labour. From these indices, the

TFP index is calculated as $TFP = \dfrac{Q}{X}$ (1)

Most empirical application of TFP measurement to date has been undertaken at the economy or sectoral level and in developed countries. Measurement of TFP at the firm or industry level in developing countries is far less prevalent (Nelson, 1981).

For the Caribbean, there has been little or no total factor productivity measurements undertaken for the agricultural sector, its constituent industries or industry segments. This is also true for the banana industry.

Banana Industry Data

All data were obtained from the respective Banana Growers Associations (BGAs) annual reports over the 1965 (in the case of Dominica and St.Vincent) and 1971 -1995 period.

Appropriate data continues to be a problem for TFP measurements. The construction of capital input series for the agricultural sector continues to be a priority. While the data have been derived from various sources, separate annual surveys on farm employment, quality-adjusted for differences in general education levels, surveys for production inputs such as fertilizer, energy, intermediate and miscellaneous inputs are also required. Finally the valuation of land continues to be a problem. A study of the service flows from land should also be considered to be a priority area.

Output

Data on banana production is generally reported as the volume offered for sale by farmers to their respective BGAs. 95% of the farmers' sales volume is usually exported. For this reason, banana exports are used to represent banana output. The banana price refers to the average annual price received by the association.

Aggregate Input

At the industry level, the value of input includes the value of primary factors, labour and intermediate inputs. The impact of land, as a primary factor, was not included in this analysis due to the difficulties associated with land valuation. The major inputs used in banana production may be considered as `flow' inputs since they are completely consumed over a well defined period (usually one year) in the production process,

such as labour, fertiliser, chemicals and packaging material.[5] Four input categories were measured: intermediate inputs, fertiliser, labour and energy-based inputs.

Intermediate Inputs comprise chemicals, packaging materials and other miscellaneous production items. A complete series of price and quantity data for all inputs was not available except for gramoxone. This input represents one of the most widely used inputs in the banana production process and therefore the market price for gramoxone (EC$/litre) was used to deflate the total expenditure on chemicals and other intermediate inputs, while the unit price per box was used to deflate cartons and packaging materials.

Fertiliser Input data reflect the BGAs' total expenditure on same. Total expenditure was deflated by the annual average market price of fertiliser to obtain a fertiliser quantity index. The market price data available from the BGA reports were cross-checked with an import price series constructed from trade data.

Labour: The total wage bill is defined as the sum of wages, salaries, allowances (travel and subsistence) and the employers' national insurance contributions. Data on total expenditure on labour employed by the Associations, were classified as either professional or casual. The average wage scale corresponding to the various categories of labour was used to deflate the corresponding labour expenditure series to derive labour quantity indices. The labour variable was not quality adjusted for education.

There are no existing household or establishment surveys (including the recently concluded census in these islands), designed to provide annual data on the number of persons hired for farm labour.

Energy-based Inputs: This category aggregated the residual expenditures on the Associations' services and operations and includes expenses incurred during fruit operations such as electricity, communications and operating overheads. This residual therefore represents the total expenditure minus the costs of labour, intermediate and fertiliser inputs. The energy-based input series was deflated by a Petroleum Index (1979/80 weighted) series obtained from the World Bank International Finance Corporation publication of Quarterly Review of Commodity Prices.
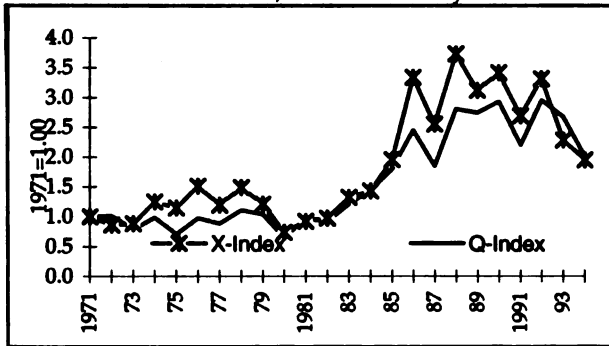
II: COUNTRY RESULTS:
PRODUCTIVITY GROWTH IN THE WINDWARD ISLANDS BANANA INDUSTRY, 1965-1994

1- The St.Lucia Banana Industry

The performance of the St.Lucia Banana industry over the 1971-1994 period may be assessed through an examination of the output and input quantity indices. Notwithstanding the year-to-year variations evident in Fig. 1, the overall trend in output and aggregate input use over the period was positive, but negative since 1988. In fact, for both indices, highest growth rates occurred in the 1981-1987 period.

productivity improvements ie., technical progress (Table 1 and Fig.2).

Table 1: TFP Index
St.Lucia Banana Industry

Year 1971=1.00	TFP Index	Year 1971=1.00	TFP Index
1971	1.000	1983	0.916
1972	1.208	1984	1.008
1973	0.887	1985	0.920
1974	0.786	1986	0.735
1975	0.616	1987	0.725
1976	0.644	1988	0.752
1977	0.740	1989	0.880
1978	0.745	1990	0.858
1979	0.861	1991	0.813
1980	0.877	1992	0.892
1981	1.054	1993	1.171
1982	0.942	1994	1.027

Fig. 1 Aggregate Input (X) & Output (Q) Indices, St.Lucia, Banana Industry

Over the entire period, there was a close association between the output and the aggregate input quantity indices with the output index closely following the aggregate input index.

The estimates suggest that output growth over the 1971-1994 period was primarily input-driven. This implies that, barring the adverse effect of natural disasters, the performance of the industry was determined almost exclusively by increased input utilisation and not by any meaningful

Between 1971-1994, annual growth in aggregate input of 6.5% slightly exceeded the rate of output growth resulting in a negative, albeit slight, growth in total factor productivity of 0.2% per year. This supports the observation of virtually no overall gains in the industry from efficiency and/or technical improvements.

In terms of output volumes, 1980 represents perhaps the worst year in the industry's history with exports of only 28,995 tons. This depressed situation was attributable primarily to hurricane-induced devastation in the late-1979/80 period. Destruction of banana fields also largely explains the corresponding declines in the aggregate input index, with overall industry input use

declining by 18% in 1979 and 39% in 1980. This decline in input utilisation was, however, more pronounced for labour, the cost share of which fell by 4.4% in 1979 and 16.7% in 1980.

Fig. 2 TFP Index, St.Lucia Banana Industry
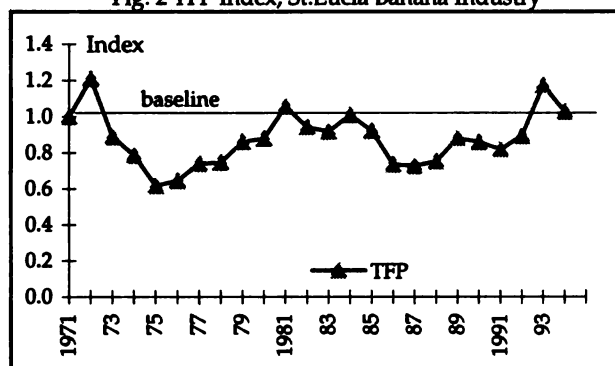
Annual fluctuations in banana production were more pronounced in the pre-1979 and post-1986 periods. In the pre-1979 (1971-1978) period, the rate of output growth was low and unstable, yet positive. At the beginning of the period, (1970), the decline in output (exports) was viewed then as the most disastrous experienced since the industry's inception in the early 1950s. The Fyffes/Jamaica banana price-crisis, the subsequent importation of substantial volumes of bananas from non-Commonwealth sources, adverse weather conditions (prolonged droughts, flooding and numerous windstorms) and strikes in both Holland and the UK (which affected the delivery of fertiliser and other materials as well as banana sales), combined to reduce exports from 85,487mt in 1969 to 51,029mt in 1970. In addition, competition for labour due to the rapid expansion in non-agricultural sectors exacerbated the delay in field rehabilitation further contributing to the highly variable output performance.

Up until the 1979/90 hurricane-period, the industry continued to be affected by a combination of the prolonged drought (1974) and the beginning of the first oil shock between 1973/75. Escalating prices,

particularly that of fertiliser, resulted in inputs being less accessible to growers since the SLBGA was not in a position to finance fertiliser bulk purchases. This limited input supply may have contributed to a relatively low output growth rate (4.4% per year) compared to an aggregate input growth rate of 8.4% per year between 1972-1975. The 64% increase in the actual expenditure on fertiliser in 1975 over 1974, other than reflecting an increase in the quantity purchased, also reflects these price increases. This suggests that even in the face of increasing prices during the oil crisis, the industry attempted to maintain an appropriate level of fertiliser utilisation in order to maintain and/or expand output.

Notwithstanding the effect of rising prices, the more rapid input growth rate was also due to the introduction of boxing in 1972. Up to this point, boxing was the first major innovation in the industry since its inception. Export bananas were subject to strict grading standards during which a large proportion of production was rejected. Boxing led to an increased expenditure on intermediate inputs which increased to roughly 18% of variable input cost (compared to less than 5% in the pre-1971 period based on information available for Dominica and St.Vincent).

The SLBGA 1972 auditors report noted that..

"..*as a result of complete conversion to boxing operations in 1971, the fractional gain in weight previously received no longer exists, but instead, very substantial losses in weight are experienced. This is a direct result of losses in weight arising through loss of stem weight and loss of fruit discarded as unsuitable for export purposes*".

Even with the loss-in-weight factor, a combination of poor fruit quality, inefficient buying point operations, damage due to handling/transportation and marketing

problems were also largely responsible for the post-boxing decline in output.

In the period immediately following boxing, an analysis of the input indices and cost shares indicate that intermediate inputs (Sh.Inter.) accounted for the largest source of growth in aggregate input utilisation, with an annual growth rate of 31% per year between 1971-1978. This growth is reflective of the conversion to boxing and the attendant increased requirements of post-harvest and packaging materials which led to the significant increase in the use of these inputs in 1973 (65%) and 1974 (155%). When these years are excluded, the growth in the cost share of intermediate inputs averaged 0.47% per year between 1971-1978. In spite of the growth in the shares of the (fertiliser (Sh.Fert) and intermediate inputs), and the relatively constant and declining share of energy-based inputs (Sh.Eng.), the results indicate that over the period labour (Sh.Labr) continued to comprise the largest share of industry total cost, averaging 61%. Comparative input cost shares for the 1971-1994 period (period average) is indicated in Fig. 3.

Fig.3: Input Cost Shares, St.Lucia Banana Industry
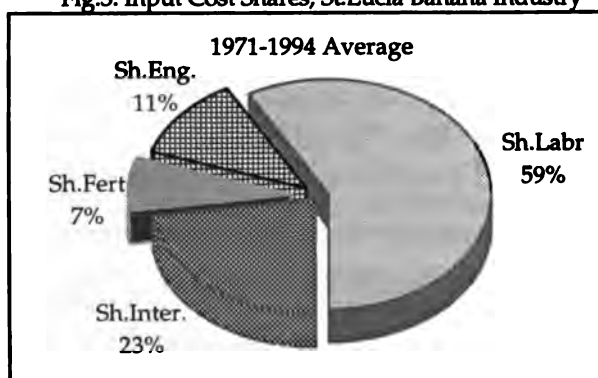
The high inefficiencies and poor output performance of the industry in the pre-1979 period were reflected in the TFP index which declined between 1973 and 1975 before rising slowly up to 1978. The annual TFP growth rate for the banana industry was actually negative between 1971-1978 (averaging -4%) with significant negative growth recorded

for three out of the eight-year post-boxing period ((1973(-26%), 1974(-24%), 1975(-21%)). This indicates that the adjustments and learning period made necessary by the conversion to boxing initially exacted a fairly high cost on the industry's efficiency.

There were, however, individual years in the pre-1979 period when the industry experienced high productivity growth. 1972 was one such year when notwithstanding a 13.6% reduction in the utilisation of inputs, output increased by 4%, suggesting some efficiency gains in input utilisation, sufficient to offset the reduction in input use. Consequently, the rate of TFP growth was 17%, with the TFP index moving up by a mere 0.2 points from the base.

The post-1980 period and up to the year 1988 represented a period of output recovery. In fact, in terms of output performance, the period 1981-1987 represented that of fastest growth in the industry, averaging 19% per annum. An analysis of the source of this impressive growth indicates, however, that it was predominantly input-led. Input growth, which averaged 21.5% per year, was particularly rapid in 1981, 1983 and 1985/86. In 1981 and 1984, in particular, in addition to the increased utilisation of inputs, improvements in productivity of 27% and 11%, respectively, contributed positively to output growth. Improved input use and output performance in these years resulted in the TFP index just slightly exceeding its base year level.

Input growth stemmed largely from an increase in the use of fertiliser (by 4.3% per annum) and labour (by 2.7% per annum), compared to a reduction in the use of intermediate inputs (by -1.6% per annum). In spite of a relatively slower growth in use of intermediate and energy-based inputs. The introduction of the field-pack system in the early 1980s was partially responsible for the increased use of fertiliser

and intermediate inputs and the decline in the other two inputs, particularly between 1984-1987. This system led to a reduction in non-labour Association boxing plant expenses. In contrast, there was an increase in the labour input due to the additional demands, particularly for skilled fruit selectors and packers. Inspite of the high demand for labour, the overall increase in the cost of labour may explain its declining share in industry total cost between 1981-1992.

While the sharp declines in output in 1987, 1991 and 1994 were partially caused by windstorms and flood damage to fields, the post-1992 decline in output resulted from a slowdown in aggregate input utilisation, by just under -1% per annum. Of the individual categories, the slowest growth was recorded for labour (1.9%) and intermediate inputs (0.7%). The share of labour, however, returned to its pre-1980 levels of 65% of total cost, reflective of the increased demands on skilled labour as a result of the changing fruit preparation and packaging systems.

The significant and rapid expansion in the banana industry between 1981-1992 therefore was not a result of improvements in productive efficiency or technological progress. One explanation for this continued growth without productivity syndrome was the failure to conduct on-going analysis into optimal input combinations, particularly in response to rapidly changing input and output prices.

In the post-1987 period, the upward trend in the TFP index was, however, due mainly to the relatively strong output performance of the industry in the years 1988 and 1992. In 1992, in particular, output grew by 34%, due to a combination of positive growth in inputs (22%) and TFP growth (12%). In fact, 1992 represented the year of record output of some 132,863 mt.

The fact that, on average, the TFP index remained below 1.0 implies, that compared to its base year level, there was little improvements in productivity growth from 1985 until 1992. In spite of the real and nominal increases in the banana export price over the post-1987 period, in terms of output growth, the industry's performance matched that of the pre-1978 period.

Conclusion

In terms of output growth, the output performance St.Lucia was far superior during the second half of the period, i.e., post-1983. This resulted from the appreciation of the Pound Sterling between 1986-1988 which created the illusion of rising market prices for bananas, hence stimulating rapid expansion in banana cultivation. The tendency of the TFP index to remain below, close to, and instances slightly above its base year level for only 5 out of the 24-year period indicates that overall, the St.Lucia banana industry suffered from low and deteriorating rates of TFP growth.

The constant upgrading of post-harvest procedures increased the demand for skilled labour, use of imported material inputs and expenditure on the services offered by the industry. This increase in input use and expansion in industry services was not matched by a corresponding increase in output. Consequently the industry experienced a "cost-price squeeze" which impacted negatively on output and industry viability. The results support the observation that generally, over the 24-year period, (1971-1994) growth in inputs accounted for virtually all of the growth in banana output. The general lack of total factor productivity improvements are thus a manifestation of the growth and decline which marked in the St.Lucia banana industry from 1971.

The introduction of the NBR, falling market prices and the depreciation of the Pound

Sterling to the EC dollar were decisive factors constraining industry output in the post-1992 period. The extreme market uncertainty led to a grower industrial action which disrupted banana harvesting. This situation also stimulated the partial, and in a few cases, total abandonment of banana fields. Shortages in critical imported inputs, such as fertiliser, further exacerbated the situation and subsequently resulted in an unusually high level shut-outs, some 3,187 tons in 1993, of which 2,073 tons were for the month of December alone.

At the end of the period, in an effort to improve the competitiveness of the banana industry, the SLBGA accelerated its restructuring programme, major features of which included a reduction in the labour force through the retrenchment and attrition, the closure of some boxing plants and the tendency toward target aerial spraying as opposed to the blanket aerial spraying approach previously employed. In addition, the operations of one of the fruit reception depots was privatised. The SLBGA faces a challenging future and to strengthen the industry survival prospects in the liberalised market, improvements at the farm level (increased yields per acre) and the containment of escalating costs at the industry level, will become necessary.


□

2 The Dominica Banana Industry

For the Dominica industry, in particular, the hurricanes of 1979 and 1980 were extremely devastating to the banana industry compared to the effect on the other Windward Islands banana producers. As such, these years represent anomalies and are thus excluded from the analysis of the results.

The results indicate that in terms of the output index, the Dominica banana industry performed relatively well over the 1965-1994 period. On average, industry output grew by 5% per year between 1965-1994. This relatively good output performance was led by a corresponding annual increase in the rate of aggregate input growth of 7% (Fig.4). In fact, with the exception of 1972-1985 period, the level of the output index exceeded its base year, with output levels in the post-1985 period matching the high production levels of the late-1960s.

Fig. 4: Aggregate Input (X) & Output (Q) Indices Dominica Banana Industry
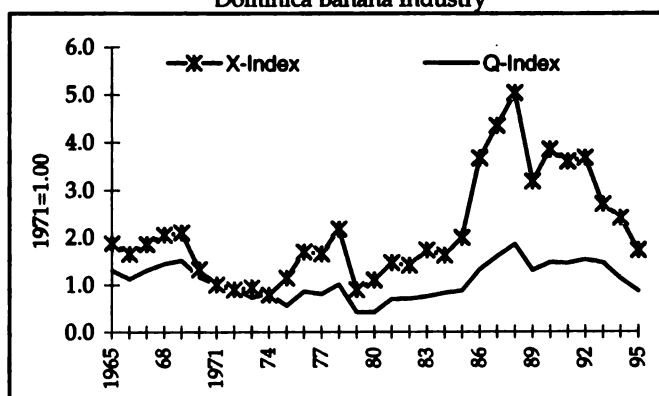
The overall high output levels in the 1960s were maintained in spite hurricane-induced damage (Inez-1966, Dorothy-1970, Cleo-1971) which resulted in major crop losses. Output growth between 1966-1969 was reportedly associated with rapid increases in banana mat productivity which derived from the increase in fertilisation made possible by the introduction of a British Government funded "Replanting Incentive Scheme" during 1968-1971. This programme included elements which allowed inputs to be provided free of charge, or on extended credit terms to growers. Measures designed to improve crop efficiency were implemented on an extensive scale and special attention was directed at nematode control. The results of these initiatives were manifested in production increases in 1969 of 4.8% over 1968 output and the continued

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rise in average stem weight throughout 1969-1971 which made Dominica the leading producer in the Windwards (Table 2). That fact that Dominica was the only member of WINBAN to institute a mandatory fertiliser cess may have also accounted for that country's significant results in respect of increasing average weight per stem.

Table 2: Indicators of Yield 1961-1971

Year	Total Stems	Avg.Weight lb/Stem
1962	2,393,928	26.42
1965	4,006,089	27.40
1966	3,495,017	27.50
1967	3,551,105	27.50
1968	4,099,128	30.00
1969	3,819,519	33.82
1970	2,776,901	32.67
1971	1,418,261	33.20

SOURCE: DBGA 1970 Report

The effect of the pre-1970 hurricanes and a reduced cultivated acreage is clearly demonstrated in the aggregate input quantity index which declined by 4.8% per year between 1965-1970. The decline in output in 1970/71 was attributable to hurricane damage, the reduction in the export prices which discouraged proper field husbandry and expansion in cultivation.

Prior to 1970, labour (Sh.Labr) and fertiliser (Sh.Fert) comprised the two major inputs in banana production. Their share in total cost averaged 72% and 14%, respectively, compared to the 8% cost share for energy-based (Sh.Eng) inputs and a 6% cost share for intermediate (Sh.Inter) inputs. Prior to 1971, the widespread use of chemicals in bunch protection and post-harvest packaging materials was uncommon. Whenever used, chemicals were largely limited to the control of leafspot and to the combating of periodic outbreak of pests and diseases.

In 1969 the industry introduced materials for fruit protection such as field boxes and foam for padding during transportation. This partially accounted for the increase in the

share of intermediate inputs in total cost, an average of 25% in 1971 compared to 2.2% between 1965-1969 and 4% in 1970. At the disaggregated level, the cost share of fertiliser increased from an average 13% between 1965/69 to 17% in 1970/71 period, with the cost share of energy-based inputs averaging 19.6% in 1970/71 compared to 3% between 1965/69. The relatively larger share of intermediate and energy-based inputs in 1970/71 was associated with the conversion of the industry to boxing in 1972.
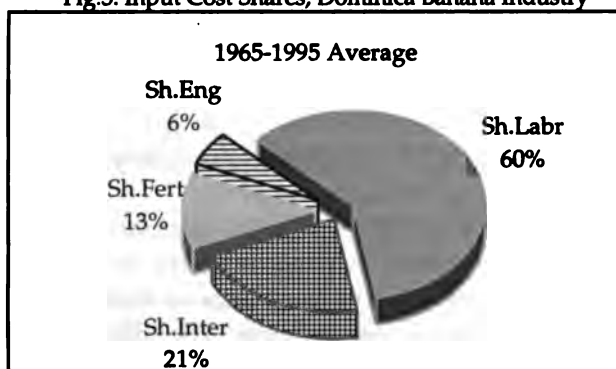
The continued decline in output until 1985, (notwithstanding continued adverse weather conditions and the abnormal years of 1979/80), was thus partially attributable to the boxing as well as the drastic price increases for vital inputs, particularly intermediate materials and fertiliser following the two oil crises. Use of inputs increased by an average of 14% per year, between 1971-1978. This rapid increase in aggregate input use was primarily for post-harvest operations, (ie. the need to facilitate boxing). Therefore while production levels may have been high, the negligible annual growth rate in output (3.5% per year between 1971-78) could be attributed to high post-harvest losses at boxing plants. The output index remained well below the base year level indicating the a general reduction in the levels of banana output during that period.

Labour continued to account for more than half of total expenditures on inputs, with a growth rate of 19% per annum between 1971-78. The average share of intermediate inputs in total cost increased to 25% with the shares of fertiliser and energy-based inputs remaining relatively constant.

In spite of rapidly increasing oil prices between 1971-1978, the industry increased the use of fertiliser by 31% between 1971-1978.

Following from the 14-year period (1972-1985) of industry recession, in spite of the post-1979/80 hurricane rehabilitation and field replanting programmes, recovery continued to be slow. In fact, full recovery did not occur until 1986, with additional stimulus to expand banana cultivation and increased output in the form of rising export prices. In 1986, aggregate input use increased by 52%, resulting in a matching increase in output. Labour recorded the largest growth in total input cost share, with the shares of energy-based inputs, fertiliser and intermediate inputs declining by 44%, 22% and 18%, respectively in 1986 from 1985. Comparative average input cost shares for the 1971-1994 period is indicated in Fig.5.

that the behaviour of the output quantity index closely followed the pattern set by the input quantity index.

With the exception of the year 1974, the only year when the TFP index was just slightly higher than the base, any instance of positive growth in TFP over the period occurred from already very low TFP levels and were therefore totally ineffective in ensuring real and sustained growth in banana production. The results indicate, that on average, TFP growth declined by just about 2% per annum between 1965-1994. Thus, in terms of production efficiency, the Dominica banana industry was a poor performer (Table 3 & Fig.6).

Fig.5: Input Cost Shares, Dominica Banana Industry

1965-1995 Average

Sh.Eng 6%
Sh.Labr 60%
Sh.Fert 13%
Sh.Inter 21%

The rate of growth in output averaged 9% per year between 1986-1993, before declining by 23% in 1994. During this period of rapid growth, the aggregate input index achieved the highest levels of the entire 29-year period, suggesting an almost tripling of the overall quantity of inputs used in the banana industry between 1986-1993, compared to previous years.

Given that the pattern of growth and decline in banana industry output was determined primarily by the levels of input utilisation, then one expects the results to indicate virtually no productivity growth in the Dominica banana industry over almost three decades. Fig. 4 shows

Table.3: TFP Index, Dominica Banana Industry

1971=1.00	TFP Index	1971=1.00	TFP Index
1965	0.695	*1980*	*0.376*
1966	0.681	1981	0.475
1967	0.703	1982	0.499
1968	0.701	1983	0.433
1969	0.720	1984	0.510
1970	0.884	1985	0.439
1971	1.000	1986	0.360
1972	1.039	1987	0.364
1973	0.778	1988	0.366
1974	1.034	1989	0.408
1975	0.484	1990	0.379
1976	0.508	1991	0.402
1977	0.487	1992	0.413
1978	0.465	1993	0.540
1979	*0.460*	1994	0.467

Fig6. TFP Index Dominica Banana Industry
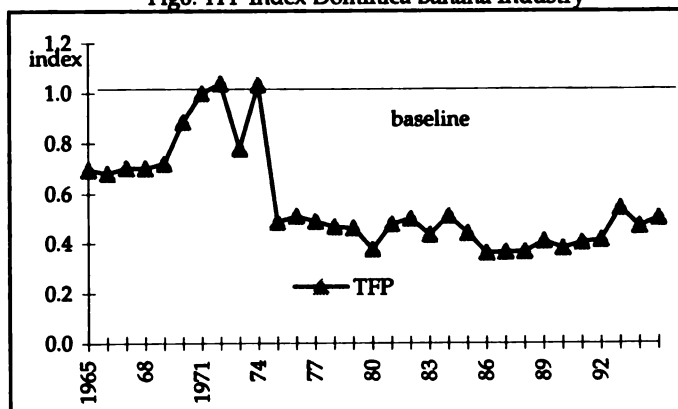
Against this backdrop of industry contraction, the performance of the industry in the year 1974 is noteworthy only in the sense that some brief mastery over the newly introduced fruit boxing techniques was achieved. This was not sustained, as indicated by the inability of the TFP index to remain above its base year level.

Conclusion

Continuous improvement in productivity growth is an indicator of long-run economic sustainability. The converse also holds true. That productivity improvements played no role in output expansion is indicated by the results. All of the growth in output of the Dominica Banana Industry was therefore virtually driven by input growth. In only 9 years out of the entire 29-year period, did the output growth rate exceed that of aggregate inputs.

Output growth was also facilitated by extensive production as indicated by a general increase in cultivated acreage, particularly in the post-1986 period (Table 4). A larger production base and an intensification in input utilisation allowed the industry to maintain high output levels in the post-1986 period even in the face of severe damage from windstorms and hurricanes and fruit quality problems.

Over the period, there was a close association between output level and banana prices. Periods of expanded output usually followed both real and nominal price increases. In order to benefit from these price increases, banana cultivation was extended into marginal areas and production inputs heavily utilised. A reverse pattern of output response to falling market prices was also evident. In the midst of price-induced variations in output, two facts have remained; the inability of the industry to raise and maintain an acceptable quality standard; and the inability to curtail rising costs, whether at the farm, or the industry administration level. The result has been low

and declining levels of total factor productivity in the Dominica banana Industry.

Table 4 - Banana Acreage, Dominica, 1965-94

Year	Acreage	Year	Acreage
1965	16,000	1980	10,259
1966	17,000	1981	11,089
1967	22,000	1982	9,685
1968	19,298	1983	9,782
1969	16,246	1984	9,293
1970	16,500	1985	9,502
1971	15,204	1986	10,171
1972	14,801	1987	12,774
1973	14,416	1988	13,240
1974	15,533	1989	10,139
1975	13,047	1990	11,608
1976	12,245	1991	11,018
1977	12,061	1992	11,606
1978	13,027	1993	10,408
1979	12,759	1994	10,502

SOURCE: DBMC Annual Reports/WINBAN

□

3 The St.Vincent Banana Industry

In terms of TFP growth, the performance of the St.Vincent banana industry over the 1965-1994 period was similar to that of the Dominica banana industry. The inability of the industry to consistently maintain high output levels in spite of high use of inputs resulted in low and declining total factor productivity growth (Table 5 and Fig.7).

Annual growth in total factor productivity averaged -4.3% per annum between 1965-1994. The declining trend in the TFP Index over the 1965-1994 period indicates a persistent deterioration in technical efficiencies and perhaps, in economies of scale/size in the industry. The fact that the TFP index remained well below its base year level since 1968 indicates no economically meaningful productivity growth in the St.Vincent banana industry over 29-year period.

Table 5: TFP Index, St.Vincent Banana Industry

1971=1.00	TFP Index	1971=1.00	TFP Index
1965	1.205	1980	0.450
1966	1.167	1981	0.490
1967	1.183	1982	0.534
1968	1.137	1983	0.503
1969	0.695	1984	0.584
1970	0.824	1985	0.477
1971	1.000	1986	0.383
1972	0.852	1987	0.392
1973	0.678	1988	0.413
1974	0.535	1989	0.451
1975	0.436	1990	0.398
1976	0.485	1991	0.418
1977	0.513	1992	0.488
1978	0.465	1993	0.598
1979	0.532	1994	0.511

Fig.7 - TFP Index, St.Vincent Banana Industry
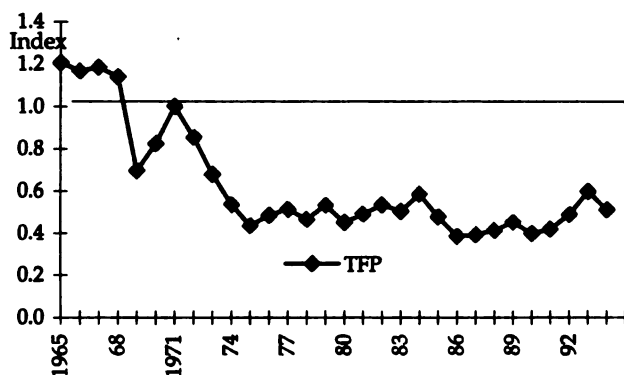
As with the St.Lucia and Dominica banana industries, the 1979-1980 period was marked by industry decline due to adverse weather conditions. Output in St.Vincent in late-1979 was affected by volcanic activity and in 1980, the industry recorded its lowest export volume of 18,578 tons.

Given that the industry was characterised by low and declining productivity growth, increased reliance and use of inputs was almost exclusively responsible for output growth over the three decades. Fig.8 shows the higher than proportional increase in the aggregate input index

from 1972 compared to banana output index. Indeed the only instances when the output quantity index exceeded the aggregate input index was at the beginning of the period (1965-1968).

The general decline in the output quantity index between 1965-1971 can, in the absence of any adverse weather conditions, be explained by the decline in aggregate input utilisation. Up until 1969, this decline further exacerbated by the production of sub-standard fruit. The SVBGA reports stated that from 1967, fruit standards had fallen considerably. In addition, according to the SVBGA 1966 report, the persistent downward trend in output was a clear indication of insufficient fertiliser application to banana mats. The result was very low average yields, estimated at two (2) tons/acre in the 1960s.

While fertiliser was used in the initial stages of industry development (1965-68), the industry was largely labour intensive, with chemical application usually limited to ground control of leafspot and periodic pests outbreaks and fruit protection and quality enhancing material introduced in the post-1969 period.

Fig.8 - Aggregate Input (X) and Output (Q) Indices, St.Vincent Banana Industry
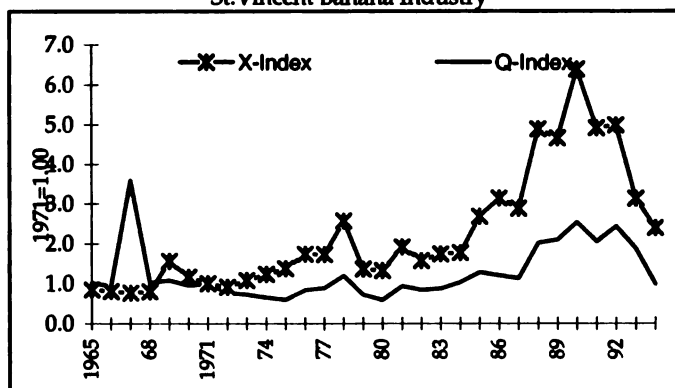
The negligible share of intermediate inputs in the earlier part of the period (1965-1968) reflects the highly domestic content of banana production and exports which did not require the widespread use of modern inputs such as chemicals, packaging and other bunch protection and production materials.

Increases in the utilisation of intermediate materials and fertiliser inputs were also matched by a 6% increase in the use of labour, despite the 12% decline in its share in total cost. Throughout the sub-period, labour, however, continued to be the dominant input. Labour (Sh.Labr) accounted for the largest share in total industry cost between 1965-1971 (73%), compared to 13%, 9% and 5%, for fertiliser (Sh.Fert), energy-based (Sh.Eng) and intermediate (Sh.Inter.) inputs, respectively.

In fact, in 1970 a 39% decline in labour use resulted in an almost 25% decline in total input utilisation, contributing to a 12% decline in output. This situation may be partially attributable to a decline in the banana export price, which led to a decline in the SVBGA revenues and farmer incomes. From 1969 onwards, (despite the periodic adverse weather conditions) the level of banana output became completely dependent on the level of input utilisation. Reduction in the overall use of inputs resulted in a corresponding decline in output. Other factors, such as wide-ranging inefficiencies and poor fruit quality also contributed to the decline in output.

The SVBGA was the first in the Windwards to achieve complete boxing in June of 1971. The expectation of a marked increase in prices of boxed fruit did not materialise, since there was no corresponding increase in fruit quality to justify a price premium. The 1972 report indicated that efforts to improve quality achieved little success and numerous instances of unsatisfactory and unfavourable out-turn from the Association's boxing plants

were reported. The UK dockers strike in 1972 further worsened the problems, since exports to the UK were suspended resulting in a total loss of revenue to the SVBGA during the period of unrest.

By 1973 the fruit quality problem was reported to have reached crisis proportions, with less than 10% of fruit from St.Vincent achieving the "Special and Best" Category. As a short term measure, Geest was forced to secure supplies from Latin America and elsewhere. The implementation of a joint SVBGA/British Government financed "Rehabilitation and Replanting Scheme" in 1974 as a means of stimulating production, improving efficiency and enhancing the industry's competitive position, did not, however, yield the anticipated results. Consequently, the British Government issued the industry an ultimatum to improve fruit quality by the end of 1974 in order to gain continued acceptance in the UK market.

In addition to high losses from boxing, the 1973/74 oil shock and the consequent spiraling of input prices , prolonged drought and borer weevil infestation in 1975 contributed to the progressive decline in the output quantity index between 1972-1975, by 11% per year.

In 1973, there was a surge in input utilisation, particularly of intermediate inputs in response to the demands of fruit boxing and post-harvest fruit quality improvement techniques. The share of intermediate inputs in total cost moved from virtually zero between 1965-1968 to 10% in 1969 and 1973. This category of inputs registered the most rapid rate of growth compared to fertiliser, energy and labour. The explosion in the rate of growth in the cost share of the intermediate input category (175% per year) in the post-boxing period was a direct consequence of the increase in expenditures on chemicals and cartons and associated materials. The effect

of additional expenditures on cartons is evident from the over 1,000% increase in the intermediate material input index in 1973 over the 1972 figure. It may thus be concluded, that in addition to the adverse effects of external occurrences on the industry, inefficient use of inputs also played a role in the poor performance of the industry, resulting in an 13% per annum deterioration in TFP growth between 1972-1975.

This downward trend in the industry output was stemmed in 1976 and excluding the natural disaster-induced declines in 1979, 1980 and 1987, there was a generally upward trend in the output index up to 1993. In fact, in contrast to the 1979/80 natural disaster induced banana shortage, the SVBGA faced problems of over-production in 1981. The reports make specific mention of the fact that this surplus production was obtained from a reduced acreage, supporting the previous reports of increased yield per acre and fruit quality improvements.

Output growth was not, however, sustainable since it was primarily input driven. In fact, input growth of 15% per year, was largely responsible for the 14% annual growth in output between 1982-1993. This indicates no productivity growth during this period, as shown by a decline in the TFP index from 0.53 in 1982 to 0.48 in 1993. The sharp decline in the TFP index in the 1986/87 period (average 0.38) may be partially attributable to crop failure in the aftermath of tropical storm Danielle in 1986. Some improvements in input utilisation were achieved, however, based on the reported progressive improvements in yields/acre from 4.3 mt/acre in 1984 to 5.7 mt/acre in 1985, to 6.9 mt/acre by 1990.

The adverse effects of the hurricane resulted in a 6% decline in output in 1986 inspite of a 17% increase in input utilisation. Analysis of the aggregate input quantity index reveals

that this increase was led by fertiliser and labour inputs, compared to a decline in the use of intermediate inputs. The data indicate that in 1986, the industry spent approximately EC$5 million on fertiliser purchases, representing a 34% increase over 1985 actual expenditures. In spite of the rapid increase in the utilisation of energy-based inputs that year, its cost share remained fairly constant, at 6% of total cost, with that of labour increasing slightly (3.6%). The cost share of intermediate inputs in total cost declined by 11% between 1985 and 1986. The 1965-1994 average share composition of the inputs in total cost is shown in Fig.9.

Fig.9 - Input Cost Shares, St.Vincent Banana Industry
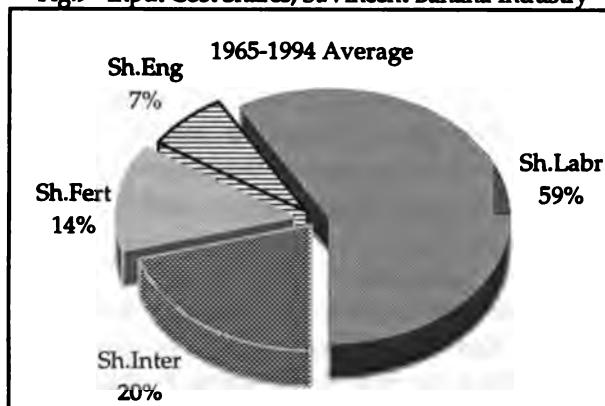
Post-hurricane Danielle recovery was rapid and in terms of the level of the output quantity index, the period 1988-1993 stands in stark contrast to the pre-1987 period. Firstly, the quantity index achieved higher absolute levels than for any other year the pre-1987 period. The level of the output quantity index indicates an almost threefold increase in industry output over this latter period. This was attributable, however, to an increase in the number of active farmers in the St.Vincent banana industry, from fewer than 4,700 in the pre-1986 period to approximately 7,460 farmers between 1988-1993. This upsurge in producer entry into the industry was motivated by the real and nominal increases in export and in producer prices in the post-1986 period.

Consequently, during this latter period, the output growth averaged 4.7% per year.

In spite of the expanded production base (both in terms of number of farmers and total acreage), the high levels of output are largely a factor of the corresponding rapid increase in utilisation of inputs. As shown in Fig. 7, the input quantity index achieved higher levels than any one year over the 1965-1987 period. This threefold increase in input use levels was maintained until 1994 as indicated by the low growth rate of 0.7% between 1988-1994. This high level of input use derived not from proportionate increases in all four input categories, but was a result mainly of the increase in the number of farmers which effectively increased labour and not from an increase in overall industry input utilisation rate. Based on the foregoing, it may be concluded that the high output levels of the post-1988 period reflect an expansion in the sheer size of the industry as opposed to efficiency-based industry expansion.

The downward trend in the output index from 1993, however, indicates a worsening of the industry's position and implies that the industry became increasingly vulnerable to changes in the environment which directly and indirectly influenced its performance. In fact, the SVBGA 1993 report noted that the contraction in the industry in 1993 was alarming given the excellent weather conditions which prevailed. The behaviour of the output quantity index in the post-1992 period in a sense, reflects the uncertainty and general loss of confidence in the industry, occasioned by the falling prices and the impending 1992 timetable for EC banana market reform. Growth in input utilisation declined by approximately 38% between the 1992/1994 period, with each of the input categories recording substantial (between 20 and 50%) declines in their own utilisation rates.

Conclusion

The results indicate that growth in output was primarily the result of growth in inputs. These large injections of inputs were, however, insufficient to ensure sustained industry recovery in the absence of productivity improvements. Over the last three decades, while the level of output generally increased, in terms of improvements in production and input utilisation efficiencies, the St. Vincent banana industry was also a poor performer and characterised by declining labour participation, low domestic content and increasing dependence on imported imports. Given this performance, the virtual absence and persistent deterioration in TFP growth was to be expected.

The creation of a strong internal organisation has been identified as a pre-requisite if the industry is to effectively confront the challenges of a more competitive international market. This notwithstanding, serious attention needs to placed on improving productivity in banana production if cost reductions, quality improvements and general industry well-being are to be achieved and sustained.

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4 The Grenada Banana Industry

The pattern of growth and decline for the Grenada banana industry over the 1971-1994 period was unlike that for the other three banana producing countries of the Windward islands. The existence of well-developed alternative agricultural enterprises into which farmers diversified has had a profound impact on the parallel development of the banana industry. The performance of the Grenada banana industry has thus been affected, not only by natural hazards such as pests and diseases, but also by the ability to successfully cultivate alternative permanent crops of nutmeg and cocoa. This cropping system

invariably, did not facilitate a high standard of banana farming, a situation which become even more critical when banana prices declined. This was manifested in 1983, when in response to very low prices, banana growers refused to harvest fruit. In addition, problems of low productivity and poor quality plagued the industry throughout the period.

As shown in Fig. 10, with the exception of the years 1975 and 1976, in terms of output performance, the Grenada banana industry declined progressively throughout the 1971-1994 period. In general, absolute levels of the output index were much lower than that for the other banana producing Windward islands.

Fig.10 - Aggregate Input (X) and Output (Q) Indices Grenada Banana Industry
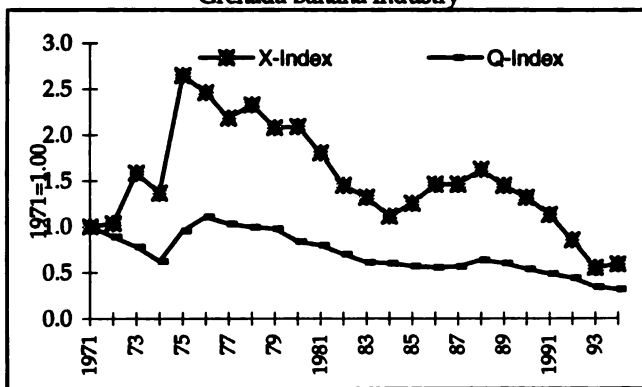
The factors responsible for the declining trend in output were the decline in aggregate input use, declining yields and poor quality fruit. Aggregate output declined by 4% per year over the period, with the rate of decline being more pronounced in the post-1988 period, of 8% per year between 1988-1994. The only two instances where positive output growth was recorded were between 1974/1976 and 1986/1988.

The brief recovery in exports between 1987-1988 was attributed in part, to the widespread participation in the (1984-1985) BDD financed Banana Rehabilitation project and the Agricultural Rehabilitation and Crop

Diversification (ARCD) project which provided greater access to banana investment financing and opened up private lands for banana production, facilitating the entry of many young growers into the industry.

General improvements in agronomic field management ascribed to higher rates of fertiliser utilisation and the total transformation to the field packing and its attendant benefits also assisted in this recovery. The 2.4% increase in output in 1987 may have been associated more with an increase in yield per acre than with acreage expansion, since only 140 acres were brought into banana production between late 1986 and early 1987. Based on the results of a banana mat census in 1987, the acreage under banana was estimated at 1,410 acres, some 500 acres less than the 1980 estimate. The census also estimated yields to be in the region of 6 tons/acre.

Other major setbacks to banana production in Grenada were identified as low market prices which acted as a disincentive to production, the significant absence of special funding to the industry between 1979-1983 (which in the past served to ease the escalating cost of production), the marked decline in labour availability and the slow, but persistent spread of *moko* disease. Grenada's banana production unlike the other Windward islands producers was compromised by the incidence of the moko disease.

In 1982, the GBCS launched an EDF-financed Moko Eradication project aimed at determining the incidence of the disease, mode of spread and persistence of the pathogen, the comparative assessment of alternative eradication techniques and the eradication of diseased mats. It was determined that moko disease, spread by the distribution of diseased planting

material among farmers, was epidemic among the major banana growing areas.

While a total of EC$3 million was spent up to 1988 in moko eradication/control, progress in bringing the disease under control was reported to have been slow. The moko disease resulted in considerable loss to the industry in terms of the impact of the moko disease on the ruin of banana cultivation in Grenada over the 1983-1994 period (Table 6). The equivalent acreage of banana destroyed between 1984-1994 was 396 out of a total of 1,400 acres of bananas. Destroyed banana mats and fields area are usually allowed 2 years to lay fallow.

Table 6: Moko-infected mats destroyed, Grenada Banana Industry, 1983-1994

Year	Diseased Banana Mats	Buffer Banana Mats
1983	10,605	3,370
1984	13,132	1,849
1985	14,724	2,034
1986	17,006	3,836
1987	15,855	18,771
1988	14,186	22,474
1989	10,724	14,758
1990	13,708	9,553
1991	10,925	1,733
1992	13,161	724
1993	5,843	271
1994	13,285	1,901
SOURCE: GBCS Reports		

The aggregate input quantity index shows a progressively declining trend in input utilisation from 1975 to 1994. In fact, Fig.10 indicates that positive growth in inputs occurred only in the 1972/73 and 1985/86 periods. Given this poor performance, the results of low and declining TFP growth was to be expected. was somewhat inevitable (Table 7 and Fig. 11)

The steady decline in output resulted in a decline in TFP growth by 4% per annum between 1971-1994, causing to the TFP index to

move from its base year level to a low of 0.38 in 1986 and 0.54 in 1994. The trend in the TFP index indicates that over the 24-year period, the average level of total factor productivity in the Grenada banana industry was less than half of 1.00. This means that there was practically no growth in productivity, or alternatively stated, the industry was not characterised by technological progress and production efficiency. In addition, its seems that the industry did not derive much benefits from economies of scale, input quality improvements and public investment in research and extension in the banana industry.

Table 7: TFP Index, Grenada Banana Industry

1971=1.00	TFP Index	1971=1.00	TFP Index
1971	1.000	1983	0.462
1972	0.859	1984	0.538
1973	0.492	1985	0.454
1974	0.454	1986	0.379
1975	0.361	1987	0.389
1976	0.451	1988	0.393
1977	0.471	1989	0.416
1978	0.429	1990	0.407
1979	0.471	1991	0.431
1980	0.402	1992	0.515
1981	0.441	1993	0.620
1982	0.481	1994	0.539

The aggregate input quantity index shows a progressively declining trend in input utilisation from 1975 to 1994. In fact, Figure 8 indicates that positive growth in inputs occurred only in the 1972/73 and 1985/86 periods. Given the rate of decline in output

Fig. 11 TFP Index, Grenada Banana Industry
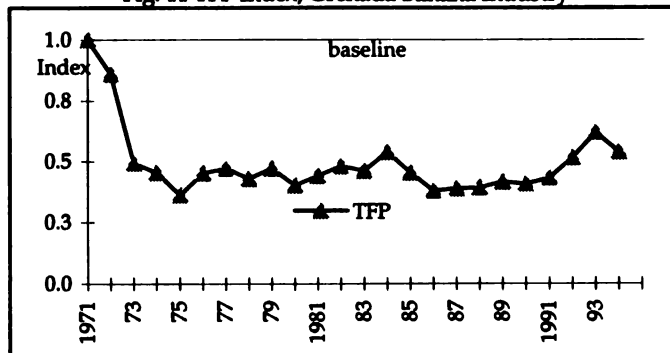
and a negligible rate of input growth of 0.4% per annum, the consequent decline in the TFP was to be expected.

Notwithstanding the general decline in output over the 1971-1994 period, the levels of output attained was primarily input-driven. The results indicate that between 1984-1986, an increase in labour use may have accounted for the increase in the share of the aggregate input category. Between 1984-1986, the share of labour (Sh.Labr) in total cost increased rapidly, from 60% in 1984 to 69% in 1986, compared to the shares of fertiliser (Sh.Fert) which declined from 11% in 1984 to 8% in 1986, and intermediate inputs (Sh.Inter), which moved from 25% in 1984 to 20% in 1986. In contrast, the share of energy-based (Sh.Eng) Inputs remained relatively constant at 3% over the 1984-1986 period. Fig. 12 show the average share composition of the four-input category over the 1971-1994 period.

Fig12: Input Cost Shares, Grenada Banana Industry
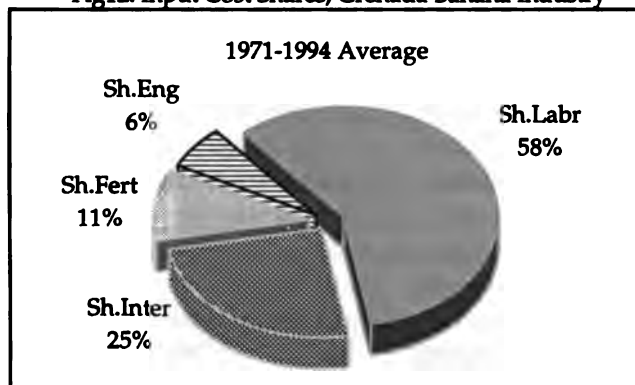
Conclusion

From 1979 Grenada's exports had fallen by 38.8% in 1984 and 67.6% in 1994. Apart from the acceleration in the shift towards the higher priced nutmeg production, banana exports in 1990 were also depressed by hurricane Arthur and the persistence of the *pin-spot* disease which affected fruit quality. The combined pressures of these factors reinforced by uncertainty about the post-1992 future of the Windwards banana

industry acted as a further constraint to rehabilitation and expansion. The bulk of exports produced was from approximately 600 active growers and an additional 150 growers who sold bananas sporadically.

Exports in 1994 represented the lowest recorded for Grenada since the industry's inception. The issue of whether Grenada should continue to pursue banana production or shift emphasis on tree crop production is dependant on the ability of the industry to resuscitate itself in the face of declining prices and the reduction in commitment of capital and other forms of assistance. The aggressive expansion of acreage into new lands and upgrading of enterprise management on all farms especially on the medium sized farms will ensure the island's future exports of bananas as well as facilitate in the revitalisation effort. A step in this direction has already been taken with the establishment of the newly opened production centres (Belvidere and LaSagesse).

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**Trends in Producer Net Incomes**

Heightened concerns over rural welfare necessitate some treatment of such issues within the context of the Windward Islands banana industry. The economic measures of the terms of trade (TOT, defined as the ratio of the index of output prices to the index of input prices (computed using the Divisia indexing method)) and of Returns to Costs (RTC, defined as the ratio of the index of the value of output to the index of the value of input), may be used to measure the net income position of banana producers.

The RTC may be thought of as measuring the relative income position of farmers (solely from income generated on farm). If productivity improvements, which imply a

reduction in unit costs of production, are greater than the decline in the terms of trade, the welfare position of farmers can be argued to have improved. As long as the degree of cost reduction derived from technical efficiencies is greater than the degree of TOT deterioration, then such productivity improvements will be sufficient to offset the negative effects on producer incomes which would otherwise result from more rapidly rising input prices. Conversely, if TOT deterioration is not compensated for by increases in productivity growth, then the RTC will decline. The subsequent deterioration in the income position of farmers will, however, be more evident in the absence of market distortions (i.e., no government support programmes).[9] Table 7 reports the sub-period growth rate averages of TOTG and RTCG for the four Windward Island producers, with annual movements illustrated in Figures 13-16.

**Table 7: TOT and RTC Growth Averages
Windward Islands Banana Industries, 1965-1994**

Period	StLucia	Dominica	StVincent	Grenada
TOTG:				
1965-71	na	-5.09	-4.10	na
1971-78	6.01	18.32	11.68	16.82
1981-87	2.67	1.12	2.95	1.98
1988-94	-4.20	-2.68	-2.96	-3.46
1971-94	0.75	6.04	3.81	5.15
RTCG:				
1965-71	na	-0.33	-12.36	na
1971-78	1.98	7.48	0.79	1.25
1981-87	0.09	-0.09	0.32	0.81
1988-94	1.04	-0.12	1.03	-0.12
1971-94	0.89	2.16	0.58	0.81

The behaviour in the TOT index during the 1965-1971 period for Dominica and St.Vincent, was similar (Fig. 13). The pattern of TOT decline was attributed to the more rapid rate of growth in input prices compared to output prices. For Dominica in particular, between 1965-1971 the output

price index actually declined by 0.3% per year compared to an input price index growth rate of 6.4% per year.

Fig. 13 : ToT Growth, Banana Industries, St.Vincent (SVG) and Dominica (Dom)
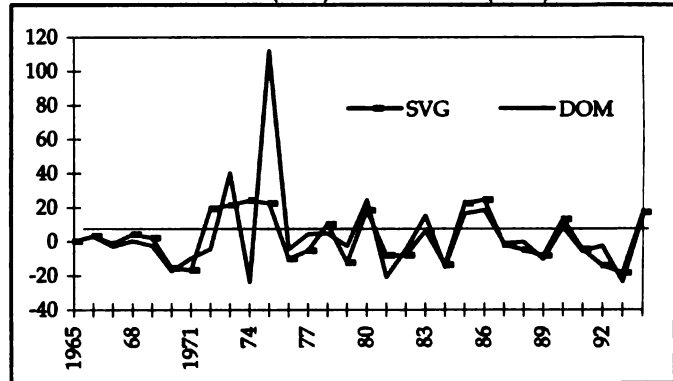
Deterioration in the TOT between 1965-1971, coupled with low (Dominica) and negative (St.Vincent) average annual TFPG, resulted in a worsening of the income position of producers in these two countries (Table 7). The TOT deteriorated sharply between 1970/71 for the industries in both Dominica and St.Vincent, declining by 13.6% and 16.3%, respectively. Such deterioration in the TOT is commonly interpreted as a "cost-price squeeze". In St.Vincent, productivity improvement between 1970/71 to a large extent compensated for the decline in the TOT, resulting in a slight improvement in the economic position of the industry (defined solely in terms of banana export earnings).

For all the countries, in spite of the wide annual fluctuations in the TOT index, positive annual rates of growth were recorded over the 1971-1987 period, with generally declining growth in the TOT from 1988 to 1994 (Figures II.13-14). The difference in the TOT index for St.Lucia may be due to the certain scale advantages enjoyed by the industry in that country. St.Lucia's banana industry recorded the highest annual growth in the TOT (1971-1992 average). This, combined with a

relatively higher level of productivity growth, resulted in the higher (albeit extremely unstable) annual levels of growth in the income positions of its producers.

Fig. 14: ToT Growth, Banana Industries
St.Lucia (SLU) and Grenada (GRE)

The year to year changes in the income positions of banana producers in the other three Windward Islands exhibited less annual fluctuation. St.Vincent recorded the lowest annual growth in TOT over the period and given negative overall TFPG, its banana producers experienced the lowest returns to cost over the 1971-1994 period. Figures 15-16 illustrate the growth patterns in RTC for the 1971-1994 period.

Fig. 15: RTC Growth, , St.Vincent and Dominica
Banana Industries

High, positive annual average TOT growth rates were recorded between 1971-1978. This was due primarily to a more rapid increase in output prices compared to input prices, particularly between 1972-1975. The income
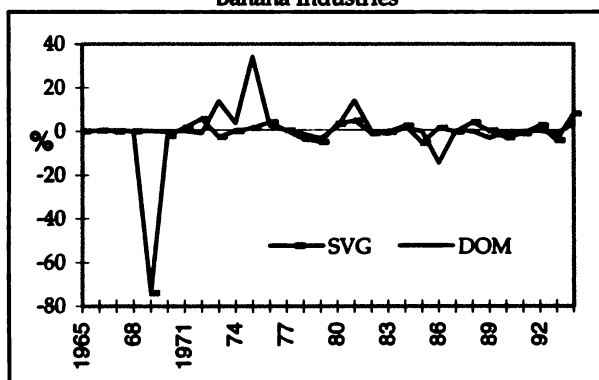
position of banana producers for all four countries was best over the 1971-1978 sub-period, arising from a favourable growth in the TOT which offset the negative overall decline in the rate of productivity growth over the same period.

The sharp and steady appreciation of the Pound Sterling against the US dollar (1978-1981) as well as nominal increases in the export price led to a continuation of the high annual rates of TOT growth in the post-1978 period up to 1986. In addition, the continuous upward trend in export prices until 1986 was sufficient to offset the depreciation in the exchange rate, resulting in favourable TOT. The post-1986 TOT deterioration, a feature common to all four banana producers, was the result of a general increase in input prices, a declining trend in export prices and deterioration in the Pound Sterling exchange rate to the US dollar.

Of significance is that between 1981-1987 sub-period, the situation, in terms of RTCG among the four banana producing countries, was reversed with producers in St.Lucia experiencing highest annual growth in returns to costs. The income position of producers in the other countries worsened, due primarily to negative rates of productivity growth which averaged -1.67% per year and negligible growth in the TOT.

Producers' incomes in Dominica actually declined between 1981-1987, by 0.1% per year. Deteriorating TOT in the post-1987 period, not offset by the slight improvements in productivity, resulted in a worsening of the income position of banana producers in Dominica and Grenada in the 1988-1994 period. For these two countries, the positive effects on RTC which would have resulted from an average annual rate of TFPG of 3.1%, was exactly

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offset by the deterioration in the TOT, resulting in a 0.12% decline each, in the net income position of their banana producers.

Fig. 16: RTC Growth, , St.Lucia and Grenada Banana Industries
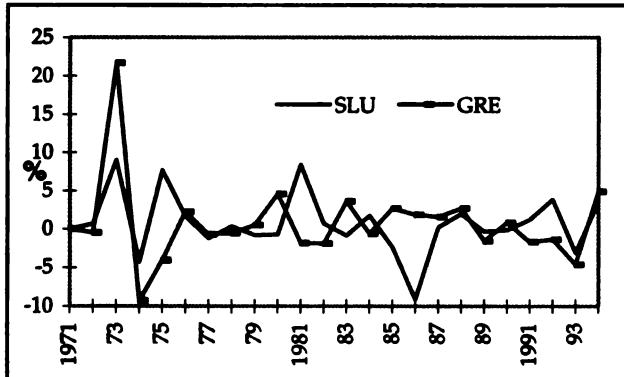
In contrast, the banana industry in St.Lucia continued to outperform the other three banana producers, recording relatively higher TOT and RTC growth levels in the post-1987 period. The improved economic position of the industry in St.Vincent (solely in terms of income generated), in the face of declining TOT was possible because of positive rates of productivity growth.

For all countries, even in Grenada, the apparent improvement in the net income position of producers in 1994 may be almost exclusively attributable to a nominal increase in the banana export price coupled with relatively stable exchange rates that year. Analysis for the post-1994 period is still on-going, however, preliminary results suggests that the increased price instability exacerbated in part by the production of lower grade fruit in some islands and over supply in the EU market, appeared to have led to further deteriorations in the income position of producers. While the status of the industry varies across the Windwards, considered jointly, the results suggest that the income position of producers deteriorated throughout the 1971-1994 period. However, the fact that TOT improvements constitutes the major source of RTC growth, renders the industry

particularly vulnerable to price and market instability brought about by the introduction of the new EU banana regime.

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Summary and Conclusions

Bananas are the most important tropical fruit in world trade. In 1995, world imports of bananas totaled 10.6 million metric tons valued at over US$5.3 billion. The Windward islands have traditionally depended significantly on banana export earnings. Though per caput banana imports have risen over the last 10 years, real prices have generally declined. As the growth and revenue prospects for banana exports are not anticipated to improve, countries have intensified their efforts to improve the viability of banana cultivation or to find some alternative economic activity.

The foregoing empirical analysis suggests that over the last three decades, the full economic potential of banana export production has been severely constrained by a general lack of productivity growth. Notwithstanding the adverse effects of hurricanes and other naturally occurring conditions over the 1971-1994 period, the output performance of the St.Lucia, Dominica and St.Vincent banana industries was characterised by a high level of annual instability, with that of Grenada exhibiting steady decline.

It may be argued, however, that these industries have experienced remarkable output growth, particularly since 1986 and that based on this, these industries may be said to have performed fairly well. The results of the TFP analysis, however, indicate that this argument is flawed. It is a well known fact that the Windward islands banana industry is highly input-dependent, particularly on

labour and intermediate materials. This observation is clearly supported by the results which indicate an overall high and rapid rate of growth in inputs. While increased use of inputs over time may be used as an indicator of industry growth and expansion, it becomes worrisome when the level and the rate of growth in input use exceeds the rate of growth in output. This was what occurred in the banana industries over the last three decades. The productivity results thus indicate that not only was the level of banana output determined exclusively by the quantities of all inputs used, but by implication, input use in banana production was highly inefficient.

The implications of the results for the Windward Islands banana industry are bothersome, since its viability both within the framework of the present EU regime and in the more liberalized environment will depend on generating and sustaining productivity growth. For protected banana producing countries, such as the Windward Islands, trade liberalisation, including a liberalised EU market and more recently, the creation of the WTO and the subjugation of the agricultural sector to multilateral discipline has had profound impacts on the agricultural sectors in general, and the banana industry in particular.

The Windwards share represented less than 2% of the declining ACP total of 5 - 6% share of world exported output. Producers from Latin American account for 70% of the total supply of bananas on the world market. Following the 1992 EU banana market reform, it was thought that patterns of world trade and world prices for banana would be altered, thereby in turn, impacting the welfare of the exporting and importing countries. The Windward Islands have been engaged in constant negotiation aimed at maintaining current levels of protection. Although inconsistent with the EC's

objectives of removal of internal border restrictions and harmonisation of external trade, Lomé IV (signed in 1989) has provided an additional 10-year window of protection during which the Windward Islands must attempt to overcome the major factors impairing the banana industry's ability to be compete.

The continuation of the Lomé preferential market access, albeit at a greatly reduced level, however, is no longer a source of security for the Windward islands banana industry. The January 1997 ruling of the World Trade Organisation in favour of the US challenge to the EU New Banana Regime (NBR) has effectively neutralised this market arrangement. The WTO ruling is therefore of particular relevance, in that the accelerated pace of market liberalization will adversely impact the terms of trade position of the Windward Islands banana industry. In fact, the WTO interim ruling just accelerated the inevitable for the industry in Grenada and some producers in St.Vincent, St.Lucia and Dominica.

It is unlikely that the Windward Islands banana industry is competitive with Latin America now. So the question really is, can it be, and of so, what would it take? Should the Windward Islands industries continue to be less productive than its competitors, then their short-run inability to compete (hence long-run survival) in the liberalised market is virtually assured. The formation of policy alternatives which are non-trade distorting and which simultaneously provide WTO-consistent incentives for productivity enhancements will be important for the industry, regardless of whether a preferred post-1997 market arrangement is obtained or not. Post-1997, the Windward islands are faced with the twin tasks of ensuring the survival of their individual banana industries while simultaneously addressing problems associated with a slow and limited progress made in banana diversification.

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Endnotes:

1. Colin Thirtle and Paul Bottomley, "Total Factor Productivity in UK Agriculture, 1967-1970" Journal of Agricultural Economics, Vol.43, No.3 (1992).

2. Paul Krugman "Pop Internationalism", MIT Press (1996).

3. Inputs usually are measured in different units of measurement, such as pounds, tons, litres.

4. Banu Suer "Total factor productivity growth and characteristics of the production technology in the UK chemicals and allied industries" Applied Economics. (1995), 27.

5. While stock have been carried over from one period to another, the values of such were quite small for most years.

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