SPILT MILK:

TRADE LIBERALISATION AND THE BARBADOS DAIRY INDUSTRY

by

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Abstract

Dairying in Barbados is under tremendous pressure. Government reduced its role in the industry during the 1990's structural adjustment programme. A quota system took effect. Milk production fell nearly 50 per cent between 1992 and 1993. By the end of 2010, 16 commercial dairy farmers remained in the industry – less than half of the 37 registered farmers in 1990. National milk output stood below 7 million kilograms - one-half of the 14 million kilograms recorded in 1991.

Farm consolidation is common worldwide. The precipitous drop in milk output that occurred in 1992 Barbados is not. Dairy products constitute a significant part of the local diet and income. Milk remains one of the few agricultural products in which the island claims self-sufficiency. Hiccoughs in this industry trickle down to the larger society making it imperative that difficulties in the industry be identified and addressed.

The changing international trade regime, farm management practices, domestic policy and weather patterns all potentially affect economic outcomes. We examine whether moves toward trade liberalisation increased milk-based imports. Our findings show it unlikely for milk-based imports to have been responsible for the 1992 milk production drop. Today, however, the evidence suggests that trade liberalisation is exerting pressure on the local industry. Fresh milk and cream imports rise more than 3 percent after 2000. Imports of milk products that compete with locally produced ones also exhibit signs of increase.

Questionnaire-based responses identify structural characteristics of the industry. Survey data indicate high farm-level costs of production - some hovering around US$1 per kg – high prevailing price levels, reproductive and management issues, a paucity of industry support services and industry-specific research, and the absence of independent quality control and quota administration. Evidence of industry distress includes declining farm numbers, low production, and high costs.

In short, we examine factors that affect the economics of producing milk in Barbados. We find that the viability of dairying in Barbados depends on successfully dealing with domestic policy and herd management issues, given the shifting trade environment.

Preface

This research was wholly conducted by the author, Sophia N. Kellman, under the supervision of Sumeet Gulati and was written in its entirety by Sophia N. Kellman. No publication outside the thesis has arisen from this work but is expected in the future. Research was undertaken with approval from UBC's Behavioural Research Ethics Board. UBC BREB Number is H09-03239. All errors are my own.

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List of Abbreviations

ACP	Africa, Caribbean & Pacific
APEC	Asia Pacific Economic Cooperation
APU	Agriculture Planning Unit
ASEAN	Association of Southeast Asian Nations
BADC	Barbados Agricultural Development Corporation
BADMC	Barbados Agricultural Development & Marketing Corporation
BALDECS	Barbados Livestock Development Cooperative Society
BAMC	Barbados Agricultural Management Company
BAS	Barbados Agricultural Society
BDBPA	Barbados Dairy & Beef Producers Association
BER	Barbados Economic Report; Barbados Social & Economic Report
BHL	Banks Holdings Limited
BSIL	Barbados Sugar Industries Limited
BSS	Barbados Statistical Service
BS&T	Barbados Shipping & Trading
Budget Speeches	Barbados Financial Statement & Budget Proposals
CAP	Common Agricultural Policy
CARICOM	Caribbean Community & Common Market
CARIFTA	Caribbean Free Trade Area
CBERA	Caribbean Basin Economic Recovery Act
CBI	Caribbean Basin Initiative
CCI	Caribbean Cotton Industry Incorporated
CDB	Caribbean Development Bank
c.i.f	Cost Insurance Freight
CET	Common External Tariff
CGCEP	Caribbean Group for Cooperation & Economic Development
CMCF	CARICOM Multilateral Clearing Facility
COP	Cost of production
CRC	Caribbean Research Council
CSME	Caribbean Single Market Economy
E(E)C	European (Economic) Community
ECF	Export Clearing Facility
ECLA	Economic Commission for Latin America
ECLAC	Economic Commission for Latin America and the Caribbean
ECOWAS	Economic Community of West African States
EFTA	European Free Trade Association
EU	European Union
FAO	Food & Agriculture Organisation
FDI	Foreign Direct Investment
f.o.b	Free on Board
FTAA	Free Trade Area of the Americas
FTC	Fair Trade Commission
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product

GOB	Government of Barbados
HS	Harmonized Commodity Description and Coding System of tariff nomenclature
IMF	International Monetary Fund
ISA	International Sugar Agreement
LAFTA	Latin American Free Trade Area
MAR	Barbados Ministry of Agriculture and Rural Transformation
NAFTA	North American Free Trade Agreement
NTTL	Nestlé Trinidad and Tobago Limited
OLS	Ordinary Least Squares
OPEC	Oil & Petroleum Exporting Countries
PC	per capita
PEM	Protein-Energy Malnutrition
RNM	Regional Negotiating Machinery
RTP	CARICOM Regional Transformation Programme for Agriculture
SAP	Structural Adjustment Programme
SITC	Standard International Trade Categories
SNA	(United Nations) System of National Accounts
SSE	Squared Sum of Errors
TC	Tonnes of cane
TS	Tonnes of sugar
T&T	Trinidad & Tobago
UNCTAD	United Nations Conference on Trade and Development
UNSNA	United Nations System of National Accounts
UNDP	United Nations Development Programme
USSG	United States Sponsored Group
UWI	University of the West Indies
WIRC	West India Royal Commission
WTO	World Trade Organization
VAT	Value-added tax

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Finally, I would like to extend grateful appreciation to all my family for their unflagging support, their consistent concern and for their commitment to making this process as 'painless' and as enjoyable as possible.

Dedication

To Akasia, my *labor amoris*

Introduction: Dairying in Barbados

1.1 Thesis formulation & research questions

This thesis critically examines the Barbados dairy industry in light of the local economic and political structure and given trade liberalisation. Motivation for this work came from research that indicated potential changes in the Barbados farming environment due to trade pressures. A sharp unexpected drop in milk production after 1992 proved to be intriguing, particularly because this coincided with the nation's structural adjustment programme. WTO entry followed quickly on the heels of these events. Was government policy or was WTO-entry responsible for the declines in milk production and the industry's consolidation? Did government policy lead to trade liberalisation, thereby increasing imports and affecting domestic production? More important, is trade liberalisation currently affecting the industry? If so, what are the prospects for survival?

Some of the industry's key stakeholders believe that increased imports associated with trade liberalisation are to blame for the current state of affairs - declining milk production and fewer farms. Others believe that it is farm management practices. Some cite the domestic institutional environment. Yet others simply 'blame it on the rain'. Our research indicates that a mix of factors affect milk production in Barbados. Chapter 2 uses a formal economic model – an application of the gravity model analysis of trade flows – to show that while trade liberalisation did not cause the drop in milk output in 1992/1993, liberalisation is beginning to be more strongly felt by the industry today. This

compounds the difficulties associated with both the domestic institutional and farm level practices and characteristics.

Chapter 3 concentrates on how domestic policy and cost factors affect milk production. This chapter presents original research used to calculate local costs associated with milk production and it situates the Barbados dairy industry within the world context by comparing it to regional dairy industries and the Canadian dairy industry. As Chapter 3 shows, the Barbados dairy industry continues to be fragile – susceptible to shocks. Understanding what happened at the beginning of the 1990's could help the industry learn from past mistakes. With this in mind, our analysis proceeds along 3 main strands. We pose the questions:

1. Did trade liberalisation affect the Barbadian dairy industry;
2. How competitive is the local dairy industry with respect to imports;
3. What are the institutional characteristics of the Barbadian dairy industry that affect its competitiveness?

The case study of the Barbados dairy industry shows that by the early 1990's government fiscal deficits led to a reduced role for government in the industry. The industry contracted with reduced government support. Pine Hill Dairy - essentially the lone domestic processor of milk and milk products - was then classified as a State Trading Enterprise (STE) and was, in some respects, the brainchild and darling of the fledgling nation's push for economic growth and development. As the role for the Government of Barbados (GOB) fell, the processor's management now had increased latitude in the decision-making the process. With Government unable to maintain its interests in dairying, it gradually relinquished control. The processor, in turn,

strengthened its position. In 1989, Pine Hill Dairy, with Mr. Carl Sylvester as President, introduced quota talks. As negotiations continued the phrase 'entitlement to supply' replaced the word 'quota' so as to de-stigmatise the concept. After the quota took effect in, the results were immediate and dramatic. Almost a third of the farmers exited the industry. Milk production faltered as farmers baulked at the tiered payment system. The farmers that remained contrived to cut costs but bottlenecks and institutional and market deficiencies continue to stifle domestic industry.

The 21st century ushered in additional challenges. Milk production in Barbados is now also being directly impacted by liberalisation measures. Milk imports rise, independent of national income levels. Farmers are under constant pressure to cut costs so as to remain competitive vis-à-vis imports. The analysis uses a blend of statistical data, library and other research methods, and local farmer-, processor- and government-experience to investigate and document the impact of trade liberalisation on Barbados cow milk production.

1.2 Methodology

Statistical tests employ a gravity model analysis to determine whether steps toward trade liberalisation have affected the local industry. The backbone of the gravity analysis model is annual import and export figures for milk and milk products by country, from 1980 to 2009. Raw statistics are based on the Barbados Statistical Service (BSS) and the local Ministry of Agriculture and Rural Transformation, Agricultural Planning Unit (MAR, APU) database information. We then add data concerning economic sizes of and great circle distances between Barbados and its trading partners.

Real GDP and population data are retrieved from the United Nations System of National Accounts database.

We test the data using the structural adjustment programme (SAP) of the early 1990's as the main policy variable because this programme was largely unanticipated and led to a re-structuring of the overall economy. The SAP is a key policy variable used in the analysis because it occurred without much warning, unlike WTO entry – our other variable of interest. These 2 variables serve as proxy variables for trade liberalisation.

1.3 Findings

Econometric tests lead to three conclusions. First, the sudden drop in milk production that occurred in the early 1990's did not stem from import pressures. This is to be expected since Barbados is a price-taker on international milk prices. Economic theory implies that imports would affect local production only if the tariff wall is broken. There is no evidence to indicate that occurred. During the years leading up to the 1992 milk output drop, GOB still had enough policy space to invoke embargoes on milk imports, raise import levies, refuse import license issuance or use other trade restricting policies should local production be threatened. Second, econometric tests show no indication that fresh milk import levels witnessed a structural change as a result of the SAP or due to WTO entry. Finally, statistical tests do indicate a gradual trade widening after this period. Trade liberalisation appears to boost dairy product exports. By 2000, there is some evidence of structural change in milk imports levels when compared to the 1980-1999 period.

Chapter 3 presents evidence that domestic production costs are falling but local production. Trade liberalisation would suggest increased imports. Tariff levels on imports (though lower than in 1995) are still high for some products that compete with local production. This allows local production costs to remain high and still compete with imports. Although the volume of fresh milk and milk powder imports is too high for some farmers, it is still lower than would result under a lower (or no) tariff scenario. Despite the high tariff on milk imports, statistical tests indicate that imports continue to expand gradually. This reflects gradual moves to reduce trade barriers, in compliance with WTO requirements of tariff-only import restriction measures. Import licenses, although still in place, are granted automatically, non-tariff measures were essentially all converted to tariffs in 2000, and tariff levels on milk imports fell between 1995 and 2004.

Econometric tests are based on chapter 04 of the current harmonized classification system. Categories include HS 0401 - milk and cream, not concentrated nor containing added sugar or other sweetening matter; HS 0402 – milk and cream, concentrated or containing added sugar or other sweetening matter; HS 0403 – buttermilk, curdled milk and cream, yoghurt, kephir and other fermented milk and cream, whether or not concentrated or containing added sugar or other sweetening matter; HS 0404 – whey & products of natural milk constituents, not elsewhere specified or included; HS 0405 - butter and other fats and oils derived from milk (and dairy spreads); HS 0406 - cheese and curd.

Trade flow expansion occurs amid a backdrop of WTO negotiations. Barbados agreed upon and became a signatory to WTO in December 1993. WTO rules took effect in January 1995. WTO commitments raised quota levels for HS 0401 (fresh milk and

cream) and 0402 (powdered, concentrated and condensed milk) imports from 341,236 kgs in 1995 to 568,727 kgs by 2004. Imports exceed these amounts. Tariff levels on HS 0401 and 0402 fell from 171% to 141% over this period and - by the turn of the 20th century – Barbados's non-tariff trade barriers and other protectionist policies were converted into tariffs as it entered a full tariffication phase. (WTO TAO/IDB, 2010)

The OLS results show milk import patterns undergoing structural breaks around 2000. This coincides – not with the SAP or WTO signing - but with the move to replace import control instruments with tariffs. After 2000, milk imports increase without regard to Barbados GDP levels. This lends credibility to the thought that trade liberalisation now influences Barbados milk trade patterns. The high tariffs on fresh milk imports continue to mute the impact of trade liberalisation on local production.

These results for the fresh milk and cream sub-category mimics farm milk production, with milk imports rising during the mid to late 1980's followed by declines during the 1990's. At that time, imports were centralized and were intended as a stop-gap measure for production gaps. Imports increased from 1987 to 1989. At the same time, domestic output doubled. This period corresponds to increased income levels. Ordinary Least Squares (OLS) regression results suggest a correlation between increased real Barbados income and increased imports. Incomes fell 1990 through 1992. Milk output plummeted in 1993. Fresh milk and cream imports plunged after 1990.

The statistical evidence indicates a strong correlation between real Barbados GDP levels during the 1980's and 1990's and milk imports. The link between import and Barbados GDP levels weakens in more recent years. Real values of fresh milk and cream import values after 2000 are consistently higher (and rising) than the post-2000 period

despite periods of economic downturn. Attention turns inward, then, and domestic policy is examined to understand general economic constraints dairy farmers face.

Chapter 3 features domestic policy as a major influence on milk production. The mid to late 80's was characterised by increasing local milk production in tandem with increasing milk imports. By 2009, the tables are turned and milk production falls as milk imports rise. The data do not indicate that increased milk imports adversely affected domestic production during the 1980's. Today, as trade barriers fall or are lowered, increased import levels have greater potential for directly influencing local production. The gradual expansion of milk imports in recent times could present a challenge to milk producers. It is also an opportunity for the processor to seize the opportunity to expand exports.

When measured in real terms, the increases appear to be small. Caution is needed because of the fragility of the local milk industry and the similarities between today's economic crisis and that of the early 90's. Both crises were characterised by large current account deficits - make it imperative that local industry participants to learn how best to deal with increased import levels, given internal structural deficiencies. As trade barriers continue to fall, the face and very nature of milk production in Barbados will change. Anecdotal evidence indicates additional pressures stemming from milk-alternatives or milk substitutes including soya, almond and other milk replacement beverages. These are not usually high-tariff imports. Although the impact of these cow milk substitutes is outside the scope of this paper they compound the challenges of the local industry.

Policy matters as much in this context as it did in the early 1990's. Although it is unlikely that the 1st decade of the 20th century will witness a drop in milk output to rival

that of the 1992/93 era, continued farm consolidation and milk output declines highlight the need for GOB and processor policy – as well as farm-level policy – to provide incentives for industry entry, sustained production levels and lowered costs. Chapter 3 discusses the link between policy, production costs and investment choices.

1.4 Procedure

Library research and data collected through questionnaire-based surveys address the second research question – how competitive is the local dairy industry with respect to imports. This original research goes to the heart of the issues. Farmers were invited to provide responses to Exhibit B in Appendix A. Farm-level data point to a coincidence between the drop in milk output and Government-inability to actively support dairy farmers during the 1990's. Chapter 3 links the fall in milk production to the public sector reform that sprung from the externally imposed structural adjustment programme. The current account imbalances of the late 1980's precipitated the SAP. Negative balance of payments forced the GOB to begin divestiture of its assets, including its interests in Pine Hill Dairy and in its dairy operations. This period of fiscal reform and economy-wide re-structuring reduced the Government's fiscal space. It increased the processor's latitude in the determining farm policy but also led to some farmer discomfort. Chapters 3 and 4 develop the idea that domestic policy - Government, processor & farmer - matters for this industry's survival.

Survey responses are the basis for calculating the cost of producing 1 kg of milk in Barbados. Cost of producing milk in Barbados averaged around BDS$1.90 per kg (US$.95) for the 2008/2009 production year. One local calculation dates back to 1987

and does not adequately capture current conditions. We include this calculation as a point of comparison between costs then and now. The comparison gives evidence that unit costs have fallen with time. FAO estimates show higher production costs. Their data also indicates fallen costs, when measured in real terms. Calculations are presented in Chapter 3 along with a discussion of factors that affect production costs and investment choices.

Chapter 4 deals with institutional features that impact the dairy sector. Library copies of the Pine Hill Dairy's Annual Reports dating back to 1969, recent PHD Annual Reports, FAOSTAT data, colonial Despatches from the Comptroller of Agriculture, post-independence GOB budget reports, speeches and development plans, and the Ministry of Trade's Economic and Social Report (variously called the Barbados Economic Report & the Barbados Economic Survey) from 1971 through 2009 add to interview responses to address the third research question regarding the institutional characteristics of the Barbadian dairy industry that affect its international competitiveness.

Major institutional constraints include port delays, labour shortages, production bottlenecks characterised by a lack of or thin markets for inputs including feed, the lack of a fluid market for quotas, and that the quota volumes are administered and determined unilaterally by the processor. Added to these constraints is the absence of an integrated scheme to deal with trade liberalisation that is coherent to farmers and processor alike. The farmers face production quotas but price controls were abolished during the 1990's under public sector reforms geared towards trade liberalisation. Import controls appear to have all but disappeared and the usual triad of quota system, price support and import coordination no longer complement each other.

Somehow the industry has managed to survive and is reminiscent of the sugar industry. The similarities between the two industries underline the idea that dairy's institutional framework is, in fact, suggestive of institutional characteristics of major government-supported agricultural sectors, and may reflect the outlook of policymakers rather than a purely strategic approach to agriculture. They diverge in one important respect. Sugar's unit COP rose steadily over time. Dairy farmers (despite absolute cost increases) continue to reduce unit costs with time. This important difference could be critical to the future viability of dairying in Barbados. Despite an acrimonious relationship between the processor and some farmers, we attribute the falling COP, at least in part, to the discipline imposed by the processor on farm production techniques.

The conclusion summarises our findings. Measuring outcomes in terms of local milk production and per capita consumption, milk output per cow, PHD intake of locally produced milk, and dairy-product exports, we conclude that although farmers have weathered the storm at present, there is still much to be done if the industry is to survive into the future. Finally, we observe that domestic markets, and commercial and traditional dairying, must play complementary roles if local dairying is to withstand international trade pressures. Dairying in Barbados is compared with Canada along the way with points of interest delineated in the concluding chapter.

1.5 Scope

Two important issues that this research does not attempt to address is the extent to which trade liberalisation should be embraced and whether or not having a dairy industry is the best use of resources. Rather, trade reforms are taken as given and the focus is

restricted to an examination of their impact. The research also neglects the impact of non-milk products that compete with cow's milk in vying for market share. Despite this, the research indicates that current challenges facing the milk industry in Barbados can be attributed in part to both the domestic institutional structure and to changes in the global trading framework as reflected by import competition. We restrict our focus to understanding the evolution of dairying in Barbados in light of trade liberalisation with the presumption that dairying is to survive.

1.6 Related literature: health & wealth

Local leaders in the 1960's supported the development of a local milk industry to achieve economic, political and social ends. Around the world, leaders of newly independent countries adopted import-substitution and export-promotion tactics in their quest for economic growth. The Caribbean region was no exception. In 1965 the Caribbean Free Trade Area (CARIFTA) was formed to foster closer regional economic ties, and to develop a regional food plan aimed at encouraging balanced regional development with centres for agricultural production.

Pre-independence Barbados faced high and rising food imports costs. According to FAOSTAT data, in 1961, condensed milk imports ranked 2nd in terms of import costs to Barbados. Cow milk butter, cheese from whole cow's milk and dried whole milk powder ranked 7th, 17th and 19th respectively. Dairy products accounted for more than 1/5 of money spent on the 20 most costly imported products. At the same time, sugar's role in the economy was waning.

Not surprisingly then, local leaders promoted the creation of a local milk industry to stimulate the economy through job creation, to reinforce moves towards integration among West Indian countries, to reduce the food-import bill, and to generate export income. One writer, Ramsey [1979], records a high prevalence of protein-energy malnutrition (PEM) in Barbados during these years. Ramsey reports malnutrition and gastroenteritis as the main reason for long-stay admissions in 1965. Milk seemed to hold out the promise of moving the economy forward while at the same time filling local needs by tackling malnutrition and poverty in one fell swoop. Three main streams of thought emerged in development literature during the 60's and influenced policy makers – dependency theory, Marxist theory and the predominant modernization theory. These are briefly outlined below. We then briefly review the literature pertaining to the role of institutions in development and the theory governing the use of the gravity model.

1.6.1 Related literature: dependency theory & economic development

The Barbados dairy industry was in its conceptual stage when dependency theorists rejected the notion that comparative advantage benefits all participants in trade. American economist, Paul Baran, released *Political Economy of Growth* in 1957 – directly challenging the dominant "modernization theory." Baran argued that the conditions of dependency created by imperialism leads to systematic subordination with comparative advantage perpetuating that subordination.

Raúl Prébisch of the Economic Commission for Latin America (ECLA – now the Economic Commission for Latin America & the Caribbean) popularised the idea of "systematic imbalance" created by trade patterns. This "structuralist dependency view"

found resonance in twentieth century Barbados – a plantation-based economy – as it witnessed fluctuating international sugar prices and rising labour costs. The "imbalance" was reflected in widening trade deficits and limited ability to provide for a growing population. Securing and maintaining preferential access to European and North American markets preserved the economic base of the fragile nation-state. International Sugar Agreements (ISA) and preferential market access became increasingly threatened in the wake of the post-independence movements. GOB policies of the 1960's sought to overcome the limitations associated with reliance on one primary cash crop that filled no basic local need by re-structuring the domestic economy and by forging new economic ties.

1.6.2 Related literature: Marxist theory & economic development

Marxism was a school of thought that attracted some leaders of newly independent states. This way of thinking had little resonance in Barbados' economic pursuits. U.S.-expressed antipathy toward Marxism, the regional repercussions of Cuban isolation and of the Grenadian experiment with Marxism served as warnings that Marxism could not be officially embraced as the route for growth.

Barbados remained fully integrated in world trade and continued to be, at a primordial level, reliant on trade for obtaining life's necessities. The small local capitalist class precluded Barbados from ridding itself of "subservien[ce] to the international system." (Isbister, 1993) Despite any rhetoric to the contrary or any desire to reverse an economic system that seemed stacked against it, the very nature of the island dictated that

poverty reduction objectives and open trade policy norms share complementary roles on centre stage.

1.6.3 Related literature: modernization theory & economic development

Dependency theory described much of Barbadian economic realities but could not help the island fully chart a path to development. Marxism was not a feasible alternative. Planners looked to research emanating from a third ideological school – the mainstream "modernization school" with its focus on internal deficiencies.

Mainstream modernization theorists variously ascribe economic growth to geography (Diamond 1997; Sachs 2001); institutions (North 1990; Hall and Jones 1999, Açemoglu et al 2001); or to culture or trade openness (Frankel and Romer 1999; Sachs and Warner 1995, 1997; Berg 2003). Theorists in this school are linked by the idea that government policy matters in determining economic outcomes.

GOB leaders embraced the thought that Government had a role to play in determining economic outcomes. Particularly during the 1960's and 1970's, they pursued agendas giving Government an active role in gearing trade toward growth and poverty alleviation. The Barbados dairy industry followed some dependency prescriptions that were also to be found in mainstream economic thought. Locally produced condensed milk replaced condensed milk imports. Trade restrictions included embargoes to help give the "infant industry" the "big push" it needed to get on its feet. By the 1980's, however, it became increasingly clear that export-promotion needed to take precedence over import-substitution if dairying in Barbados was to become viable. Institutional development and market strengthening were, and remain, neglected areas.

One prominent West Indian economist, the St. Lucian born and Nobel Prize recipient Sir W. Arthur Lewis [1950, 1954] wrote that poor countries could grow rich if only they would increase the productivity of labour. He advocated increased productivity by pulling labour out of traditional sectors into manufacturing. For small-island economies like Barbados, Lewis proposed growth through "industrialisation by invitation". Barbadian policymakers closely followed this policy prescription with mixed results.

In line with the Lewis model, the milk processing plant began with domestic and external investment sources. Policy makers intended the milk processing plant to stimulate domestic manufacture by using foreign investment, to replace some imports by domestic manufacture, and to reduce poverty levels through increased employment and improved nutritional status. Agriculture's role was to provide basic foodstuffs, including milk, for domestic consumption, but it was manufacture and the industrial sector that were intended to boost productivity and overall income levels.

1.6.4 Related literature: trade & economic development

Berg & Krueger [2003] point to empirical support for their conclusion that 'increases in openness to trade are an important contributor to growth' with trade often being 'a key and early instrumental part' of policy reform. Contemporary policymakers have embraced this thought but, as Chapter 4 shows, they also need to heed Berg and Krueger's caution that '[t]rade policy is only one of many determinants of growth and poverty reduction.'

1.6.5 Related literature: institutions & trade-offs

Stated agriculture policy objectives remain tied to trade goals in Barbados. In a report prepared for the CARICOM Secretariat – "A Review of Agricultural Studies: Case Study of Barbados" – the Department of Agricultural Economics and Extension at The University of the West Indies (UWI), observes that: 'overall policy goals for the sector include … domestic food security' along with a 'reduction in the food import bill'. (RTP, 2005) Kelvin Craig's 1994 article "The Impact of Pricing and Policies on Dairying in the Caribbean Community" records that Barbados dairy policy objectives between 1988 to 1993 included increased fresh milk consumption, production and output per cow, and reduced 'dependence on imported concentrate feed.' (Craig, 1994)

Craig includes 'reduced extension and veterinary services' among the 'major counter-productive policies of the 1970s and the 1980s' and trade liberalization as a counter-productive policy of the 1990's. For Craig, such policies 'may threaten the future of the dairy industry.'

Chapters 3 and 4 highlight the contradiction faced by the dairy sector with overall government policies not being aligned with sectoral objectives. This mis-alignment leads to tensions that ripple like an undercurrent throughout the milk industry. Contradictions between local agriculture policy goals and international trade rules; conflicts arising from the need to engage in open trade and a desire for self-sufficiency; and the opposition between stated agricultural promotion objectives and reduced agricultural support services send mixed signals to industry participants and potential entrants. More important, mixed signals reinforce a weak institutional framework, leading to thin markets for dairy support services.

Anderson and Valdés [2007] observe that 'trade policy instruments are almost never the first-best way to achieve [poverty alleviating objectives]'. Despite this, Barbados policy makers continue to link trade policy with employment generation and preservation. Anderson and Valdés recommend 'microeconomic reforms to mitigate deep-seated structural problems affecting the competitiveness of factor and goods markets'. Chapter 4 highlights the need for "microeconomic reforms" and reduced transition speeds, if dairying is to survive.

Barbados' attempts to link trade, agriculture and poverty alleviation is not novel. Josling, Anderson, Schmitz and Tangermann (JAST) explain in their 2010 article that during the 1920's trade policy was engaged to 'influence domestic markets' as part of overall farm policy to raise rural incomes. [2010:425] JAST interpret farm policy as the beginning of the most current wave of using protectionism as a way of achieving domestic policy. Using protectionism to forward domestic policy goals taxes resources and strains the economic environment.

The GOB has limited financial resources. The strain on its financial resources precludes it from maintaining credibility in its commitment to the dairy industry. Dairying in Barbados also involves additional internal pressures, characterised by discord among industry participants, distrust of some government initiatives, and a reluctance of private enterprise to fill the gap for industry support services. The issue of trust is of paramount importance to Chapter 4's discussion of the Barbados dairy industry. While domestic institutions constrain the range of viable policy instruments available to governments, trust levels dictate economic options available to industry participants. Chapter 4 links the reluctance to trust the markets (and other market participants) to

Barbados's institutional structure. As editors Jack Knight and Itai Sened propose in *Explaining Social Institutions*: 'Institutions structure social interactions by establishing rules with which social actors comply in making strategic choices concerning their future actions.' [1995:9]

With respect to the Barbados dairy sector, the "rules" appear in the form of information, the threat of sanctions and bargaining power. Douglass C. North [1990:3] defines institutions as 'the rules of the game in a society or, more formally, [as] the humanly devised constraints that shape human interaction'. In his article "Five Propositions about Institutional Change" contained within *Explaining Social Institutions*, North adds that '[i]nstitutions are the constraints that human beings impose on human interaction'. For him, institutions are a set of constraints consisting of formal rules, informal constraints, and enforcement. North argues that '[t]hese constraints define … the opportunity set in the economy.' Institutions determine dairy industry incentives. Chapter 3 concentrates on how these incentives translate into production costs to the local processor and farmers.

In "Institutions as the Fundamental Cause of Long-run Growth", Daron Acemoglu, Simon Johnson and James Robinson (AJR, 2004) make the case for the pivotal role institutions play in economic growth. For these three, economic institutions matter since they 'determine the incentives of and the constraints on economic actors, and shape economic outcomes' and because 'they influence investments in physical and human capital and technology, and the organization of production'. AJR observe that economic institutions define 'the structure of property rights and the presence and perfection of markets', thereby determining 'who get profits, revenues and residual rights

of control'. AJR argue that economic institutions shape both the size and the distribution of the economic pie. Chapter 4 takes up the issue of institutional strength as it is related to enforcement, property rights and market strength.

A large body of literature, then, relates trade and institutional improvement to development. While trade enlarges the economic pie, institutional improvements provide the incentives to advance desired outcomes. The case of dairy indicates that while trade is non-negotiable and therefore quickly embraced, institutional transformation in Barbados occurs at a much slower pace. Winston Griffith [2002] provides a rationale for this in "A Tale of Four Caribbean Countries" by stating that the speed of institutional change in the West Indies may depend upon ceremonialism. Chapter 4 indicates that ceremonialism and sluggish change undermine the dairy industry's ability to adapt to changing exigencies. The case of the Barbados dairy industry serves to delineate the trade-off between domestic policy, institutional strength and international trade.

1.6.6 Related literature: the gravity model

Jeffrey Frankel [1997] in *Regional Trading Blocs* employ the gravity model to address questions related to the impact of regionalism on trade flow patterns. Frankel and Shang-Jin Wei [1993] follow the standard gravity equation methodology that models trade as directly proportional to economic or population size and as a decreasing function of distance. The gravity model springs from Newton's Law which states that the force of attraction between two objects is directly proportional to the mass of the objects and the gravitational constant, and inversely related to their distances. (see Head, 2003)

Frankel et al [1997] explain that when population is added as a variable in addition to output 'the coefficient on population is generally negative.' This reflects the 'phenomenon that larger countries tend to be relatively less open to trade as a percentage of GNP.' Possible explanations for the dependence of smaller countries dependent on trade could be a lack of natural resource endowment or an inability to benefit from economies of scale in the domestic market. (Frankel et al, 1997:57)

There are several options for estimating the gravity model. The 'barebones' model estimates the equation using:

(1) ln (*real trade flows)* $=\alpha + \beta_1 lnY_i + \beta_2 lnY_j - \theta lnD_{ij} + \varepsilon_{ij}$.

The equation for estimating the 'augmented model is often expressed as:

(2) ln (*real trade flows)* $=\alpha + \beta_1(lnYi\ Y_j) + \beta_2[(lnY_i/Pop_i)(Y_j/Pop_j)] - \theta lnD_{ij}$ + Dummies + ε_{ij}.

Yi represents real income levels of bilateral trade pairs. i generally denotes the exporter and j the importer. D is the distance between country pairs. Pop refers to the population. Dummy variables depend on the question at hand and may reflect participation in a trading agreement, common borders, and linguistic or cultural ties.

Equation (2) reflects a potential link between trade and stage of economic development. Frankel et al [1997] surmise that the 'independent effect of income per capita' may be due to foreign imports being 'superior goods in consumption'. Alternatively, imports may reflect innovation and new products being developed in the exporting country. Additional explanations point to enhanced infrastructural development in more developed countries.

Although trade tends to rise less than proportionately with size, wealthier (industrialised) countries tend to trade more than poor countries. Frankel attributes this phenomenon to protectionist trade policies. Economic theory predicts that as countries develop, they dismantle barriers to trade. This coefficient for per capita income captures this phenomenon. In essence, Frankel and Wei [1993] note that 'the specification implies that trade between two equal-sized countries … will be greater than trade between a large and a small country.'

While Frankel and Wei state that increased per capita incomes could be expected to have a positive effect on trade because 'as countries become more developed, they tend to specialize more and to trade more,' Rodrigue [2006] adds another potential coefficient effect. Rodrigue notes that while we would normally expect β_1, $\beta_2 > 0$ for Equation 1, when Y is interpreted as income, and trade is 'applied to agricultural goods, Engels' Law allows for [Y] in the destination [importer] country to have a negative influence on demand for imports.' Hence, $\beta_2 < 0$ is feasible under economic theory for Equation 1.

In summary, then, the product of per capita incomes could enter positively or negatively into the equation. What is clear, though, is that standard gravity model predictions diverge from the traditional Heckscher-Ohlin trade theories. The gravity models predicts increased trade between countries with similar income levels. The Heckscher-Ohlin theory predicts more trade between dissimilar countries due to comparative advantage. The empirical results allow us to determine which theory is at play in any given example.

Unlike ‘true’ gravity model analyses, this paper employs an adaptation of the model. Our research does not examine all world trade or even all trade for a given region. Instead of the traditional bilateral country pairs, our pairings are Barbados and its trading partners and we concentrate on trade patterns for a specific industry. We would therefore necessarily expect some results to diverge from the theoretical predictions.

We anticipate some divergence between the model’s theoretical prediction and the Barbados results in the arena of distance. Economists usually assume that increasing the distance between pairs of countries lead to decreased trade while increasing the economic size increases bilateral trade. Distance is used as a proxy for transportation costs and trade barriers. The theory points to higher transportation costs leading to higher product prices. Despite arguments that state that distance should matter little for transportation costs, Head finds evidence of less trade resulting from higher distances. (Head, page 6) ‘Cultural’ and ‘physical’ distances affect Barbados' trade patterns. We use factors such as linguistic (sharing a common language) and regional ties (through CARICOM) as proxies for ‘distance’.

Transportation routes are better developed between Barbados and its historical trade partners than between Barbados and other proximate countries. The 1978 Barbados Economic Report (BER) cited the need to improve regional transportation links if a regional food plan was to be successful. Our estimation of the gravity equation shows that while improvements in regional transport links have allowed CARICOM to play a more significant role for exports, historic ties play a larger role for overall milk trade and for milk imports. CARICOM is becoming more important as a source for milk imports with time.

1.6.7 The gravity model estimate

As stated earlier, the 'barebones' model estimates the equation using:

(1) ln (*real trade flows)* $= \alpha + \beta_1 lnY_i + \beta_2 lnY_j - \theta lnD_{ij} + \varepsilon_{ij}$.

Chapter 2 presents the 'full' model that has been augmented to include:

(2) ln (*real trade flows)* $= \alpha + \beta_1 (lnYi\ Y_j) + \beta_2 [(lnY_i/Pop_i)(Y_j/Pop_j)] + CARICOM + CommLang - \theta lnD_{ij} + \varepsilon_{ij}$.

The 'full' model includes estimates for per capita income and a dummy indicator of shared common language. The CARICOM dummy captures some of the effect of regional grouping and cultural ties. Highlights of the results are presented above in Section 1.2 Methodology. Analysis is contained in Chapter 2. Additional results have been relegated to the Appendix.

1.7 Data limitations

Obtaining Barbados dairy sector-specific data is a challenge. Overcoming farmer-reluctance to share cost information at the individual level presented its own difficulties. At the national level, some information appears to be governed by the Official Secrets Act. Other information, although intended to be public, is treated as if it falls under the auspices of this act. There has, however, been a gradual releasing of information during the course of this research. Some national information that was difficult to retrieve when this study began (including the BER) is now available on-line. There are slight discrepancies between national and international data, particularly as we reach back in

time. FAOSTAT estimates of milk production during the late 1960's and early 1970's, for example, differ slightly from national statistics.

The most glaring data deficiency is periodic missing data – particularly the lack of any trade data for the 1991 calendar year. This falls within the SAP period. We use real GDP, price deflator and population figures from the United Nations system of national accounts database. The data are available for most countries in the dataset and for all the relevant years. UN numbers are used in preference over World Bank numbers or national statistics in statistical analysis for consistency purposes. Information about bilateral distance and language ties comes from Jon Haveman's dataset posted on the Macalester website. CARICOM membership information comes from the official CARICOM website.

We use national population and production statistics to calculate per capita consumption and other national estimates. Costs associated with producing milk in Barbados mainly derive from farmer responses, making our calculations estimates at best. We have made every attempt at accuracy and provide a well-reasoned range for our estimates. Reported numbers are not necessarily assumed to be accurate so, where possible, we use a range for production costs instead of pinpointing a specific number.

1.8 Approach and outline

Based on the research questions raised in 1.1 Thesis Formulation and Research Questions, we organise the paper into four chapters. In Chapter 2, we present and discuss the results of the gravity analysis model. Chapter 3 examines the competitiveness of the local dairy industry based on both original cost-of-production calculations and on

publicly available producer price indicators. After providing background information on the local industry and outlining government's changing role in the industry, Chapter 3 considers various that affect milk output costs. The high producer prices (among the highest in the world) are a function of investment choices, and structural and institutional constraints. The mix of steady but low producing, low investment farms and high volume, high investment farms appear to both be integral components of a healthy milk industry.

Chapter 4 rounds out the narrative by its discussion of institutional constraints. This chapter compares the dairy and sugar industries. It places emphasis on the need to remember traditional dairying. Traditional dairying remains an important, albeit small and often neglected, component of the overall industry. The conclusion notes points of interest between the Barbados dairy industry and that of Canada. It also offers policy recommendations based on the foregoing discussion. Interviews, data compiled from sources including government ministries, the local dairy processor and international organisations, and library-based and archival research, document this narrative of the Barbados dairy industry over time. This research takes a comprehensive look at the Barbados dairy industry, weaving statistical analysis into a narrative discussion aimed at capturing the dynamics associated with dairying in Barbados.

2. Dairy & international trade

2.1 Trade agreements & the Barbados dairy industry

This chapter presents the results of the gravity model tests. We find that, prior to 1992, real income levels in Barbados influenced milk import levels. That link weakens by 1995. After 2000, milk imports increase regardless of national income. The dataset cannot reliably determine whether the SAP or WTO entry leads to structural breaks in milk imports. Leading up to 2000, however, the results show increased significance for CARICOM milk imports and some evidence of a structural break in the real value of milk imports.

Trade liberalisation appears to have some impact on import levels. This is important because, as Anderson, Schmitz and Tangermann observe: '[t]rade agreements have evolved to where they constrain domestic policy, and international commodity prices are usually transmitted at least to some extent back to the farm level'. (Josling et al, 2010)

On the import side, the major trade agreements affecting Barbados today are its WTO commitments, its CARICOM affiliation and, perhaps the CBI. CARICOM with its Common External Tariff (CET) determines the tariff levels for extra-regional imports. One of its stated objectives is to increase intra-regional trade. The removal of tariffs on intra-regional imports is reflected in increased CARICOM milk imports into Barbados. British preferential treatment, Lomé Convention articles, and more recent European Partnership Arrangements (EPAs) directly affect how export-oriented business is

structured in Barbados. This chapter explores the interrelation between open trade, trade agreements, domestic policy and agricultural outcomes.

2.2 The gravity model

The model as modified from Newton's Law describes trade as a function of economic size and distance between trading pairs. Economic size is important in determining level of specialization and the number of different products offered for trade. Our dataset contains 83 countries (plus one 'country unknown') that have exported milk products to or have imported such products from Barbados at least once during the 29-year period under consideration. 33 of these countries have either exported milk to or imported milk from Barbados over the 29-year span. Barbados imported milk from 15 countries during the period under review.

The basic regression equation is:

$$\ln (T_{ij}) = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j - \theta lnD_{ij} + \varepsilon_{ij}. \quad (1)$$

Equation 1 explains bilateral trade flows as a function of income levels in both countries and of the distance separating the 2 countries. The dependent variable – total annual bilateral trade - is the sum total of imports and exports of various dairy products, expressed in log form, between Barbados and its trading partners in a given year. This variable is measured in real US$. Income is based on real GDP levels of the exporter ($Y_{i)}$ and of the importer (Y_j) – all measured in constant US$.

We estimate our equation by running sets of pooled regressions. To test how trade patterns were affected by a given policy we divide the dataset into 2 groups. To determine whether WTO entry in 1995 impacted trade flows in 1995 the first group

(Group 1) would include the value of total trade from 1980 and 1994. Group 2 covers trade flows from 1995 to 2009. We follow the same method for the SAP and for the 2000 tariffication phase.

2.2.1 Gravity equation estimation

We use the functional forms below for our calculations.

(2) ln (*real trade flows)* $= \alpha + \beta_1(lnYi\ Y_j) + \beta_2[(lnY_i/Pop_i)(Y_j/Pop_j)] + CARICOM + CommLang + \theta lnD_{ij} + group + \varepsilon_{ij}$.

Real trade flows is a summation of the US dollar value of trade. *Y* represents real GDP; *Pop* is the country population; *D* is distance in kilometres between country capitals; *Caricom* and *CommLang* are dummy variables used as explanatory factors. CARICOM tests the effect of membership in the Caribbean Community/Common Market while CommLang tests the effect of sharing a native tongue. Group is a dummy variable used to pool observations over several years together.

2.2.2 Hypothesis formulation

Our concern is whether policy changes, namely the 1990's Structural Adjustment Programme and WTO entry, have affected trade patterns for Barbados dairy products. The hypothesis is that the SAP of the early 1990's served as the first major step toward Barbados trade liberalisation as domestic public sector reform paved the way for significant changes in dairy product trade. The null hypothesis is that there has been no change over time.

After finding estimates for the gravity equation, we go a step further. First, we try to determine whether any changes we find are associated with increased income. Second, we conduct further tests to determine whether statistically significant results reflect a structural change associated with the policy change or whether any change is part of a gradual trend. The null hypothesis is that the group coefficients corresponding to each period is the same. We reject the null if, based on the t-statistic, the p-value is sufficiently small. The real value of milk imports (which coincides with the volume of milk imports) is the regressand. Econometric tests indicate expansion but no sign of a structural break in milk import patterns that coincide with either the SAP or WTO entry. Milk import patterns show evidence of structural change after 2000.

2.2.3 The data

The full dataset contains in excess of 11,000 line observations, including imports and exports over monthly and annual periods stretching from 1980 to 2009. We use annual numbers only. This reduces the number of observations to 2,713. Sourced from the BSS and MAR, it is relevant to use this dataset for consistency and because it is the official national data. This dataset provides detailed export and import information, by country. A major drawback is the presence of discrepancies in the data, including missing data points.

Trade values are in real US dollars using the pegged exchange rate value of BDS$2 to US$1. This peg has remained unchanged since the 1970's. Real values are calculated using the UN SNA implicit price deflator figures. Country pairs that show no trade for a given year are necessarily dropped from the regression. World and country

GDP levels are measured in constant 2005 US dollars and come from the UN national accounts database. The UN national accounts database does not include GDP numbers for few territories or dependencies. These countries are dropped from the aggregate regression. This affects a small percentage of the data and affects data integrity to the extent that (with a few exceptions) these are generally islands located near to Barbados.

Farmers expressed concern about perceived pressures stemming from milk and milk powder imports. We focus the analysis on milk imports alone because only milk is produced in Barbados. Barbados produces no milk powder locally. In addition, although restricting attention to milk limits the data set, it overcomes some of the problems associated with missing data. Only 15 countries – Austria, Bulgaria, Canada, Denmark, Estonia, Germany, Ireland, Jamaica, the Netherlands, New Zealand, Puerto Rico, Saudi Arabia, Trinidad & Tobago, the United Kingdom and the United States - export milk to Barbados at least once during the period under review. No country exported milk to Barbados each year between 1980 and 2009. We replace zeros by arbitrarily small numbers to have balanced panel data.

Distance is capital-to-capital from Bridgetown, Barbados to the respective country capitals unless there is compelling reason to use another city. We use John Haveman's distance and language data from the Macalester website. Sections 1.6.6 & 1.6.7 outline the general theory behind the use of the model. Its application, as used in this paper, is described below.

2.3 The theory

Gravity model results yield estimates about variables that influence trade flows. The concern here is not just the trade patterns. We expect a general upward trend as population and incomes grow. The focus, then, is whether trade flow patterns have changed in response to policy changes and if any differences that emerge represent a structural break. We employ 2 tests - the F-test (used in the Chow test for a structural break) and the Student t-test of paired means - to locate structural change. Only results for the t-test are presented below. Others results are in the appendix.

The paired t-test compares the means of the 2 periods and calculates the t-statistic and the associated *p*-value to determine whether the difference in the means is 0. The null hypothesis is that there is no difference in the means (Ho: $\mu_1 = \mu_2$). When the calculated t-statistic exceeds the t-critical value at a given significance level, we have grounds for rejecting the null hypothesis at that significance level. Alternatively, we can use the p-value. A *p*-value that is smaller than the relevant statistical significance level provides a basis for rejecting the null hypothesis of no structural break at that level of statistical significance. Import patterns may undergo structural breaks across periods (referred to as groups in the results below) due to changes in either the slope or intercept terms.

2.4 Regression results

2.4.1 OLS results

The results for fresh milk and cream imports are reported below. OLS results for milk imports are followed by tests for structural change. Section 2.4.2 – Data Implications – interprets the test results and outlines what we learn from these results.

Table 1. OLS results: fresh milk & cream imports

dependent variable: logarithm of the real value (in US$) of annual milk imports by trading partner

FRESH MILK	**2000-2009**	**2000-2009**
GDP Product	.757**	.780***
Per Capita Income Product	-.290	-.043
Distance	-.737**	-1.176***
CARICOM	1.907*	5.191***
Common Language	1.770***	2.150***
Group2 Indicator	1.304***	-
Barbados GDP		-8.705
Constant	-23.999***	164.194
N	425	150
R2-a	.258	.426

Note: Results are rounded to three decimal places.
The numbers shown in the square brackets are the standard errors.
Asterisks * on coefficients represent statistical significance at *** 0.001, **0.01, * 0.05 significance levels.
All variables except the dummies are expressed as natural logarithms.

Table 2. Paired t-test for structural breaks

VARIABLE	OBS	T-STAT	T-CRIT, 0.01
2004-2009 (Group 2)	425	6.801	2.58
Degrees of freedom = 424			

Table 1 presents coefficient estimates for the product of the real GDP of Barbados and its import partner, for their per capita income products, and for distance between Barbados and its trade partner. It also estimates the effects of belonging to CARICOM and sharing a common official language. We run to variants of the regression. We first run the regression with group 2 as an additional dummy. Next, we run the model with a dummy for real Barbados GDP. The group indicator dummy represents the period 2000 to 2009. The Barbados GDP dummy affects the slope of the equation and is used to

examine whether increases picked up by the Group dummy can be explained by income increases.

2.4.2 Data implications

The test results compare the periods 1980-1999 with 2000-2009. The group indicator suggests that milk imports were up 3.68 per cent (exp[1.304]) in 2000-20009 over 1980-1999. This is significant at the .001 per cent level. The calculated t-statistic (of 6.801) exceeds the t-critical value. We reject the null hypothesis of no structural change in favour of the alternative hypothesis that there has been a fundamental shift in import patterns after 2000. The lack of statistical significance for the Barbados GDP dummy shows that the structural change is unrelated to Barbados income levels.

CARICOM: The results in the appendix show that CARICOM's importance grows over time. When the Barbados GDP dummy is included in the equation, CARICOM manifests a small negative coefficient in early years. CARICOM becomes more important as a source of fresh milk imports after the CET took effect. Trinidadian exports to Barbados grow over this period. Trinidad is the only CARICOM country exporting milk to Barbados between 1980 and 1999. After 2000, Jamaica joins Trinidad in exporting milk to Barbados. Only Trinidad & Tobago, the United Kingdom and the United States consistently export fresh milk and cream to Barbados between 1980 and 2009. This helps explain the positive but weak significance level for CARICOM but the consistently strong and positive coefficient estimate for the language dummy.

During the period 2000-2009, sharing a common language increased milk imports by 5.87 percentage points (exp[1.77]). The common language suggests cultural proximity. Links to the US are a function of "modern ties" through its hemispheric

dominance, a pegged currency and the CBI. Ties to the UK have an historic origin since modern-day Barbados began as a sugar colony for the UK. Ties to Trinidad may be explained by its regional importance, the CARICOM affiliation with its CET, and historical groupings due to geographic proximity and common colonial rule.

OLS regression results and the tests for structural breaks (presented in the appendix) lead us to conclude that neither the SAP nor WTO entry radically changed trade value flow patterns for milk imports. A structural break in milk import patterns occurs after the trade liberalisation process was more fully embraced in 2000. Trade policy gained ascendancy over Barbados GDP levels after 2000.

Domestic milk production began a steady climb during the early 1980's. Milk imports rose from the mid to late 1980's in the absence of trade rules necessitating higher imports. Real GDP also rose during these years. Barbados experienced an economic downturn after 1989. Milk imports fell. Domestic milk production, on the other hand, continued to climb well into the early 1990's. The 1992/1993 decline, then, was not a direct outcome of higher imports. Instead, internal changes associated with austerity measures and real income drops that led up to the quota system are more at play.

As Table 1 indicates, milk imports begin to rise again after (but not at) WTO entry. This time, increased imports are the new norm. Milk imports now follow a structurally different pattern. The data imply that farmers operating in Barbados today must keep one eye on internal developments and another on growing import levels. Chapter 3 examines basic economic features of local milk production. Chapter 3 also provides background information on dairying in Barbados, the effect of 1990's austerity measures and cost of production numbers for the Barbados milk industry.

Chapter 3: Production costs & local competitiveness

3.1 Trade & the Barbados dairy industry

The most direct channel through which austerity measures of the 1990's affect the dairy industry is through public sector reform. Public sector reform came part in parcel with IMF balance of payments support and paved the way for trade reform. GOB 1994 Financial Statement & Budgetary Proposals states that monetary policy was reformed in 1993 to 'further financial sector liberalisation'. (Budget Speeches, 1994:8) The same budget proposal reports that trade reform began in earnest in February 1994 with 'a reduction in protection for import-substituting manufacturing […and] intensified programmes for export promotion and financing so that manufacturing firms may improve productivity and quality to internationally competitive standards.' [1994: 11]

Pine Hill Dairy (PHD), the local milk processor, numbered among "import-substituting manufacturing"' at that time. Chapter 3 develops the thought that falling Government revenues and pressures associated with austerity measures and moves towards trade liberalisation caused GOB support for dairying to wane during the 1990's. By 1989, faced with increased imports and climbing domestic production, Pine Hill Dairy initiated quota talks. Farmers faced limited loan financing as Government and the credit sector tightened their belts. In 1992, the dairy sector witnessed the cumulative result of tightening credit and decreased Government support associated with austerity measures and the impact of the new quota system and declining cow numbers. Domestic

production fell dramatically. The quota system would re-define the Barbados dairy industry landscape.

By 1992, during the nation's SAP, GOB would further reduce its role in the dairy industry as budget cuts continued. Chapter 3 examines Government's role in the Barbados dairy industry over time; presents highlights of the cost structure; compares producer costs in Barbados with international averages; and outlines other factors (including climate conditions) that affect milk output. One clear conclusion is that the cost of producing 1 kg of milk in Barbados today – nearly BDS $2 on average - is still too high. Farmers will have to act more aggressively to cut costs, should this fragile industry survive.

3.1.1 Industry highlights

Regional integration movements and the pressing need to ride the globalisation wave relegated calls for food-sufficiency, food security, agricultural diversification and protection of domestic industry for 'development' or 'national strategic' purposes – ideas that were championed during the 1960's through the 1970's – to the backburner. Everyday realities collided with visionary ideals and Government coffers simply could not afford to support these ideals. Renewed calls for 'globalisation' and 'trade liberalisation' coupled with government inability to finance its plans brought policies that were instituted during the 1960's and 1970's under fire.

Starting in 1989, Government inability to cover its expenses came to the fore. Pine Hill Dairy's 1999 Annual Report mentions that during the preceding 10-year period neither dairy farmers nor the processor received any price increases for milk. Rising milk

imports plus rising domestic production out-paced demand, creating excess supply. The processor implemented the quota system to counteract this new phenomenon. Financial support from Government fell due to budgetary pressures. Government reduced its active role in the industry and ultimately relinquished its quota during the 1990's. Herd management issues added to these factors to undermine the industry's efforts to grow again during this period. At the same time, high cost (and, by definition, less cost efficient) farmers left the industry. Barbados milk output dropped sharply. Chapter 3 first examines dairy development in Barbados. Next, we summarise characteristics of the dairy sector. After reviewing the history of commercial milk production in Barbados, we present information concerning farm-level cost-of-production figures obtained from questionnaire responses. This presentation highlights elements of the milk production cost structure in Barbados. Production costs are a useful gauge of the competitiveness of Barbados dairy production.

3.1.2 Background – dairying in Barbados

The Barbadian economy is difficult to understand without recognising that it existed as a mono-crop society for the bulk of its modern-day existence. English planters cultivated tobacco shortly after settling on the island in 1627. Attempts were made at growing cotton, indigo and ginger – the latter two in limited quantities – but these crops were supplanted in importance by sugarcane cultivation which was introduced during the 1640's. The resultant sugar industry dominated the agricultural and economic landscape from around 1650 for the next three centuries. Sugar remains the main agricultural foreign-exchange generator but it is no longer the dominant export industry.

Successful sugarcane production requires large "plantations" or estates. The conversion of land into sugar plantations would change the landscape and mould the island's future development path. (See Watts, 1966) As Watts [1978] points out:

> Profound disturbance of its [Barbados'] ecosystem commenced with the introduction of intensive sugar-cane plantation agriculture in 1645, which resulted in the removal of most of the native forest within the space of 15 years; indeed, this was one of the most rapid and comprehensive episodes of native forest removal ever documented, prior to the post-1945 period.

Sugarcane cultivation left a legacy of limited bio-diversity, depleted environmental resources, species loss and few agricultural options for future generations. As page 48 of the GOB's 2002 National Biodiversity Strategy and Action Plan highlights:

> Agricultural plantations over the last 300 years have reduced the extent of natural terrestrial ecosystems to relatively small isolated patches and created several monospecific, agroecosystems, the most persistent of which has been sugarcane. This long history of intensive agriculture has contributed to erosion of topsoil, decrease in soil fertility, and subsequent large inputs of agrochemicals, particularly pesticides and chemical fertilizers, as a means of maintaining productivity.

The physical environment was not the only element affected by the mono-crop propelled growth pursued in Barbados. The movement of human labour that was occasioned by the development of these plantation economies would have a further negative environmental impact as the large influx of primarily forced labour exerted pressure on resources. By the turn of the twentieth century, land and labour pressures mounted, and sugar prices witnessed huge fluctuations making it less reliable as a steady source of income. The plantation system had employed considerable amounts of human labour. The decline of sugar implied a large unemployed workforce. Anticipating future employment challenges, planners began the quest for a substitute industry capable of absorbing these labourers, given the land topography and other conditions.

3.1.3 Livestock development

"Backyard" Barbadian farmers cared for "creole" cattle over the centuries, but the commercial Barbados dairy industry as it exists today did not arise organically. Cattle-rearing remains a way of life for some Barbadians. Still, there exists no spontaneous development of cheese-making, butter churning, or support institutions for dairying in Barbados. Rather, dairying along with large-scale crop farming and a resuscitated cotton industry reflect the conscientious efforts of early 20th century planners in their pursuit of economic growth.

According to Hosein and Ali [1992] the development of a livestock production policy was probably initiated between the 1930's and 1940's. The West India Royal Commission (WIRC), established in 1938, and the Caribbean Research Council, established around 1946 by the Anglo-American Caribbean Commission (AACC) appear to have been the cornerstone of livestock policy in the region. One of their many objectives included increasing the supply of milk, meat and eggs.

Concerns for the welfare of the citizenry and consideration of the structural conditions underlying the local economy led policymakers on the quest for a substitute for the sugar industry subject to certain criteria. The prevalence of protein-energy malnutrition particularly among school-aged children, a rising food import bill, a desire for regional cooperation, and a declining sugar industry prompted the local government to move towards self-sufficiency in milk production, as part of its overall effort to diversify agriculture. The Comptroller for Development and Welfare in the West Indies in his 1941 & 1942 Despatches on Agriculture Development in Barbados stipulated that any alternative industry be:

- useful for domestic food consumption [a precursor to food security & sufficiency]

- able to employ large numbers of domestic labour per acre while giving steady rather than seasonal cash income
- likely to provide economic returns similar to the sugar industry, i.e. 'a large cash return per acre'
- suited to the local climate and soil conditions with the ability to survive extended dry spells
- capable of exporting to other islands in the West Indies.

The Comptroller observed that encouraging estates to 'keep dairy cows instead of oxen' could lead to milk production while safeguarding 'the output of farm manure and the meat supply of the island.' The Despatches record that the establishment of a local "condensary" would allow imported condensed milk to be 'replaced by locally produced fresh milk' permitting 'money [to] remain in the island and more labour…employed.'

The Barbados dairy industry, then, was born in response to economic and social imperatives. As such, the story of the Barbados dairy industry is a narrative of the changing policies and goals of the Barbados government in its aim to achieve economic development amidst a shifting international and political climate. By pulling together the elements of production, consumption, and domestic, regional and international trade, the state of the Barbados dairy industry is, in many respects, indicative of the health of the overall economy and the underlying institutional structure.

3.1.4 Genesis of the Pine Hill Dairy

Commercial dairying in Barbados is in many respects a response to perceived problems precipitated by shocks to the sugar industry. As shown above, colonial policy makers had already expressed support for a dairy industry. This support was re-articulated during the 1960's, when the GOB proposed establishing a dairy processing plant in conjunction with its overall objectives to:

- Diversify the agricultural sector

- Promote industrialisation and create employment
- Regulate and control the sanitation and quality standards of milk production and distribution
- Improve the nutrition of the population by having fresh milk more widely available
- Ensure the availability of wholesome milk and milk products for the tourism industry.

As outlined in Chapter 1, the writings [1950] of St. Lucian born economist and 1979 Nobel Prize recipient, Sir W. Arthur Lewis informed policy planning at that time. Lewis anticipated excess demand for food within the islands but predicted that to satisfy increased demand, the island economies would need to overcome the hurdles associated with small size while generating sufficient foreign exchange to cover the food imports bill. Lewis advocated vigorously pursuing a policy of industrialisation by invitation. Fiscal incentive schemes, regional integration plans, and the establishment of the Pine Hill Dairy to process milk products followed on the heels of Lewis' model. Pine Hill Dairy aimed 'to encourage the production of, and to process and distribute, locally produced milk of high quality.' (GOB, Barbados Development Plan 1969-72:70)

Government played an instrumental role in dairy industry development and continued to facilitate the industry's development through verbal, financial and legislative support. Mr Errol Barrow, in his capacity as Prime Minister, declared a complete embargo on milk and condensed milk imports. Barrow advocated government spending to promote national growth. (Budget Speeches, 1971) GOB invested in establishing the processing plant and, in the 1974 Financial Statement and Budget Proposal, the Prime Minister again called for a total embargo on evaporated and condensed milk imports. Embargos ended in 1983. Other active policies to support dairying included the legal *requirement* that estates hold dairy livestock on their lands. Government also owned and operated two dairy farms where research benefiting the local industry was conducted.

Particularly during the 1960's and 1970's, the GOB exhibited strong political support of the dairy industry. The GOB ran two dairy farms – Greenland Dairy and Hope Dairy – under the auspices of the Barbados Agriculture Development Corporation (BADC). Both farms had previously been sugar cane plantations. When private owners of Greenland could no longer absorb the losses associated with sugar, Government assumed control of the Greenland estate to maintain employment levels. According to Mayers [1982], the Greenland Dairy started operations in 1968 with 240 milking cows through "soft" loans from the Canadian Government. Canadian cow imports provided foundation breeding stock for the fledgling industry. The GOB intended Greenland to be a prototype of dairy farm management techniques for potential farmers and focused its efforts on grass cultivation and feed research, and on intensive dairy farming techniques similar to those of developed countries' dairy industries.

The GOB continued to underscore the importance of the industry when, in 1973, it assumed control of a dairy entity that showed signs of collapse. Hope dairy became the new government-run dairy operation and animals from Hope and Greenland formed the basis of the 230-strong milk herd. (Mayers, 1982) The Ministry of Agriculture (MAR) continued to raise replacement heifers at Greenland and to conduct research into appropriate grass feeds for the imported cattle.

Despite (or due to) the political interest in dairying, tensions existed in the industry. Gooding [1970] records the sentiment of some estate owners when he writes of their acrimonious feeling towards being forced to keep stock by law on the estates. Gooding describes the law as 'an irritant to most of [the estate owners].' Smaller dairy holders supported government plans to establish a processing plant and, despite the

difficulties associated with dairying, Gooding notes that the small farmers 'were holding on only until the proposed pasteurising plant became a reality.' With this background in mind, the 1990's drop in milk output - although dramatic - is hardly surprising and may have led to a 'steady state' for local milk production.

Milk processing continued to be linked to national objectives into the 1970's. Page 69 of the 1969-72 Barbados Development Plan specified a two-fold policy objective of the processor:

- To increase the consumption of milk per head of population;
- To increase the proportion of locally produced milk in the total volume consumed.

GOB's purchase of the ailing Hope dairy, verbal support for the industry and increased investment in the processing plant demonstrated the GOB's commitment to the industry. By 1980, its share ownership in the processing plant had risen to 40 per cent, up from 25 per cent ownership at the inception of the plant. This, however, would prove to be unsustainable. By 1989, Guyana, Jamaica, and Trinidad & Tobago had entered adjustment programmes with the International Monetary Fund (IMF). The GOB was already beginning to feel the pangs of a current account deficit due to rising import prices and limited export ability to regional partners. By 1989 the Government found itself unable to maintain domestic price supports. By mid-1992, during the Barbados structural adjustment programme (SAP), the GOB made one million of its shares in PHD available to the public as part of its divestment programme. The Caribbean Community's Common External Tariff (CET) took effect during 1992 further reducing government revenues by reducing income from tariffs on regional imports.

Figures 1, 2 & 3 illustrate the coincidence between Government support and milk output. The data for Figures 1, 2 & 3 have been retrieved from the local processor, from

BSS and MAR, from FAOSTAT, and from various editions of the BER. Figure 1 reveals that per capita milk consumption (as measured by domestic production and net imports of fresh milk and cream) initially rose sharply during the period of heavy government involvement. Per capita milk consumption falls following the 1991/1992 SAP. The fall in per capita consumption mimics the post-1992 downward trend of per capita milk production observed in Figure 2. Milk consumption per person exceeded domestic per capita production in more recent years as imports rose to fill the void. (Compare Figures 1 & 2).

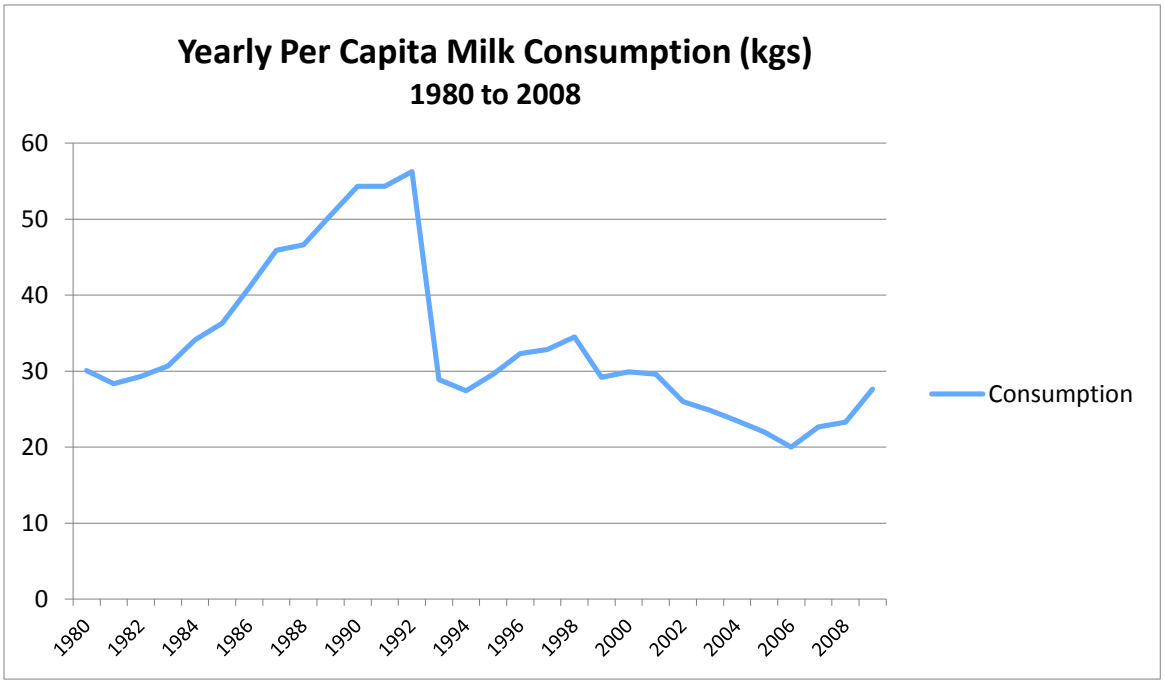

Figure 1: Per capita milk consumption in Barbados, 1980 to 2009

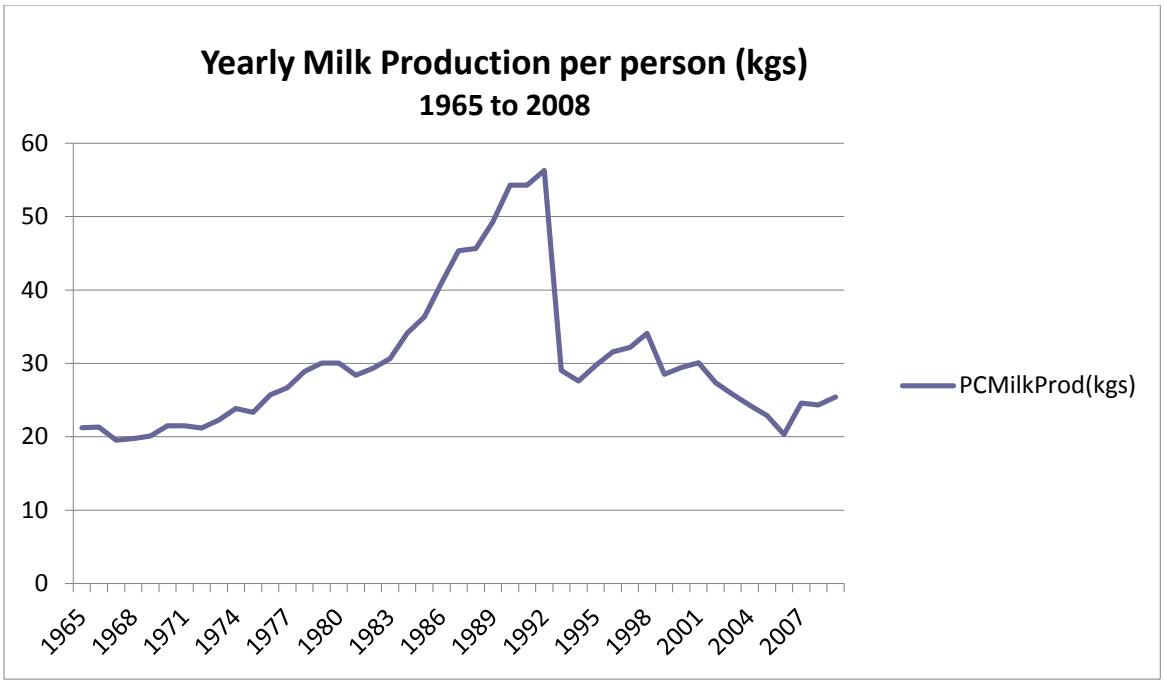

Figure 2: Per capita milk production in Barbados, 1965 to 2009

Figures 1 & 2 show the unintended consequences of government intervention in the milk industry. Government's stated twin goals of production and consumption increases lasted only as long as government funding and support existed. When Government support fell, so did milk production and consumption per person. During the mid-2000s, per capita milk consumption began to outpace milk production per person. This is worrisome to local farmers if imports that are intended to complement local shortfalls replace domestic production instead by changing consumer tastes.

GOB articulated two other important stated policy goals - self-sufficiency in milk production and employment generation. The question of employment generation is taken up under section 3.2.1 Farm Characteristics and the Industry Today. Figure 3 launches the discussion about self-sufficiency. Figure 3 shows that, based on BSS database numbers, from 1980 onward the bulk of fresh milk and cream consumed locally was also produced locally. This corresponds with the 2008 Barbados Trade Policy Review (TPR)

which reports that ‘75% of local demand for milk (some 4.5 million kg) was produced domestically in 2006.’ (http://www.sice.oas.org/ctyindex/BRB/BRBNatlDocs_e.asp. Trade Policy Review, August 2008) Milk continues to play a pivotal role in the domestic economy. FAO reports that Barbados is self-sufficient in only 2 sectors: milk and poultry production and that, between 1981 and 1991, cow milk production in tonnes was second only to sugar cane production.

However, local consumption as a proportion of domestic production plus net imports of both fresh milk and cream, and concentrated milk products follows a somewhat different trend. Powdered, concentrated and condensed milk products are used locally as substitutes for fresh milk. Locally produced milk as a percentage of this total ranges from 80 to 89% of domestic demand between 1980 and 1990. This percentage falls below 80 % during the 1990’s. After 2002, that percentage dropped below 65%, including a low of 43% during 2006.

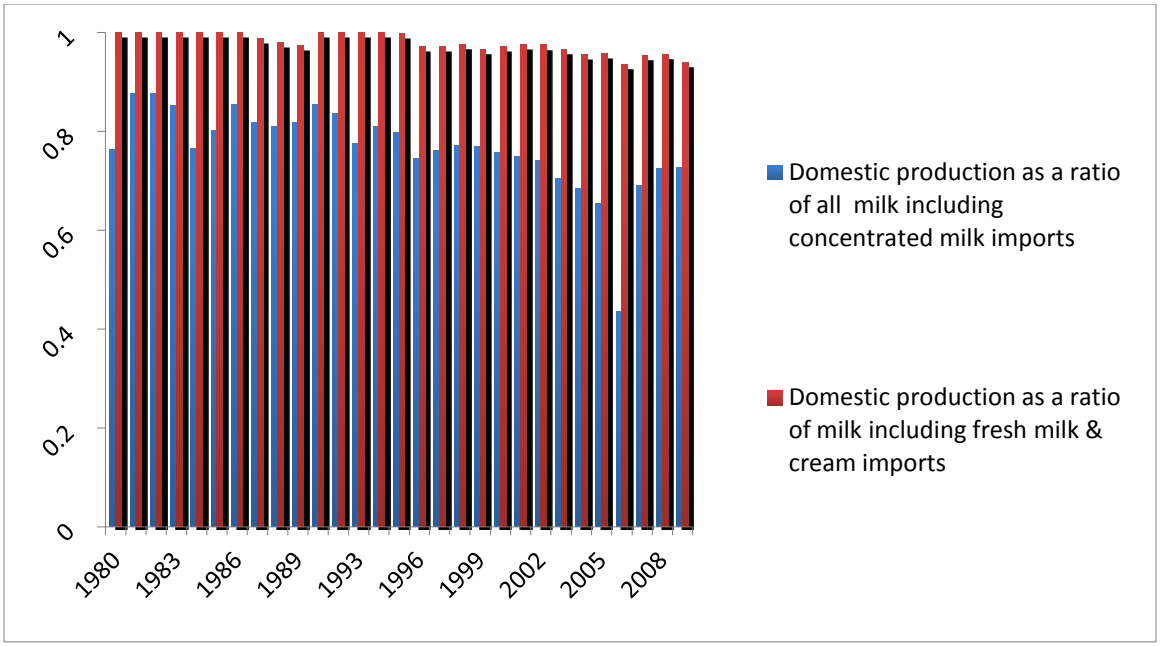

Figure 3: Milk production in Barbados as a proportion of milk & milk product imports

Note: trade data for 1991 is missing.

3.2 The Barbados dairy industry today

As Figure 4 shows, milk processing began at the Barbados Dairy Industries Limited when sugar production had started its decline. Barbados Dairy Industries Ltd. (BDIL) was established as a legal entity in March 1964. This entity was registered with two subsidiaries: Pine Hill Dairy, which processes milk into pasteurised milk, and imported milk products plus any excess domestic production into flavoured milk, cream, and yoghourt, and Pine Marketing Co. (BDIL, 2008) Pine Hill Dairy was 'formed to collect and process fresh cow's milk and distribute pasteurized milk and other milk products' but, in an attempt to remain competitive and boost sales, the plant now manufactures and distributes a range of fruit juice drinks.

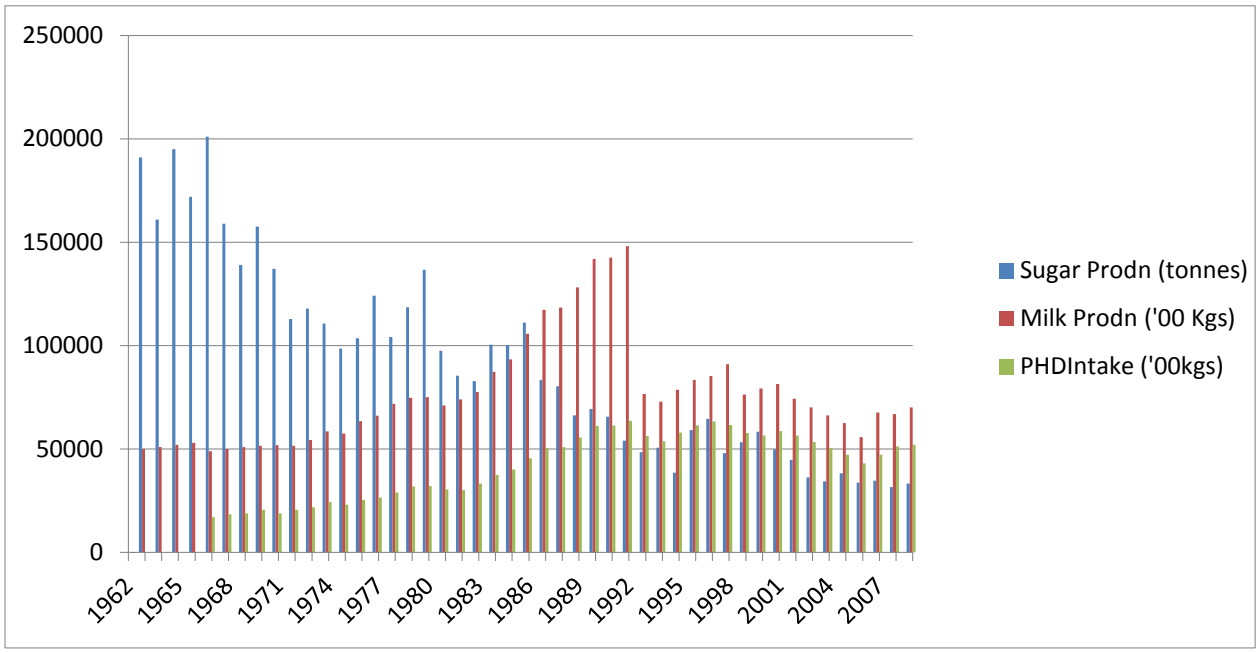

Figure 4: Barbados Sugar & Milk Production 1962 to 2009

Note: Data is scaled to fit the graph. Sugar production is in tonnes, while milk output and intake is in 100 kilogrammes.

Pine Hill dairy purchased roughly 40% of milk produced locally between 1970 and 1992. After 1993, the processor purchased roughly three quarters of milk produced on the island. The percentage increase reflects the 1992/1993 drop in overall milk output. Figure 4 indicates a rise in milk intake in absolute terms throughout the 1980's. Milk intake by the processor remains relatively flat after 1989 when measured in absolute terms. PHD annual milk intake fluctuates between 4¼ and 5.8 million kilogrammes after 1999. Milk production falls below 7,000 million kilogrammes in 2004 – lows that had been unheard of after 1977.

3.2.1 Farm characteristics and input structure

Survey data (see questionnaire in Appendix A) indicate that commercial operations rely heavily on commercial feeds and supplement commercial feeds with grass-feeding. Some operations are engaged in hay and silage making and alternative feed sourcing. Farmers with access to cotton seed add this to their cattle's diet, based on availability. The bulk of these farmers use artificial insemination and mechanical milking techniques whereby automated pulsating milkers are manually attached to the cows. Canadian Holstein is the major breed of cow in the industry. Farmers inseminate cows with Jersey semen to boost the milk fat content. A Red Pole is the off-spring of Holstein and Jamaican Black Pole. This cross is better adapted to local conditions, although milk production per cow is generally lower than that of a Holstein. Creole cows are locally adapted animals. These are not used much in commercial dairying but these, along with unwanted dairy animals, are the basis of the island's beef industry.

Under PHD's quota system, farmers are prohibited from selling milk produced through any channel apart from the processor. In 2009, as Table 3 highlights, fewer than 20 registered dairy farmers marketed their milk solely through PHD. This compares with the 44 registered farmers in 1967 at the industry's inception. Trends towards consolidation over time are consistent with international patterns. In Canada, for example, 145,000 dairy farms reported having 2.3 million dairy animals in 1996 whereas in 1966, when the Canadian Dairy Commission was established, there were more than 200,000 dairy farms. (National Resources Canada, Census 1996) Fewer than 15,000 dairy farms currently market in Canada. In Canada, (as is oftentimes the case for Barbados), the trend is for a smaller aggregate number of cows on fewer farms to produce more milk.

In Barbados, milk production continues to be supply-managed under the quota system. The processing plant (which owns no dairy farms) controls supply. Government is no longer directly involved in the Barbadian dairy industry. It has no financial share in the processing plant and it no longer operates any dairy farms.

Table 3 compares statistics of the Barbados dairy industry with those of Canada. At its inception, commercially dairying in Barbados mimicked Canadian traditions. Canada provided soft loans, Holstein cows and information on cow-rearing techniques to help the industry get started. The cow base continues to be Canadian Holstein, but some farmers now import semen from the US for use in artificial insemination (AI). Unless otherwise stated, information contained in Table 3 only refers to commercial dairy farms in Barbados rather than to all milk farmers. Table 3's statistics reflect a difference in scale (Barbados measures output using kilograms while Canada uses hectolitres), and in efficiency levels. To convert from hectolitres to kilograms, we use the following conversions:

1 hectolitre = 100 litres

1 litre = 1.033 kilograms

Table 3. Dairy industry snapshot: Barbados & Canada

	Barbados[1] (2008/2009)	**Canada[2] (2008/2009)**
Dairy industry genesis	1966 (dairy processing)	Early 1600's
Farmer Age	Mid-50s	Mid-40s
Years in Dairying	30+	n.a.
Age of current business	25-29 years old	n.a.
Quota as a contract	No	Yes
Type of Milking Parlour	Abreast	n.a.
Milking System	Mechanical, a few semi-computerised & computerised	Semi-computerised & computerised; some robotic milkers
Annual Milk Output	5,197,620 kgs	82.9 million hectolitres
Cows in the Industry[3]	~ 1,360	978,400
Cow breeds	Holstein, Jersey, Black Pole, Red Pole, Guernsey, Swiss, 'Creole'	Holstein (more than 93%), Ayrshire, Jersey, Brown Swiss, Canadienne, Guernsey, Milking Shorthorn
Average herd size (cattle)	120	72 cows (up from 42 in 1996)
Annual production per cow[4]	Average: 4,600 kg; best: 7,500 kg	9,592 kg per lactation (305 days)
Net Farm Receipts	n.a.	$5.3 billion; 3rd after grains and red meats
Farm labour	70	26,000 (1997/98)
Plant labour	184 (in 2007)	22,730
No. commercial farms	18	13,587
No. dairy processing plants	1	459 (276 federally registered)

[1]Barbados dairy characteristics based on 2008/2009 data unless otherwise noted. Source: Primary survey data.
[2]Canada dairy characteristics based on 2008/2009 data unless otherwise noted. Source: Canadian Dairy Commission 2008/2009 Annual Report & Natural Resources Canada website: http://www.dairyinfo.gc.ca/index_e.php?s1=cdi-ilc
[3]For Barbados, questionnaire responses indicate around 1,360 cows and approximately 2,190 cattle in commercial farming. This compares with the estimated 2,057 animals in 2007 reported in BSS/MAR reports. By 2010, there were about 2,000 milk-producing cows.
[4]Unlike Canada, there is no national milk tracking system in Barbados. Annual production per cow is based on farmer responses and is calculated over 305 days. As a point of comparison, CDC numbers indicate milk output of about 6,660 kilograms per cow in 2000.

Clearly milk yields per cow in Canada exceed those in Barbados. The Barbados dairy industry is miniscule when compared to Canada. An important statistic to notice is the ratio of farm labour to farms. Barbados farms employ approximately twice the number of workers per farm as would a typical farm in Canada. PHD employed 184 persons in 2007. The 459 Canadian dairy processing plants employed 22,730 persons - an

average of 50 persons per plant. By these measures, dairying has achieved its third objective of generating employment.

Tables 4 & 5 step away from the North American lens and compare the Barbados dairy industry with those of other Caribbean nations. Tables 4 & 5 are based on FAOSTAT data. These tables report on each country's entire national dairy industry – unlike Table 3 which only examines statistics for commercial dairy farms.

Table 4. Comparative statistics: Barbados & regional dairy industries

	NUMBER HEAD MILK ANIMALS					OUTPUT PER COW (KG/ANNUM)				
	1970	**1980**	**1990**	**2000**	**2009**	**1970**	**1980**	**1990**	**2000**	**2009**
Antigua	3,100	6,000	5,924	5,715	6,246	1,000	1,000	934.8	922.7	856.5
Barbados	4,000	5,000	8,000	4,400	4,307	1,294	1,500	1,775	1,802	1,665
Belize	3,300	3,800	1,200	2,300	3,877	1,030	1,026	1,033	607.4	968.3
Guyana	26,032*	6,800F	22,000F	31,696 Im	37,145 Im	773	822.5	855	966	1,098
Jamaica	45,600F	48,000F	51,500F	26,500F	16,174 Im	1000	998.9	1,000	990	989
T&T	4,300	5,797	16,000	15,000F	17,800	1,740	1,010	696.7	698	629
Total	86,332	75,397	104,624	85,611	85,549	-	-	-	-	-

Source: Calculations and raw numbers based on FAOSTAT: Production, Livestock Primary (http://faostat.fao.org) 2011 data
Notes: 1 metric tonne = 1,000 kgs
* = Unofficial figure
F = FAO estimate
Im = FAO data based in imputation methodology

Taken together, Tables 4 and 5 demonstrate changes to the industry's landscape over time. The average cow produced 1,665 kilograms of milk in Barbados in 2009. Commercial dairy cows yielded over 4,000 kilograms on average. Some Barbadian commercial dairy cows yield twice that output per cow today. Considering the region as a whole, cow numbers in Barbados and in other countries – with the exception of Trinidad & Tobago - fell after highs in the late 80s and early 90s. Apart from Guyana, average output per cow has fallen when compared with 1990.

3.3 Milk Production in Barbados: 'hard times'

Commercial dairying in Barbados appeared to bloom during the 1980's. Milk production flourished and registered steady increases over the decade. "Hard times" for the industry followed closely and continue to threaten its viability. Hard times – a phrase coined to describe the economic strain sugarcane workers faced during periods of seasonal unemployment when there was no reaping to be done - indicate that structural weaknesses and strengths became manifest at this time. When Barbados applied for formal membership to the World Bank in 1973, government policy still appeared to be at the discretion of local government. By 1980, Barbados' dependence on external financing came to the fore. Barbados spent most of the 1980's in recession. In 1982, it entered into a stand-by arrangement with the IMF. This occurred again in February of 1992. The 2009 economic downturn has again sent Barbados back to the IMF.

Barbados was not alone dealing with economic downturn during the 1980's and 1990's. Other CARICOM governments faced severe downturns during this time. These downturns affected regional dairies in succession. Table 4 shows a pattern of declining milk output in the region during the 1990's. This coincides with a period when, one after another, Caribbean economies entered into stabilisation and structural adjustment programmes beginning in the 1980's and extending into the early 1990's. Of the 6 countries highlighted, only Guyana & Trinidad posted annual output in 2009 that returned to highs of the 1980's and early 1990's.

Jamaica's long history of producing milk was unable to shield this industry from economic downturns. Dairy processing in Trinidad & Tobago falls under the auspices of Nestlé but it too registered minor drops in the mid-1990's. Despite other problems

plaguing domestic milk production in T&T, it retains the distinction of being the only country among the 6 to maintain local production during times of severe economic downturn. This is perhaps attributable to its independence from local government policy for Nestlé - and not the local government - remains the main stakeholder in Trinidad & Tobago's dairy processing operations.

Table 5. Regional milk production

	MILK PRODUCTION (METRIC TONNES)									
	1980	**1985**	**1989**	**1990**	**1991**	**1992**	**1995**	**2000**	**2005**	**2009**
Antigua	6,000	6,200	5,800	5,538	4,848	5,900	6,000	5,273	4,062	5,350
Barbados	7,500	11,840	12,822	14,199	14,253	8,656%	7,869	7,930	6,256	7,170
Belize	3,900	5,600	1,076	1,240	1,293	1,147	1,318	1,397	3,786	3,754
Guyana	6,580	11,110	17,690	18,820	19,280	19,500	13,000	30,631 Im	36,118 Im	40,798 Im
Jamaica**	48,000*	45,297	48,200F	51,500F	53,000F	46,262 Im	28,090	26,248	14,574	16,000P
T&T	5,857	10,884	10,743	11,147	11,578	10,813	9,175	10,477	10,500	11,200
Total	77,837	90,931	96,331	102,444	104,252	92,278	65,453	58,332	75,296	47,552

Source: FAOSTAT 2011 data, http://faostat.fao.org/site/339/default.aspx
%The 1992 Barbados Economic Report states that '[m]ilk production continued its ten year growth trend in 1992 and increased to 14.8 million kilogrammes.' FAOSTAT records 1992 Barbados milk production at 8.656 million kilogrammes.
F= FAO estimate
Im = FAO data based in imputation methodology
*= Unofficial data
* *Starting 1994, FAOSTAT records indicate goat milk output in Jamaica exceeding (and perhaps replacing) cow milk production

Figure 2 (above) showed the near immediate response of local dairy production to the policy changes of 1992. Declining domestic milk output coincides with decreased government influence and involvement in the dairy sector, and an altered producer/processor relationship. Table 6 uses share ownership of the processor over time to highlight waning government interests in the industry. In 1980, GOB held majority ownership (40%) in the processing plant. Plans started for Government divestment of assets at the end of the 1980's. Government fully relinquished its stake in the processor by the end of 1997. During this period, too, farmers would also divest of their shares in the processor, giving testimony to the growing tensions in the producer-processor relationship and to the changed focus of the processing plant.

Table 6. Share ownership of Barbados Dairy Industries Ltd

ENTITY	1966 INVESTMENT	1966 % SHARE	1980 % SHARE	1993 % SHARE	1995 %SHARE	1998 %SHARE
Government of Barbados	Land and buildings	25	40	35 (1,732,431 shares)	15	0
New Zealand Dairy Board	Raw materials	25	20	20 (1,000,000 shares)	20	0
Northern Foods U.K. Ltd	Equipment & technical support	25	20	20 (1,000,000 shares)	20	0
Dairy farmers (local)	Working capital	25	20	25	20	1.3
Local investors (other)	-	-	-	-	25	15
BS&T via Banks Holdings	-	-	-	-		83.7

Source: Various PHD & BDIL Annual Reports

Austerity measures took place across the region. Barbados faced economic downturns both at the beginning and at the end of the 1980's. Milk production only fell during the later downturn. In 1980, Barbados was in recession and needed IMF assistance. Despite this, Table 6 indicates that the GOB increased its ownership interests in PHD. Local milk production rose (see Figure 2) and fresh milk imports remained low or non-existent. By 1989, the Government again landed in financial difficulty requiring IMF assistance. This time, the GOB announced plans to reduce its ownership share.

The primary difference between 1980 and 1989 was that Barbados government could no longer chart its own path. IMF conditionalities constrained the options of the Barbados government. Page 18 of a report by Blake & Charles observes that '[t]he structural adjustment programmes implemented in many CARICOM countries in the 1980's into the 1990's were strongly biased against agriculture and long-term investment in areas not considered directly productive'. As Table 5 shows, a marked decline in cow milk production coincided with later stabilisation programmes in the CARICOM region.

Economic theory states that by allowing the most competitive (lower-cost) farmers to remain, competition should ultimately stimulate production, reduce processing costs, and boost exports. The remainder of this chapter examines whether the exit of

Government from the sector reduced the milk industry's reliance on financial support by boosting processor and farmer efficiency, as reflected by lowered costs of production.

3.4 Insular – by nature

Following the dismantling of trade barriers, processor margins declined due to competition from similar imports. The processor also benefited from reduced trade barriers and the CET by boosting exports. Changes in consumer tastes and ready access to new products made milk-replacing beverages viable alternatives over that period. Kreps [2006] writes that "the type of dairy products consumers demand…generally remained tied to traditional consumption habits despite 'westernization' of diets." This is not true of Barbadian consumers and farmers express concern that consumer tastes are changing and Barbadians 'soon will not know the true taste of milk.' (Survey response, 2009)

During the 1st half of the 1990's, the processor observed that the constricted local population limited its sales growth and its ability to reap economies of scale. In response, the processor - looking outward - embarked on an aggressive intra-regional export campaign. The export sales division now represents about 12.5 per cent of PHD's portfolio and includes most of the English-speaking Caribbean region. Looking inward, it resorted to product diversification and cost-cutting measures at home. PHD benefited by increasing its exports. The farmers, on the other hand, continue their struggle to boost output and lower costs.

Producer and processor alike invest in technology and innovation where feasible, although much of this is sculpted by changes in northern economies, including the U.K.,

the U.S. and Canada. The processor provides some infrastructure to support local farmers. This is not enough to placate some farmers who contend that the processor subjects them to unduly strict standards and that the quota system is unduly restrictive. They argue that compliance with all processor demands leads to further input costs increases. Antagonisms run deep and a tense processor-producer relationship has developed over time. An overarching constraint is that this dairy sector is insular by nature. Transportation costs are high, further straining all sectors of dairying in Barbados. Institutional weaknesses, geographic constraints and global changes all influence economic decisions and ultimately determine economic outcomes.

All farmers are subject to the same jurisdictional borders and, given the small size of the economy and the small number of commercial dairy farmers, the farmers remain price-takers for farm inputs. Farmers face pressures from policy changes and internal challenges that include, but are not limited to, high input prices. Not surprisingly then, local farmers and the processor alike acknowledge that dairy farming cannot continue in Barbados under the existing framework. In 2004, the Prime Minister expressed concerns about declining milk production and urged farmers to expand production and increase herd sizes. By October of 2006, Barbados experienced a national milk shortage.

Since 1996, fresh milk and cream imports have not fallen below 190,000 kilograms. Barbados only imported evaporated milk during 1981 and 1984 during the 1980-1989 time span. The country has imported evaporated milk each successive year after 1999. Condensed milk imports - non-existent during 1981 through 1983 - fluctuated around 1 million kilograms throughout the 1980's and 1990's, and swelled to over 4 ½ kilograms in 2006.

By 2001, the domestic supply management system had begun to falter. Increased import competition (from milk and milk-alternatives) created further pressures to reduce costs, increase production efficiency and meet global milk production standards. PHD warned in the 2000 Annual Report that evaporated and sweetened condensed milk sales subsidise domestic milk production. The rise in imports of these products led PHD to increase its use of imported milk powder instead of locally produced milk in production. Other cost-cutting measures included decreasing payments to farmers, increasing milk product prices and/or reducing farm-level quotas. Like the processor, farmers depend on economies of scale to improve and to reduce unit costs. Lower quota levels increase farmers' unit costs and reduce their ability to improve production efficiency. Lack of replacement cows, a reluctance to experiment with new technology or farming methods, high labour costs and climate patterns that are not conducive to dairy production also affect production costs.

While the processor initiated measures to sustain its profit margins, farm and processor management practices and dairy outcomes came into sharper relief. The processor reduced quota allocations to farmers. Commercial farm numbers fell from 37 in 1989 to 27 in 1995 and stand at 16 by the end of 2010. The new rules of the game – restricted supply, the removal of price controls, and government inability to support the farmers or the processor (government would sell ¼ of its shares of the dairy processor by 1992) – caused the least competitive (or least optimistic) farmers to exit the industry. As the GOB and processor tightened their belts, the farmers that remained in the industry had little option but to do the same. MAR documents show 1987 farm production costs of

BDS$2.05 per kg (US$1.03). We calculate 2009 average production costs of approximately BDS$1.84 per kg (US$0.92) at the margin.

3.5 Factors affecting farm-level COP

There are obvious complications associated with getting cost information. It is sometimes difficult to access the true data because records could be incomplete. Reported information might change based on circumstance. In some instances, respondents might feel an incentive to omit some costs. At other times, cost figures could be exaggerated. Some information may be unknown or not easily calculated with exactitude. Despite this, we use responses, local pricing information and additional data to get a feel for local production costs. We find average farm-level COP of under US$1 per kg, at the margin. This number ranges from US$0.59 to over US$1.38. FAO estimates indicate production costs (of about US$1.39) in 2009. FAO data also show, though, that when measured in constant terms, Barbados producer prices falls with time.

Costs differences are a key ingredient in determining farm longevity. For example, the data suggest that low milk production per cow coupled with a high cost-of-production can be a useful predictor of farm viability. Such farms are expected to exit the industry. On the other hand, the combination of initially high but declining aggregate costs of production over time, coupled with declining per kg costs, indicate high start up costs but good long-term prospects. The use of artificial insemination appears to marginally increase production.

With the exception of a few farmers, the industry is plagued with long intervals between successive calvings. In some instances the calving interval exceeds 18 months.

This adds to the cost of production. It also adds to the costs associated with replacement heifers. Cows are often periodically imported to counter declining herd numbers at a national level. (See Table 4 for evidence of herd declines on a national level.) Feed is by far the biggest contributor to costs, exceeding half of all costs to the industry. Commercial feed purchased from the local feed processor accounts for about two-thirds of feed costs. Some farmers have managed to reduce feed costs to around 20% of costs. For the most part, though, cattle are "eating many farmers out of house and home" with feed costs exceeding two-thirds of some farm bills. Other big contributors to costs include labour and fixed costs.

3.5.1 Weather effects

Situated at 13^{o} $06^{'}$ North and 59^{o} $37^{'}$ West, Barbados is definitely tropical by nature. Its insularity and tropical nature define some of the constraints related to milk output. More than half of commercial dairy farming occurs in the interior agricultural region in the parishes of St. George, St. John and St. Philip. Barbados has a land area of 430 square kilometres (166 square miles) of which 21,560 hectares (167 acres) is devoted to agriculture. 16,000 hectares (under ¾ of the total agricultural land) is arable. WDI estimates the agricultural value added to be US$15,600 in 2005 in constant 2000 dollars. Regional estimates stand at $3,010 in 2005.

Table 7. Barbados country statistics

Demographics	Total	Source
Human population	275,700 (estimated)	BER 2009
Population density (people per sq km)	641	Calculated
Employment in agriculture (%)	3.3	WDI 2010
Urbanization (%)	39.8	WDI 2010
Land		
Land area (sq km)	430	
Agricultural area (%)	21,560 hectares (38.8)	MAR 2005
Share of permanent cropland (%)	2.33	WDI 2010
Share of forest (%)	3.95	WDI 2010
Landscape topography	Hilly/undulating	
Maximum height	280m (1,115 ft)	
Climate	Maritime & tropical	
Prevailing Winds	North-east trade winds	
Economy: 2009 estimates		
GDP (BDS$M) – provisional estimates	6558.4	BER 2009
Agriculture GDP & as share of total GDP (%) in 2009	BDS$160.7 million (2.45)	BER 2009
Livestock GDP & as share of agriculture GDP (%)	BDS$61.4 million (38.2)	
Livestock GDP as share of total GDP (%)	0.94	
Employment in agriculture, 2001 (% all employed)	5,400 persons (4.2)	
Trade: based on 2009 figures		
Dairy export volume	376,561kgs	
Dairy export value	BDS $997,169	
Dairy import volume	5,393,272kgs	
Dairy import value	BDS $36,204,747	
Net dairy imports (value)	BDS $35,207,578	Calculated
Dairy Production (kgs 2009)		
Cattle head in commercial dairying	2,190	Author survey
Dairy Cows in commercial dairying	1,360	Author survey
National cow milk production	7,013,500	BER, MAR
Commercial cow milk production	5,197,620	MAR, PHD
Milk yields (kg/cow/365-day year)	5,599	Author survey
Average dairy herd size	138 with ~ 64 cows	Author survey
Farmer's organizations	Dairy/Beef Producers' Assn & BALDECS	

3.5.2 Dairy production and weather patterns

Dairy production is generally highest in countries with moderate temperatures and rainfall (take New Zealand, for example). Imported cow genetics reflect suitability to such conditions. Figure 5 presents average temperatures and rainfall in Barbados, calculated based on Barbados Meteorological Society data.

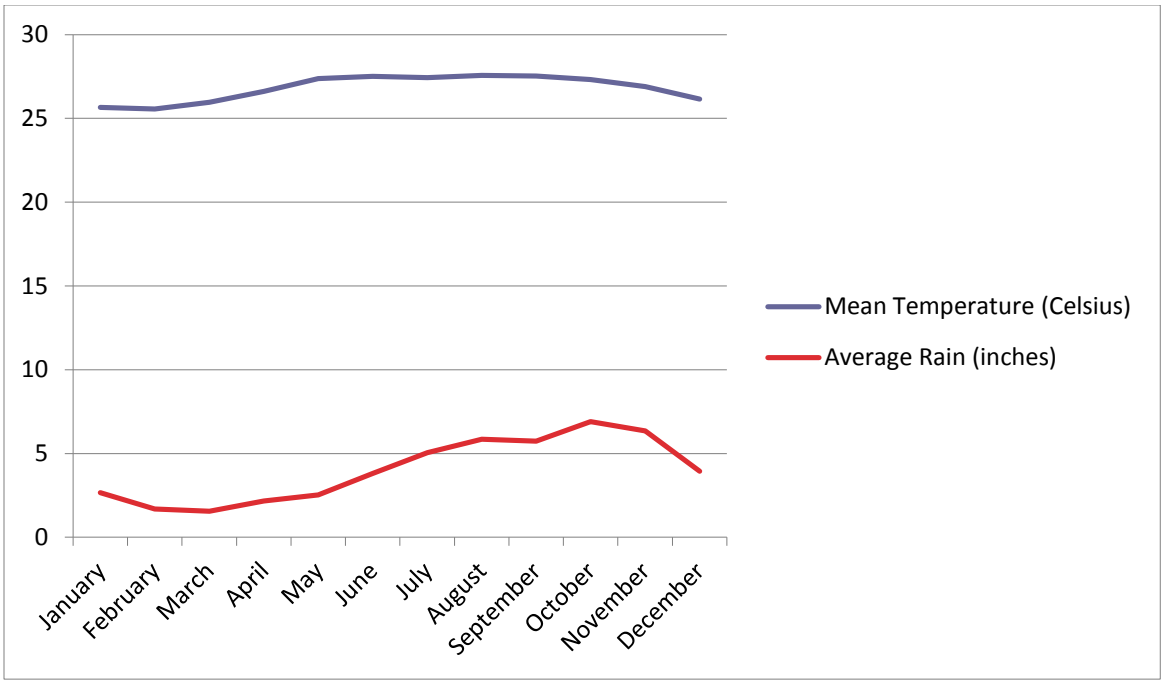

Figure 5: Mean temperature and rainfall based on 1961 to 2009 data

Insularity and tropical conditions imply that dairying is no easy task in Barbados. From Figure 5 we see average monthly temperatures fluctuating between 25 and 28 degrees Celsius. Taking seasonal variations into account, the temperature seldom deviates from the 20 to 30 degree range. Rainfall, apart from the unpredictability associated with hurricane season, generally stays within the 1 to 10 inches of rain each month. Periods of drought or hurricane-level rains often define the hot and wet (between June and November) and cool and dry (December through April) seasons. The length of these 'seasons' vary by the year.

The yearly tourist season falls within the cool and dry season, resulting in heightened demand for dairy products during that time. Quota allocations are highest in March and gradually taper off throughout the year. (See Figure 6) Changes in average monthly production, measured over a 13-year period for January through August and

over a 12-year period for September through December, are more radical than the total quota allocation for each month. As we show below, weather conditions (particularly hot or dry spells but including barometric and humidity factors), combine with fluctuating cow numbers, farm management and other factors to affect milk output.

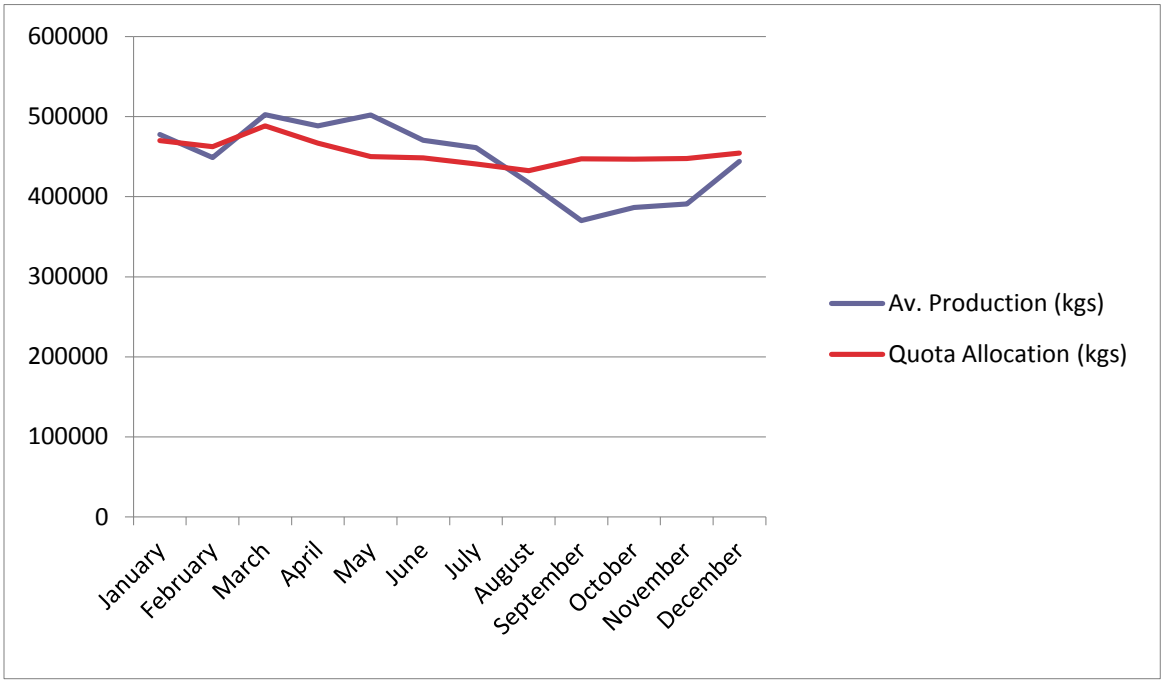

Figure 6: Average milk production and total quota allocation by month, 1997 to 2009

Figure 6 shows monthly shortfalls in production during February and between August through December each year. This corresponds to part of the tourist season, and to fluctuating weather between August and December, and to the usually dry month of February. Using the data, we find that average temperatures peak in June. The lowest temperatures occur in February. Rainfall is heaviest during October and lowest between

January and May. On the other hand, production peaks in March and May with production outstripping processor demand from March through August. Although production falls during the hotter months of May through September, it still exceeds processor demand for some of this period. The gradual rise in production from September to March is inadequate to meet the needs of the local processor (to meet demand). September to November – some of the lowest production months – coincide with generally higher temperature and rainfall months. The challenge for the dairy processor, then, is to supplement the shortfall without adversely affecting farmers during the rest of the year.

The graphs appear to show a correlation between milk output and weather patterns. Table 8 provides a simple regression analysis to substantiate that there might be a link between basic climate features (rainfall and temperature) and Barbados cow milk output. The regressand is average aggregate monthly milk production. The equation estimates coefficients for temperature and rainfall to see the extent and in what direction they might be affecting output. Temperature and rainfall data are based on monthly figures received from the Barbados Meteorological Services.

Table 8. Estimating the role of temperature and rainfall on milk production

NUMBER OF OBSERVATIONS = 152			
	Estimate	t-test	95% C.I.
Temperature	-24,030.73***	-4.03	-35,826.96, -12,234.51
	[5,969.707]		
Rainfall	-5,646.774***	-3.38	-8,945.294, -2,348.255
	[1,669.28]		

Note: The numbers shown in square brackets are the standard errors.
** * on coefficient estimates represent statistical significance at 0.01 significance levels.

We run the simple regression analysis below to link milk output with temperature and rainfall.

(6) output = $\alpha + \beta$temp + γrain + ε.

Output refers to monthly milk production in kilogrammes; temp is average temperature in degrees Celsius and rain is rainfall as measured in inches. Running the OLS regression yields the equation:

(7) output = 1,124,800kgs - 24,030.73temp – 5,646.774rain

Equation 7 shows that for every one (1) degree celsius temperature rise, production falls an average of 24 thousand kilograms. The corresponding fall for every additional inch of rainfall is 5 thousand kilograms. Weather is clearly correlated with output changes but heat increases lead to larger drops in production. Both variables are statistically significant at the 1% level. This is not surprising, given studies that have shown the link between milk production and the temperature-humidity index (THI). In 1922, Walter W. Fisk stressed "The Relation of Temperature, Humidity and Pressure to Dairy Operations" in A Handbook for Dairymen. More recently, Pennington and VanDevender of the University of Arkansas' "Heat Stress in Dairy Cattle" study relate the THI to milk production. Dikmen & Hansen's 2009 study "Is the temperature-humidity index the best indicator of heat stress in lactating cows in a sub-tropical environment?" makes direct application to sub-tropical regions. With this body of literature in mind, our statistical results correlating temperature rises and increased rainfall with decreased milk output are not surprising. Instead, studies showing a link between the weather and output imply that farmers will need to take preventive measures

to ‘protect’ the largely imported milk herd from the elements and from ensuing heat stress.

Some local farmers take active measures (including installing fans and sprinkler systems in barns, providing shade for the animals, and making water freely available for animal consumption) to mitigate against shortfalls in production associated with weather. At least 1 farmer uses a rearing system that is adapted to local climate conditions. During the rainy season, when grass for grazing is more readily available, the animals stay indoors - protected from the heat during the day. They graze freely outdoors during the evenings and night. One-sixth of the farmers interviewed use semi-intensive rearing methods (similar to those described above). One-half of farmers report intensive farming practices only.

The choice of rearing method, the decision to insulate against weather effects, the choice of farm technology and input combinations all impinge on farm-level production costs. According to FAOSTAT data, only Brunei Darussalam, Cuba, Iceland, Singapore and the Syrian Arab Republic reported producer payments greater than Barbados producer payments during 2005-2007. Even when compared to other islands, producer prices in Barbados remain high as shown in Figure 7. This indicates at least two things: 1st, through 2009, fresh milk imports appear to supplement shortfalls in production. The downward movement in farm gate prices over the years indicate that imports may have some role pushing milk prices down. 2nd, high producer prices imply that the processor has an incentive to seek alternative, cheaper milk options for use in processed goods so as to offset processing costs.

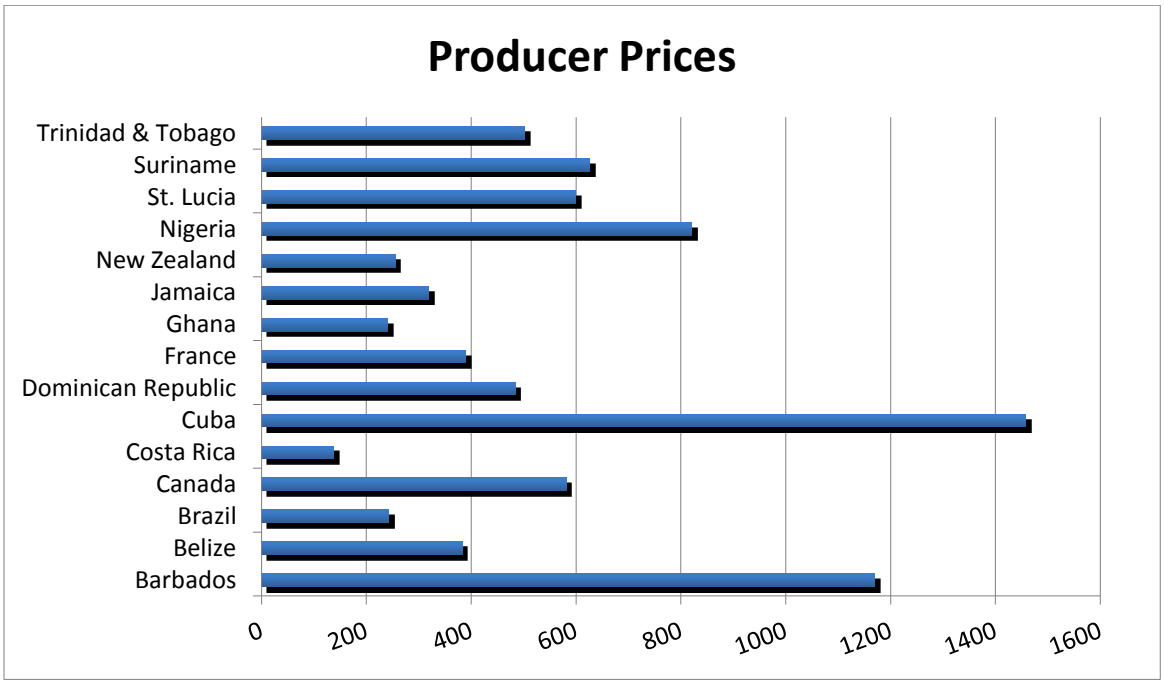

Figure 7: Annual producer prices, 2005-2007, in USD per tonne
Source: FAOSTAT, 2010 data

3.6 Cost-cutting

In its 1980 Annual Report, Pine Hill Dairy cautioned:

> [in light of price increases for imported milk powder] the Dairy's profitability is largely dependent on the goodwill of Government. If the Dairy is able to obtain realistic prices on its controlled milk products, then its profitability will be assured. At the same time, the Dairy will continue its policy of product diversification and make every effort to reduce the costs over which it has direct control.

Producer payments represent a large part of plant expenses. 1989 cost reduction led to the quota system, referred to as an Entitlement to Supply. Processor payments to farmers fell from BDS $9.3 million in 1990 to BDS $7.9 million in 1993, all in nominal terms. Farm management practices determine the extent to which farmers invest in farm activities. Such practices determine farmer-ability to maintain consistent milk output levels and their ability to accommodate changes in milk output levels associated with

seasonal need. The quota system clearly signals processor need of local milk. Local demand and costs shape that need.

Table 9 relays survey-determined costs associated with production. It also compares costs in 1987 with 2009. As mentioned earlier, these results are estimates at best. True production costs are difficult to know with certainty because of incomplete records, unknown variables, or reported numbers that understate or exaggerate true costs.

Table 9. Costs associated with producing milk in Barbados

	PERCENTAGE CONTRIBUTION		2008/2009 COST RANGE	
Cost Description	1987	2008/2009	Non-zero low	High
Fixed Costs				
Buildings & maintenance	0.00	1.04	0.32	20.00
Management & supervision	6.08	5.63	1.72	7.37
Depreciation	9.16	2.62	1.61	10.04
Taxes & lease payments	2.08	1.23	0.07	5.27
Property Insurance	1.41	0.18	0.21	1.00
Interest on fixed costs	0.64	1.47	2.21	13.34
Sub-total fixed costs	19.37	12.17	-	-
Variable costs				
Labour	15.18	14.30	4.35	26.29
N.I.S. payments*	1.21	1.41	0.49	2.34; 10.43
Equipment running & maintenance	2.45	1.75	0.38	1.84
Vehicle running & maintenance	0.00	3.95	1.41	9.22
Feed – commercial	26.55	34.11	6.53	57.68
Other feed	2.29	19.28	3.22	29.75
Fertiliser	5.65	1.03	1.81	4.30
Utilities	5.63	3.27	0.82	9.43
Water	2.17	2.06	1.15	4.74; 12.06
Artificial Insemination	0.28	0.72	0.20	3.28
Medical & sanitation	3.38	1.99	0.57	5.71
Veterinary services	2.81	2.03	0.60	3.80
Technical support	.	0.29	0.008	1.72
Non-labour security	.	0.02	.	.
Contingencies	2.81	0.46	.	.
Replacement heifers	6.75	0.71	0.57	1.61
Interest on variable costs	3.47	0.21	2.21	13.34
Sub-total variable costs	**80.63**	**87.83**	**-**	**-**
Total	100%	100%	-	-
Annual cost totals	$180,000		$99,000	in excess of $2M
Unit costs (BDS$)	$2.04	$1.84	$1.19	$2.76 ($3.18)

*One small farm reported NIS payments that exceeded the cluster of highs. This is reported as a second high.

Feed, labour and infertility costs are the main obstacles to farm-level cost reductions. Feed costs represent the largest cost factor. Farm-level cost reduction plans include reducing reliance on commercially processed feed by sourcing commercial feeds extra-regionally and/or by developing alternative local feeds. Alternative local feeds include grass-planting, hay- and silage-making, allowing farm animals to graze, and developing 'in-house' feed alternatives. Regional lower-cost feed producers have made unsuccessful bids to penetrate the local market. The resultant lack of competition in this arena keeps feed costs at high levels.

Labour, the other big cost source, continues to keep production costs high. To overcome this, some farmers supplement hired labour with their own labour efforts. Others who find it difficult to reduce labour and feed costs reduce spending in other areas by reducing new investment, neglecting repairs, eliminating contingency planning, and by reducing veterinary and medical care. Some farmers generate their own water or collect rainwater in tanks for farm use to reduce costs. Farmers also make the trade off between rearing locally adapted, low maintenance but low producing cows and high producing but high maintenance imported cows.

The costs associated with rearing replacement heifers fell between the 2 periods above. This is primarily due to low reproduction rates. With fewer heifers to raise on-farm, farmers incur additional costs from importing replacement heifers. These are one-off costs and only show up in the data if heifers or cows were imported during the survey year. At least 1 farmer did import cows during the survey period. The lack of replacement heifers on farms reduces immediate costs but constrains future growth and output.

3.7 Summary

Some farmers who have been in dairying for decades have been able to increase milk output per cow and decrease unit production costs. New entrants have initially high costs but also bring innovative farm practices that lead to falling costs and high output per cow to the industry. The farms with low output per cow and low production costs make meaningful contributions to overall milk production. Farms with high production costs and low milk output continue to be worrisome. Farmers who have no plans to expand their enterprises tend to be the same farmers that face higher unit costs and lower output. Given the small size of the economy and the limited number of farms, it remains to be seen whether dairying has a future in Barbados. Chapter 4 examines the future outlook for the industry under the current institutional climate.

Chapter 4: Institutions

> Because different groups and individuals typically benefit from different economic institutions, there is generally a conflict over these social choices, ultimately resolved in favor of groups with greater political power. […] Economic institutions encouraging economic growth emerge when political institutions allocate power to groups with interests in broad-based property rights enforcement, when they create effective constraints on power-holders, and when there are relatively few rents to be captured by power-holders.
>
> - Acemoglu, Johnson & Robinson, 2004.

Three main elements influence day-to-day economic outcomes in the Barbados dairy industry: relationships, oversight & management concerns, and structural features of the industry. Chapter 4 considers these issues as part of the industry's institutional framework. We examine relationships as they affect property rights and power constraints. We use the 'voices' of those interviewed to highlight the organisational structure of the industry and examine the role trust plays. These 'voices' underscore the complexity of the issues confronting industry participants and their attempts to grapple with the changing landscape.

The chapter uses anecdotal evidence from farmer accounts to highlight downward price pressures transmitted through quota reductions or price cuts and to show rigidities in the institutional framework. Additional evidence related to quota lease values captures the idea that there are still potential rents to be made by industry participants - ultimately leading to some tensions in the industry.

Tensions include calls for self-sufficiency in milk production despite the rigid high-priced environment. High prevailing price levels reduces incentives for the private market to provide support services to the industry. Some local farmers are particularly frustrated by high input prices (in particular feed and labour). Most strikingly, is the sense

of disenchantment the institutional structure creates - leaving some farmers to feel as if they “don’t really have any control”.

4.1 “Trust in God – all others pay cash”

The primary participants in the commercial side of the Barbados dairy industry are a dozen and a half producers and the lone processor. All dairy farmers fall under the umbrella of the Barbados Agriculture Society (BAS). Specifically, they fall under the auspices of the Barbados Dairy & Beef Producers Organisation (BDBPA). BAS is an historically stable entity that was founded in 1845. It now serves several farmer groups. Another group – BALDECS – also functions as a dairy cooperative.

Despite apparent goodwill by all groups, trust levels between industry participant pairs vary. The issue of property rights, potential oversight, and perceived benefits from across-the-board collaboration are all interwoven in the complex working relationship between industry participants. All of these are affected at a primordial level by the quota system which determines a priori the stakes under consideration.

4.1.1 The producer-processor relationship

PHD has the complex task of attempting to align its own interests with those of the local farmers. PHD has taken several steps to show its commitment to the industry. Despite this, some farmers distrust the processor. A key reason is the “quota” system. This system has defined the local industry after 1991. According to PHD officials, the quota system was introduced with 2 objectives - to control and manage the supply of milk to PHD; and to allocate the entitlement of supply in a way so as not to disadvantage any

farmer. As shown in preceding chapters, locally available milk was rising. PHD proposed the quota system to re-align supply with demand.

The two main farmers' organisations – BDBPA and BALDECS - held differing views of the proposed quota scheme from its inception. BDBPA and the Chairman of PHD's Board (who was a farmer) supported the proposal and suggested that PHD use past production as the basis for determining allocations. The smaller farmers had other ideas. They proposed equal quota levels to each farmer, observing that the Chairman of the Board, a farmer himself, essentially forced the quota into being by importing 150 cows into the island over a two-year period.

The April-June, 1990 Pine Hill Dairy Newsletter quotes the 1970 Managing Director as remarking: "In the long term the only practical way of satisfying the liquid milk market at all times is slight overproduction on the farms controlled by a self-regulating two tier price structure and the utilisation of surplus milk in manufactured products." Paul Davis, the current BDBPA President was relatively new to the industry when the "Entitlement to Supply" scheme was first proposed in 1989. He comments in the July-September issue of the 1990 Pine Hill Dairy Newsletter that: "once put in place all sides can observe how the scheme is working and make constructive recommendations for change, dependent on market conditions."

The issue was ultimately resolved when PHD chose to allocate quotas to farmers based on their average production levels over the previous 3 years. Quota levels reflected consumer demand. 6% of the quota meant 6% of consumer demand. Although farmers exited the industry during the SAP downturn after the quota was introduced, PHD acknowledges that the quota system worked well until around July 2001. Trade

liberalisation was fully in effect. New rounds of CARICOM negotiations removed intra-regional tariffs. Trinidad & Tobago (& Jamaica) could now export to Barbados tariff-free. Nestlé operates in Trinidad as Nestlé Trinidad and Tobago Limited (NTTL). NTTL produces reconstituted milk. Chapter 2's statistical test results reflect the expanded role for Trinidadian and Jamaican milk imports. In addition to T&T, Nestlé operates in other regional markets, including Jamaica.

Table 10. Registered farmers & farm payments

YEAR	# REGISTERED FARMS	DOMESTIC PRODUCTION (KGS)	AVERAGE PRICE PAID PER KG (BDS $)	SIGNIFICANT EVENT
1967	44	1,710,953	.33	Industry's inception
1970	31	2,064,391	.32	Greenland Farm faces closure; Government assumes control; Hope dairy added a few years later
1982	33	7,041,000	1.15 (2.45)	Large farmers included in PHD's Directorship
1985	32	9,330,700	1.31 (2.38)	
1990	37	14,199,200	1.53 (2.19)	
1991-1993	26	14,252,900 (1991); 7,668,100 (1993)	1.53; falls to ~1.41 (1.88)	PHD aggressively pursues regional exports thrust
1997	26	8,531,400	1.33 (1.54)	Trade barriers relaxed; PHD revises production year; PHD milk intake from domestic producers falls during the 1997/1998 production year (Sep to Aug)
2001-2007	20, then 19	6,827,651, on average	1.76*	Domestic production dips and farmers exit the industry
2008	19	6,694,400	2.30* (1.95)	Excess milk fetches BDS$1.45

* Indicates stated top-tiered quota payments. Actual payment may be less.
Numbers in parentheses () are producer payments in real (2005) terms.

4.1.2 Dairying under the quota system

Table 10 highlights declining payments per kg in constant BDS dollars between 1982 and 1997. The price farmers received for each kg of milk produced remained flat and even fell in nominal terms between 1990 and 1997. Some farmers exited the industry

in 1991 in anticipation of the proposed quota system. Output levels fell one year later (at the end of 1992). The industry remained relatively stable thereafter and business proceeded as usual despite additional upheavals.

By 1995, the local industry appeared to have recovered from the 1992/1993 shocks and output rose to over 7.8 million kgs. Despite price freezes, production continued to rise, reaching over 9 million kilograms in 1998. At the same under the Treaty of Chaguaramas (which governs trade between CARICOM member states) and in accord with WTO rules Barbados opened its markets to other CARICOM countries; the GOB began to relinquish its 2 (of the 7) directorate positions in PHD; and GOB re-affirmed its commitment to free trade. Trade barriers continued to fall through 2000. By 2001, farmers perceived an increased threat from imports.

Chapter 2 indicates structural breaks in milk import patterns with milk imports increasing at a higher rate at the end of the 1990's than in previous years. Farmers felt the import pressure and so did the processor. PHD revised quota levels downward. Some farmers exited the industry and milk production fell, as shown in Table 10. Some farmers have a good working relationship with the processor. For those who do not, the most acrimonious point of the producer-processor relationship is the system of quota allocation and determination. Quota levels continue to be unilaterally designed and allocated by the processor.

The issue of quota determination and allocation came to a head when a sub-group of farmers launched a judicial hearing against the processor in 2003. Dairy farmers launched a formal complaint with the recently created Barbados Fair Trading Commission (FTC). The farmers argued that Pine Hill Dairy abused its dominant position

'by setting the price at which the Dairy would accept milk produced by the dairy farmers, at prices that were excessively low and unreasonable, bearing no relation to the economic value of the product'. (Barbados FTC, 2003) The FTC ultimately ruled that they did not find 'Pine Hill Dairy [to be] in breach of the provisions of the Act'. The FTC did add, though, that 'the Commission was and remains concerned at the practice of unauthorised unilateral adjustments of quotas in the dairy industry'. Tensions continue to brew over quota determination and allocation practices and some farmers point to PHD practices with regard to quota management as the top hindrance to dairy farming.

In 2001, BS&T purchased BDIL and reconfigured the industry. PHD reduced quota levels during that year and ended the practice of sharing a portion of its profits with farmers. Farmers that remained in the industry report feeling alienated from the processor and, by 2008, cut their share in PHD ownership below 2 per cent. One farmer interviewed relates that quota reductions are particularly hurtful because they were not driven by declining demand. He notes that "**a few years ago, PHD reduced quotas by 30% [and] used imported milk powder to replace domestic milk in milk blends."** Farmers negotiated an increase in the quota price (to BDS $2.30 – US$1.15 - per kg) in 2008. PHD conceded but simultaneously removed the ¼ cent cool milk bonus. Bonus removals represent other sources of downward price pressures. (For more on the quota structure and background, see Appendix 3.)

Discussions around "the quota issue" are particularly sensitive for 3 primary reasons. First, the quota system restricts market entry. To enter the industry a prospective farmer must either inherit or buy a quota allotment or buy a farm with its quota. Second, quota levels dictate financing options for some farmers. The quota market is not fluid.

The price paid “depends on who’s trying to sell or buy and on prevailing conditions”. Finally, quota payments play a critical role in determining processor margins.

Tensions built when PHD ended the practice of applying one farmer’s unused quota to another farmer who had exceeded his quota allocation. Under the ‘old system’ “PHD [would] take the unused quota from a farmer and apply it to a farmer who needed it.” PHD then charged a fee to the farmer who had been unable to satisfy his quota allotment. One farmer adds that “PHD realised that [this system] was not to their benefit and stopped doing it. Now, quota can only be leased on a 12-month basis. [The farmer] must send PHD what he’ll lease on a 12-month period and PHD then transfers the quota to the other farmer.”

Despite the foregoing, there still appears to be rents to be captured from dairy farming. PHD pays farmers between BDS$2.08 and $2.30 per kg of in-quota milk. On average, it costs between BDS$0.30 and BDS$0.40 to lease quota. This suggests that new entrants to and current participants in the industry perceive some value from marketing their milk through PHD. This must be the case because the quota as it is structured in Barbados is not a contract. One farmer considers it mere "goodwill" on the part of the processor. However, farmers who fall under PHD's quota arrangement are prohibited from marketing milk through any other channel.

Farmers concede that the PHD helps dairying by allowing farmers to focus on production rather than on accounts receivable. One farmer muses: “PHD is good because at the end of the month, the money is a sure thing. PHD repairs lines and provides sanitation products and deducts the costs from the monthly cheque.” One farmer muses: **“You never know till the cheque arrives in the mail whether you got top price or**

not. There is no guarantee." This farmer noted that in a particular month, he was paid for all his milk "at excess." According to him, he "got nothing at the 1st price" during that month. The general farmer-view of the producer-processor relationship in summarised by one farmer who states, "**Once PHD honours the quota, there's no problem.** Farmers get a good price for the milk so [we] can't complain."

Farmers who entered the industry prior to or during the 1980's were freely given the quota. More recent entrants pay for the quota and it reflects part of their investment in the industry. PHD, for its part, maintains that "farm-level stagnation" leads to poor farm outcomes, not reduced quota levels or stringent testing.

The question of property rights enforcement, perceived rents, trust, management issues, and structural deficiencies are wound together tightly in "the quota issue". PHD finds itself in an unenviable position. In addition to manning processing facilities, it is the generator, monitor and enforcement hand of standards and quality. It regularly invests in technological enhancement (including recent updates to pasteurising techniques and to the yoghurt facility). PHD is responsible for marketing and selling milk and milk-product output. This relieves the farmer of these activities. Still, farmers fear that "milk is no longer the core of PHD." Some contend that the processor wields its 'dominant position' power to reduce farm payments by reducing quota levels and by imposing unduly harsh standards. For one farmer, testing and penalties appear indiscriminate. One farmer states, "If PHD says your milk has failed keeping-quality/antibiotics/..., you have no recourse because government has not got the tags to indicate what is wrong with your milk; government takes ~ 1 month to do tests because it lacks testing strips." Farmers across

board acknowledge the processor's superior, and to some minds, overly sensitive testing capacity.

If a farmer's milk tests positive for the presence of antibiotics, that milk is removed from supply for 3 consecutive days or until the milk is shown to be free of antibiotics. Milk that is not sufficiently cooled, milk that has low milk fat or low non-fat solids, or milk that shows traces of blood, bacteria or acidity are subject to removal from supply or monetary penalties, depending on the offence. **The processor charges a "quality discount" of 2¢ per kg if solids do not meet a minimum. 25¢ per kg is removed if they fail to meet a minimum for a second time.** In other words, farmers routinely receive quota payments below agreed upon prices based unilaterally on the processor's decision process.

The producer-processor relationship is strained because they face conflicting incentives. Both need to reduce costs and maximize profits. Chapter 3 observed that trade liberalisation affects the processor differently than it does milk producers. PHD capitalised on export opportunities (initially through regional integration and the CARICOM channel and later through extra-regional market access). Freer market access makes it easier for the processor to purchase inputs more cheaply now that trade barriers and tariff levels are lower. On the other hand, PHD faces competition from imported evaporated and condensed milk products which compete with its locally produced goods. The processor's incentive is to reduce input costs and focus on sectors that increase its revenues.

Farmers, then, need to reduce costs so as to retain viability – given the existence of alternatives to fresh milk production. A lower COP increases potential farm-level

profits and also allows farmers to stay in business despite downward price pressures or processor cost-cutting procedures. When import pressure forces the processor to cut costs, these disciplinary measures are necessarily passed on to producers. Some farmers find the cost-cutting measures to be harsh but they are unlikely to prefer the other option - a complete closure of the dairy processing facility.

4.1.3 Government-processor relations

During the 1980's, the GOB blocked imports of evaporated and condensed milk products to permit development of the "infant industry" under PHD. Government announced its intentions to embrace trade liberalisation around 1995. Today, the GOB has limited policy space at the trade level but some domestic policy options but continues to manifest support for the processing operations. In 2009, in response to the processor's demands, GOB removed the VAT from flavoured milks. Requests for VAT removal began prior to 2001. In the years before 2001, flavoured milks were made from domestic milk only. VAT targets imported products and locally produced foods are VAT-exempt. Removing VAT from flavoured milks when they consisted of domestically produced milk made sense. Removing VAT at a time when imported powdered milk is a key ingredient goes against stated government goals of increasing consumption of locally produced milk.

A major hindrance to the 2 parties working in concert, however, is the slow speed of Government response to raised issues. It took nearly a decade for VAT to be removed and by the time it was removed the need was obsolete. A major challenge facing the

processor is the inordinate amount of responsibility it shoulders for the overall success of the industry.

In Barbados, the processor collects, tests, pasteurizes and processes milk. It also provides technical assistance to farmers. In addition, it is unilaterally responsible for quota administration. These functions stretch PHD's resources and force it to act in conflicting capacities. Acknowledging this, the GOB announced in its 2006 Budget Speech that $250,000 was being made to develop a business plan for the dairy industry and for the establishment of a proposed Dairy Board. In July 2007, GOB convened a meeting to discuss the establishment of the Dairy Board. No dairy board has been established to date. No clear vision has been articulated for the board although it was hoped that an independent body could oversee quota allocations and farmer grievances. Government promises without clearly articulated goals and without corresponding action undermine the government's credibility with respect to its commitment to strengthening the industry.

4.1.4 Government-producer relations

Government has taken several steps to ensure market access for milk produced locally. The Ministry of Education purchases milk under the School Feeding Programme. The 2008 TPR reports that 'Government requires that 60% milk-needs of the School Meals Service and all other Government institutions must be met from local milk production.' Pine Hill Dairy reports that the Ministry of Education primarily purchases flavoured milks for its School Meals Programme. In addition, the 2009 BHL Annual Report observed that there was a 'trade-off between flavoured and un-flavoured

pasteurized milks with the removal of VAT on flavoured milks during the second half of the year.'

Government's decisions to remove VAT from flavoured milks adversely affected milk producers in at least 2 ways. First, consumers substituted purchases of formerly cheaper un-flavoured milk in favour of flavoured milk. This product substitution decreased sales of the only processed good that only contained locally produced milk. Second, the VAT removal and the subsequent boost in those sales incentivizes the processor to import cheaper milk powder and to further reduce quota allocations.

Lack of enforcement and follow-through and the fact that official statements appear unrelated to reality further undermines the GoB's credibility. As one farmer points out, VAT removal should also benefit farmers. The Government has stated that milk is an area in which it is seeking to achieve self-sufficiency (see 2008 TPR). Given this, one farmer maintains that, "Government cannot remove VAT and not make sure the benefits go down to the farmers. The deputy Prime Minister said he'd remove VAT from flavoured milk but when he saw they use milk powder, he had a rider added. The rider said: locally-produced milk only. PHD should not add milk powder and then sell it VAT-free."

Another farmer adds that farmers too should receive concessions to level the playing field. He states, "Government must remove VAT from all imported feeding ingredients & from all farming equipment – so long as you are a registered farmer. This should apply to CARICOM and extra-regional imports." Under CET guidelines, farmers can no longer readily import raw materials - including farm equipment. Other factors constrain farmer's ability to reduce costs. In the event that a farmer could afford to

purchase new farm equipment extra-regionally, shipping costs are high. The bulk of the island's shipping falls under the umbrella of BS&T (which controls the feed industry and PHD). Transportation and shipping rates are high. If a ship's cargo is overloaded, the item that reaches the island is determined by the shipper's goodwill. Still, if a farmer manages to overcome these hurdles he still needs to get the items from the port. CET, port delays and the associated charges for storages should cargo remain at the port past a prescribed time increase the costs of farming in Barbados.

More poignantly, farmers had been affected by the re-imposition of a 15% duty on milk replacer. Some farmers use this to feed calves and replacement herd. One farmer states:

"In the past, Roberts (the former name of the local feed processing facility, now known as Pinnacle Feeds) applied for and got the 15% waived. But no one at the Agriculture Planning Unit [MAR] has advised the Minister of Finance [who must submit the recommendation] to the Prime Minister [who then forwards it to the Minister] Trade [who in turn submits] the application for a waiver of duty to CARICOM. As a result, the 15% duty remained in place. The immediate effect was to remove perhaps 100,000 lbs (nearly 46,000 kgs) of milk from the market by diverting it to on-farm use. This is costly to the farmers and to the larger economy."

Time and again, the GOB announces incentive programmes. While farmers welcome the incentives, some are unaligned with farmer concerns. Farmers report that when initiatives do address real needs in relevant ways, bureaucratic red tape, inefficiency, and loss of paperwork prevent some farmers from benefiting. The smaller dairy farmers, in particular, mention difficulties associated with receiving financing at

reasonable rates. One example of Government grants and incentive schemes that was either inaccessible or unrelated to farmer needs was the declaration of funding for a milk parlour. In the December 2004 Budget Speech, for instance, the GoB announced 'a rebate of 30%, up to a maximum of $100,000' for an 11-person minimum partnership to develop a common milk parlour. Farmers interviewed state that a shared milking parlour is infeasible and unpractical. They point to coordination problems associated with a shared milking facility. Cows need to be milked regularly and on schedule. Even if farmers could build a common milk parlour, each farmer would want to be first in the parlour to reduce hygiene risks. The cows that get milked first also have reduced risk of infection associated with late milking.

This highlighted a particularly worrisome point to farmers - whether policy makers could really be committed to agriculture despite having no or limited agricultural backgrounds. For farmers, the minister [of agriculture] "should know agriculture and be willing to give Bajan farmers a chance to work, produce and be profitable." Government allows for agricultural tax rebates. Chapter 3 related evidence of high temperatures and rainfall leading to lowered cow milk output. In 2006, the GOB offered rebates for dairy housing to 'address problems associated with heat stress.' (2006 Budget Speeches) In addition, the GOB covers the costs of testing cattle for tuberculosis; provides incentives for farmers to invest in security or to upgrade buildings and equipments; and provides limited veterinary and animal nutrition services. Despite GOB incentives, farmers generally feel abandoned. They state that many of the rebates are merely 'on paper'. Red-tape and bureaucracy frustrate efforts to access rebates and even land for agricultural use. The GOB does not directly subsidise milk production.

Land taxes and land tax laws remain a concern for one large dairy farm engaged in non-agricultural commercial activities. The entire land area must be agricultural to qualify for the land tax rebate. Referring to government-provision of tuberculosis tests, one farmer simply states, "We'll see how long that will last." Disenchantment arises because farmers think that Government support is whimsical. One farmer observes: "There is no follow through. Farmers are pretty much left on their own to make it." Another farmer adds that "[although] now and then BAS gives one or two seminars, agriculture in Barbados is a waste of time. There's no support and nobody here really has any interest in farming. The Government is bare hot air. Only after farmers make a stir do they bring in help."

4.1.5 Producer-producer relations

Barbados milk producers are fewer than 20 in number and are located within a confined geographic area. These characteristics could easily lead economists to assume that collective bargaining would be easy. Collective bargaining is undermined by the fact that the farmers are not a unified group. The fact that there are 2, almost rival, farmer organisations shows that there are issues that divide the farmers. Two glaring issues are the quota issue and cost-containment for inputs to agriculture. On the quota issue: some farmers want PHD to suspend quotas and pay top price for all milk it receives; others view the quota as an asset, even a right, and want the quota system preserved - albeit at higher levels.

The main farmer's organisation – the Barbados Dairy and Beef Producers' Association (BDBPA) has not used its leverage to decrease input costs. Faced with high

costs for feed and farm implements, and constrained on the output side by the quota system, some farmers try to overcome hurdles by working through BALDECS (known as the Co-op). Some view the Co-op as a rival organisation to the BDBPA while others see the 2 playing complementary roles. There also appears to be a 3rd, informal arrangement, whereby a small group of larger farmers pool their resources to import cheaper feed products and to share ideas on feed crops and nutrition. The success of any group or organisation will largely depend on its cohesiveness and the willingness of each member to sacrifice potential personal profits for the common good. The Co-op hopes to use common funds and bargaining power as leverage for purchases.

4.2 The BAS tree

BAS was created in 1845 prior to the development of local dairying. Although there are 2 dairy farmers' organisations, only BDBPA receives official support and recognition because it is part and parcel of the BAS tree. Some farmers view the Co-op as an informal - fringe – organisation. BAS was initially an organisation for sugar planters. It functions by performing administrative duties for various farmer organisations. Dairy farmers automatically pay CESS dues to BAS through PHD deductions from quota payments. PHD then transfers the payments to BAS to cover administrative costs. Although lacking official sponsorship, The Co-op's emergence evidences three main ideas:

- The state-supported organisation does not adequately represent the needs of all farmers
- The institutional environment allows for change, even if it is resisted
- If the potential gains are high enough, agents will overcome institutional challenges to change norms and, ultimately, reform institutions.

The Co-op exemplifies the desire for change to institutional entrenchment. None of the farmers identifying themselves as members of The Co-op belong to the traditional planter class. What unites them is their desire for bargaining power and their drive to ensure that dairying survives in Barbados. Production costs hamper the industry's development. Although unit costs have fallen over time, as presented in the previous chapter and in Table 10, absolute costs are high and rising. Entry costs are high and, as one farmer articulated, "You must have deep pockets or a point to prove" to enter dairying in Barbados, as it exists today.

4.3 A point to prove

With many issues confounding milk production, it is a wonder that so many farmers hang on to and a few even enter dairying. But Barbadian dairy farmers tend to be a tenacious and creative bunch. Questionnaire responses indicate that operations with incomes in addition to dairy farming are more likely to use external feed sources and multiple feed sources. All the farmers who reported purchasing large amounts of commercial feeds also reported that the dairy enterprise contributes less than 39% to family income. Locally processed commercial feed remains the main source of on-farm feed. Some farmers who purchase only local feed inputs do so because they have no choice.

This constraint motivated some farmers to overcome the problem of scale by collectively working together to make such purchases feasible. Other farmers work on developing their own locally adapted feed mixes. Yet others invest heavily in quota

accumulation, technological improvements and high producing cows so that the higher income compensates for higher costs.

Despite ardent attempts to make commercial dairying successful, one farmer suggests that farmers are "their own worse enemies". This feature, combined with the lack of support services, the ambivalent position that PHD finds itself in and the lack of Government recourse leaves little wonder that a farmer would state that anyone contemplating entering dairying in Barbados must either have deep pockets or "a point to prove". Table 11 summarises some of the institutional challenges facing dairy participants in Barbados.

Table 11. Farmer-reported institutional weaknesses

farmer-reported hindrances to dairying: structural	farmer-reported hindrances to dairying: financial & environmental	farmer-reported hindrances to dairying: policy
• quota system & market access • land access • grass programme • infrastural improvements • enforcement of property rights - larceny • support services • lack of technical support services when something goes wrong; PHD is unable (or not interested) in doing anything- they don't work 24 hours • testing and penalties appear indiscriminate	• high input costs: commercial feed and replacement stock • financing for business • mechanisable arable land • inability to access grants - they [Goverment offices] lose papers... • grants not worthwhile because if venture fails you have to pay back everything • have to buy everything in cash • encroaching urbanisation: farm land competing with housing • inefficient water system • infeasibility of biogas system without large cow numbers, seems low priority • Alternative energy/fuel sources • Tax system & land valuation	• need for Government to intervene to establish an independent organisation to represent farmers' interests. Government cannot give money to an industry and then not regulate it • The Government had no right to let anybody import milk powder • Government cannot remove VAT unless they ensure the benefits go to the farmers • Obtaining/sourcing stock: hard to import without quota from PHD. • Government needs a proper grass programme; cotton seed unreliable • Government must remove VAT from ALL imported feeding ingredients and from all farming equipment so long as you are a registered farmer

Farmer initiative alone will not resolve most issues listed above. Some require market creation and collective action. Law enforcement problems, the lack of industry wide support services and limited technical support weigh down the industry. Farmers

can fix only few (if any) of the issues without additional collaboration. Farmers can, however, try to tackle input costs. Production costs must fall at both the producer and processor level should Barbados become truly self-sufficient in milk. Without adequate infrastructure, proper farm management or independent oversight, though, the industry's support system will remain weak and ultimately falter.

4.4 Oversight, management and thin markets

Dairying is governed by several legislative acts. With little enforcement, official regulations and actual practice often do not coincide. Based on the 1989 Agricultural Census, estates account for some 60% of all agricultural land in Barbados. Under the law, these are still required to keep heads of cattle and to practise mixed farming. Such laws are by-and-large ignored or forgotten. Despite high domestic beef consumption, the beef industry virtually collapsed in 2010. Dairying could follow. The existence of laws does not in and of themselves create an industry. There needs to be relevant enforcement and incentive structure for the law to have the intended effect.

Part V.33 of CAP.260 – Dairy Industry (Regulation and Control) Act – specifies the establishment of a Milk Advisory Board to provide the forum for managing producer, processor and outside concerns. Discussions about the creation of a Dairy Board have not materialised. Lack of progress in this area causes the processor and producers to doubt the Government’s commitment to dairying. A Board or a similar entity with general oversight could, if properly executed, relieve PHD of its administrative duties thereby diffusing some of the strain on the producer-processor relationship. Without a quota system, however, the need for a board becomes redundant.

North explains that individuals invest in 'new altered opportunities' in response to changes in relative prices. Positioning the dairy sector as a viable, worthwhile investment leads to 'the perception that there is a high payoff to investment' in this area. By encouraging investment in productive sectors of the economy, Barbados would in turn, experience long-run economic growth. (North, 1990)

Industry support services such as cow milk production tracking, breeding monitoring and financial record-keeping services are unavailable or unaffordable to farmers who are just covering their costs. Market provision of these services would lead to better farm management practices and lowered unit costs over time. For example, missing records precludes some farmers from using AI optimally or from making relevant culling decisions. Long intervals between successive calvings, repeat AI attempts, and keeping low producing but high maintenance cows in the herd increase production costs. While high input costs matter, so too do farm management practices – some of which can be alleviated by relevant support services.

The Government cannot provide all the services that the dairy sector needs. It can, along with stakeholders in the industry, create incentives for market forces to fill some of the needs. The virtual collapse of the beef industry adds urgency to the need to strengthen the dairy industry. Doing so involves recognising and accounting for structural problems that plague the beef industry (which is in shambles) the sugar industry (which is ailing and has no profitable plantations), and the cotton industry which is barely surviving.

Table 13 indicates that farmers are aware of areas for potential improvement. Still, there are several factors that lie outside the farmer's control but which directly impact him. A few of these institutional constraints - land pressures, labour costs and

attitudes toward agriculture, the tendency towards market concentration – are outlined below. We provide examples from the sugar industry to show that these constraints are not unique to the dairy sector.

Table 12. Farmers' viewpoint: the way ahead

farmer-reported hindrances to dairying: management

- poor record-keeping
- genetics, breeding and managment need to be improved together; improved calfing intervals
- labour management is a nightmare; high turnover
- hard to accept change otherwise more farmers would use [feed alternatives like sorghum]; it takes more management but it gives a quicker crop
- farmers need to take initiative, allow criticisms and incorporate learning into management
- recognise trade-off between better pasture management, better stock and costs; need to weigh up and manage

farmer-delineated points of commendation

- training seminars provided by BAS
- once PHD honours quota, there's no problem; we get a good price, so can't complain
- matching funds from PHD for marketing campaign
- PHD laboratory is very good and can be very helpful
- dairy Show
- PHD financing farm improvements

Farmers' wishlist. If I could, I would...

- Improve training - more AI, medical and herd management training
- Focus on nutrition. We are at the mercy of the feed company. Having regular nutrition training would help educate farmers about grass types/quality, forage management & fertiliser use
- Give farmers more control in determining input choices; should be able to make own concentrate or source it differently
- Increase interest in dairying; we need young labour but youth are not interested in farming
- Help farmers realise that our climate is not harsh like [North America]; we can't really afford the newest and the best equipment - and we don't need it. Our cows can graze from sunrise to sunset.

4.5 Institutional constraints: the case of sugar

Figure 8 shows steadily increasing costs associated with producing sugar. Sugar costs reflect high local price levels. The majority of dairy farmers have successfully lowered some elements associated with production costs but labour, land and feed continue to be a challenge. Labour and land costs also affect the sugar and every industry

on the island. A future place for domestic milk production critically hinges on the industry's ability to contain costs and maintain production.

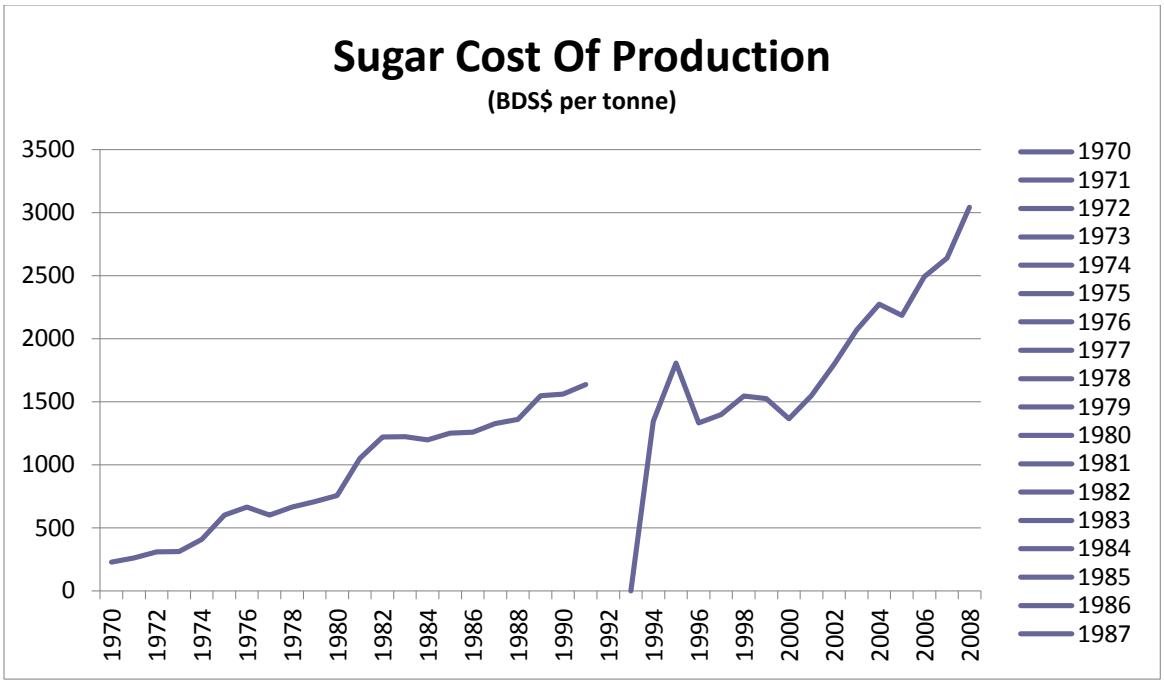

Figure 8: Increasing sugar production costs

Creeping urbanisation and high real estate prices limit agricultural growth. Land topography reduces farmer's ability to mechanise grass and agricultural production. Local attitudes towards agriculture are negative and are rooted in the past. Although it is easier to get migrant workers are willing to work on Barbados' farms, farmers find it difficult to get or renew work permits. Pilfering and high off-island transportation costs affect most of agricultural output. High transportation costs are related to limited market provision of this service.

4.6 Conclusion & points of interest for Canada

We asked 3 questions at the outset of this study:

1. whether trade liberalisation affected the Barbadian dairy industry;
2. how competitive is the local dairy industry with respect to imports;
3. what are the institutional characteristics of the Barbadian dairy industry that affect its competitiveness?

Liberalisation: Statistical results indicate indirect effects of trade liberalisation with structural change occurring just prior to 2000. The local dairy industry continues to be plagued by high input costs. The resulting cost of production – US$.59 to more than US$1.38 per kg is too high. The fact that it has fallen over time is promising but unless it falls even more we should expect to see more farmers leave the industry. Any upturn in production costs is a threat to the industry's future viability. A promising trend is that farmers who have been in the industry for more than 2 decades have made strides in lowering costs and new entrants to the industry are dynamic. Despite high start-up costs, new entrants show promising signs for reducing future costs, good herd management skills, and innovation. New entrants to the sector have already achieved relatively high output per cow and have falling calving intervals. This type of dynamic farm management is necessary for survival.

Competitiveness: Production costs remain high. Unless costs fall or milk quality improves to justify the high costs of milk, this industry will not survive without tariff protection. Institutional characteristics that continue to adversely affect the industry include high prevailing price levels, labour problems, enforcement and oversight

challenges, and limited market-provided support and technical services. Poor quality forage and inadequate record-keeping stunts farm management efficiencies.

Structural Features: The new reality is that Government's role in the industry has changed. However, it still has a role to play by creating the overall framework in which dairying operates. Its role includes consistency in its support of the industry, the provision of oversight to the industry, strengthening agricultural credit and signalling to the market to fill the existing voids. Some work may have been left undone by Government because many believe that the dairy industry is strong and here to stay. Few recognise the underlying fragility of this key industry. The industry needs to generate a collective memory so that past mistakes can be avoided. Systems that work can be re-used instead of re-creating the wheel. In 1970, Gooding wrote that 'the price paid to farmers here [in Barbados] is among the highest in the world – but…we also probably have the highest costs in the world.' Barbadian farmers today are still among the highest cost milk producers. Now – as in 1970 – '[they] have not been able to reduce [their] dependence on [imported] concentrate feeds.' This leaves farmer organisations with an important role to play.

Farmer organisations play a vital role by negotiating bulk input prices for feed, fertiliser, equipment and the like. These organisations can facilitate shared grass-growing efforts, create shared labour pools, exchange reduced-cost feed mix techniques, and generate public interest in farming. Developing readily available, low cost feed mixes and increasing the pool of agricultural (dairy) workers could contribute to reduced costs. In addition, traditional farmers and commercial farmers who no longer produce enough milk

to sell to PHD but who remain in dairying should be supported as these contribute to overall milk production.

Research and development efforts should not be biased against locally adapted cattle. In fact, survey data indicate that farms with low producing cows also have low costs. Chapter 2 underscored the relationship between milk output and income levels. Barbados remains a fragile economy - susceptible to shocks. As such, milk production should encourage and maintain a herd that can produce milk despite international economic turbulence and in spite of domestic downturns. This would secure milk production while reducing dependence on high-cost imported inputs.

In Barbados, the ***quota system*** worked well in the past but no longer operates smoothly - in part because of changing fiscal realities and changed trade rules, including its CARICOM commitments. Barbados needs to reconsider how best (or whether) to continue the quota system. It is crucial that farmers become increasingly efficient without taxing the consumer or Government budgets. The quota system requires an in-depth review. It restricts entry, is cumbersome to manage, and increases costs to the industry. Streamlining the process and perhaps a gradual phasing out the quota system might stimulate production.

Anticipating potential changes in this area, Canada does well to also review its quota system to see any areas in which it can be streamlined. Canada's system has come under attack from its Southern neighbour and as the global economy marches toward a diminished role for government in agricultural outcomes, Canada will most likely have to review its quota system. Although Canada could potentially continue to have a national milk management supply system akin to that of Barbados (adjust quota allocations to fit

demand), future trade negotiations will undoubtedly call for the removal of farm subsidies and of import controls. It is unlikely that Canada would choose to continue a system of supply-management under such conditions.

Another reason Barbados should re-consider the quota arrangement is due to the incentives it creates. Farmers have an incentive to show higher production costs because this is the basis on which they are paid. Price for milk becomes based on production costs (or on the opportunity cost of reconstituting milk powder) instead of on the equilibrium of supply and demand interactions. This skews output and potentially mis-aligns resources in the economy. If potential rents are too high, the gap between supply and demand grows. Consumers reduce demand while producers want to increase output. Quotas, though intended to align supply and demand, leads to a stifling of production by limiting even efficient producers from expanding their output.

Chapter 3 showed that PHD has a seasonal need for milk. Instead of a fixed quota system, PHD could use contracts for pre-determined periods to ensure supply. This adds flexibility to a currently rigid system and overcomes the lack of a fluid market for quota sales. On the flip side, non-contracted farmers would need to find alternative marketing outlets.

Record-keeping: Apart from the obvious difference in income levels, Barbados and Canada differ vastly in their methods of tracking milk production, consumption, and cow yields. Barbados has no milk tracking system. In Canada, it is a relatively straightforward matter to determine - not average milk production - but also solids content (including fats and protein) per province, per farm, and even per cow. No ready

supply of replacement cattle, limited genetics and limited research specifically tailored to farmers' needs.

Canada continues to invest heavily in ***research and development*** tailored to fit the needs of Canadian farmers. This research-driven farming contributes to making Canadian farmers cost-efficient with low production costs. Barbados continues to import technology, genetics, and to some extent research. Until Barbados can develop locally adapted research (genetics, feed sources and processing, animal nutrition and product development), costs associated with producing milk will remain high.

Government remains heavily involved in the Canadian sector while the GOB has taken a bow and exited the industry. This contributes, in part, to the development of ***infrastructure and support service*** to each industry. Canada's Government plays an active role in the dairy sector's development - particularly through the work of the CDC. Private actors also support the industry through veterinary and laboratory services, through technology (including technology that enables farmers to better manage the herd by tracking each cow's production and characteristics).

Both countries continue to struggle with determining how to structure payments to farmers for milk produced. Canada includes production costs in its calculations, in addition to milk solids. Barbados currently employs a mix of farmer-processor negotiations plus tiered pricing to reflect fat content.

Per capita milk consumption reflects overall differences to milk production and consumption in the 2 countries. Barbadians consume less than 29 kilograms of fluid milk per person each year. Canadians consume around 90 kilograms of milk per year. Cultural differences and physical make up account for some of this difference. A tradition of

dairying could explain yet more. Not a little of the difference is probably attributable to some of the features of each industry that was outlined above. Determining contributing factors to the different milk consumption patterns is potential area for future research.

In conclusion, government policies, increased imports, weather patterns and farm management practices all contribute to milk production levels. These are challenges and areas of opportunity and potential growth. Undoubtedly then, the path forward will be challenging but as Government, the processor and the producers take a holistic view of dairying, it is possible for a differently configured dairy industry to survive. This implies continuous public education to keep them interested and involved in the industry; to provide incentives to become proficient enough to work in the industry; and to generate interest in investing in infrastructural or research and development improvements to the industry. Creating a high-value added line could help stimulate milk production without reducing processor margins. Continuous improvement in herd management would also contribute to this industry's survival despite changes in the global economic landscape.

Appendices

Appendix 1A: Barbados dairy industry questionnaire part A

QUESTIONNAIRE

Notice: All information provided will be treated with the <u>strictest of confidence</u>. Data use will be anonymous & names and individually identifiable information will not be used at any stage of analysis.
If the questionnaire is completed, it will be assumed that consent has been given.

BARBADOS DAIRY INDUSTRY PRODUCTION & MARKETING SURVEY v0.1

A. Dairy Production Survey – 2009

NAME OF FARMER NAME OF BUSINESS

Name of Farmer/Business: _____ _____

_____ _____

Business Status: Company [1] Association [2] Co-Operative [3] Individual [4]

FIRST NAME SURNAME

Name of Respondent (if different from Farmer): _____ _____

Number of family members employed : Total [1]

Role: Management [2] Supervisory [3] General/casual labourer [4]

Address of Farmer/Business: _____ Parish _____ [ ]

Telephone:_____ email:_____

Number of Dairy Animals	
Size of Milking Herd	

NOTE: INFORMATION IN QUESTIONS 1 – 15 SHOULD RELATE SPECIFICALLY TO FARMER/ORGANISATION

1. Age (of farmer) : Under 25 [1] 25 – Under 45 [2] 45 – Under 65 [3] 65 and Over [4] N/A [5]
2. Age (of business) : Under 5 [1] 5 – Under 10 [2] 10 – Under 15 [3] 15 to Under 25 [4] 25 and Over [5]
3. Are you registered with MAR? Yes [1] No [2]
4. How long has farmer been engaged in Dairy farming? < 1 year [1] 1 – 5 years [2] 6 - 10 years [3] Over 10 years [4]
5. Number of holdings: [ ]
6. Size of holdings: [1] [2] [3]
7. What is your primary type of farming activity**? (TICK ONE)**

   Dairy only [1] Beef & Dairy [2] Other [3]
8. What would motivate you to increase production? _____

   _____
9. Do you farm: Part time [1] Full time [2]
10. Is farm family-owned? Yes [1] No [2]
11. Is farm family-farmed? Yes [1] No [2]
12. Highest Education Level attained: Primary [1] Secondary [2] Tertiary [3] Technical/Vocational [4] N/A [5]
13. Number of dependants in your household? _____
14. Is farmer/business a member of the Beef and Dairy association? Yes [1] No [2]
15. Is farmer a member of any other Farmer's Organisation/Cooperative? Yes [1] No [2]

NOTE: INFORMATION IN QUESTIONS 16 – 18 SHOULD RELATE SPECIFICALLY TO RESPONDENT

16. Age: Under 25 [1] 25 – Under 45 [2] 45 – Under 65 [3] 65 and Over [4] N/A [5]

17. How long have you been engaged in Dairy farming? < 1 year [1] 1 – 5 years [2] 6 - 10 years [3] Over 10 years [4]

18. Highest Education Level attained: Primary [1] Secondary [2] Tertiary [3] Technical/Vocational [4] N/A [5]

Interviewer: _____

Date: _____/_____/ 2009

Appendix 1B: Barbados dairy industry questionnaire part B

BARBADOS DAIRY INDUSTRY PRODUCTION & MARKETING SURVEY v0.1

B. Dairy Production Survey – December 2009

19. Farm location _____ Farm Parish:_____ ☐

20. Farm Land Tenure: Owned [1] Leased [2] Rented [3] Family [4] Landless [5]

21. Area of land (acres): _____ 24. Area of land for dairy farming (acres): _____

22. What type of milking parlour do you use? Abreast parlour [1] Herring bone [2] Tandem [3] Side-by-side [4] Other _____

23. What type of milking system do you use? Computerised [1] Mechanical [2]

24. Does farm use biogas or alternative energy? Yes [1] No [2] **If yes**, please list._____

25. What type of rearing system do you use? Intensive [1] Semi-Intensive [2] Extensive [3]

26. Are you aware of the Ministry of Agriculture's Incentive Scheme? Yes [1] No [2] **(If NO, go to Q.31)**

27. **If yes**, have you applied for any livestock incentive? Yes [1] No [2] N/A [3]

28. **If yes**, were you successful? Yes [1] No [2] N/A [3]

29. Do you own a farm vehicle? Yes [1] No [2]

30. Did you benefit from the duty free vehicle scheme? Yes [1] No [2]

31. Is farming your principal source of income? Yes [1] No [2]

32. What contribution in percentage does the **dairy enterprise** make to the family income?

Under 20% [1] 20% - 39% [2] 40% - 59% [3] 60% - 79% [4] Over 80% [5] Won't Say [6]

PRODUCTION COSTS

33. **PAID LABOUR USED FOR DAIRY PRODUCTION**

	Number		**Wage Rate per day ($)**		**Avg. No. of hours per day**		**Avg. No. of days per week**		**Total No. of hours per week**	
	Male (a)	Female (b)	Male (c)	Female (d)	Male (e)	Female (f)	Male (g)	Female (h)	Male (i)	Female (j)
(I) Full-Time										
(II) Part- Time										
(III) Occasional										
(IV) TOTAL			XXXX	XXXX						

34. **UNPAID LABOUR USED FOR DAIRY PRODUCTION**

	Number		**Avg. No. of hours per day**		**Avg. No. of days per week**		**Total No. of hours per week**	
	Male (a)	Female (b)	Male (e)	Female (f)	Male g)	Female (h)	Male (i)	Female (j)
(I) Full-Time								
(II) Part- Time								
(III) Occasional								
(IV) TOTAL								

FIXED COSTS USED IN DAIRY PRODUCTION

	Current Costs
35. Land (tax or lease payments)	
36. Buildings:	
37. Equipment:	
38.Management	
39. Other	

VARIABLE COSTS USED IN DAIRY PRODUCTION

Equipment Running & Maintenance Costs	**Amount Used (monthly)**	**Total Cost**
40. Oils & lubricants		
41. Service		
42. Spare parts		
43. Mechanic fees		

VARIABLE COSTS USED IN DAIRY PRODUCTION

Vehicle Running & Maintenance Costs	Vehicle1 Type	Vehicle2 Type	Vehicle3 Type
44. Fuel i. Diesel ii. Gas			
45. Oils and Lubricants			
46. Service			
47. Spare parts			
48. Mechanical fees			
49. Insurance			
50. Road tax			
51. Other			

VARIABLE COSTS USED IN DAIRY PRODUCTION

Utilities	**Monthly Costs**
52. Water	
53. Electricity	
54. Telephone (includes mobile phone)	
55. Telecommunications	

FEED COSTS

Nutrition	Amount Used (monthly)	Monthly Cost
56. Concentrate: i. calf starter ii. calf grower iii. dairy ration iv. by-products (indicate) v. Milk powder		
57. Forage i. Chopped grass ii. Hay iii. Silage iv. Grazed grass (estimated) - Fertilisation - Land tax		
58. Feed additives i). mineral licks (salts) ii). other		
59. Other		

VARIABLE COSTS USED IN DAIRY PRODUCTION

Miscellaneous Items	**Monthly Costs**
60. Transport (off-farm)	
61. Technical support, including consultant	
62. Security (non-labour)	
63. Artificial Insemination	
64. Other	

MEDICAL COSTS

	Monthly Costs
65. De-worming	
66. Anti-tick treatment	
67. Mastitis i. strip cup ii. California mastitis test kit iii. disposal towels iv. teat sanitizer	
68. Milking Sanitisation Products	
69. General Sanitation	
70. Medical i. Supplies ii. Veterinary visits	
70. Hoof trimming	
71. Bacterial Infection treatment	

72. Do you use artificial insemination? Yes [1] No [2]

73. Do you use a clean up bull? Yes [1] No [2]

Please provide a summary of your herd composition as it stands today:

	Number
74. Cows	
75. Heifers	
76. Calves	
77. Bulls	
78. Other cattle	
79. **TOTAL: ALL CATTLE**	
80. Milk Herd	

81. What is your **main** criterion for culling your animals? (**TICK ONE**)

Performance [1] Age [2] Health [3] Injuries [4] Other (specify) [5] _____

82. How many calves were born alive over the last year? _____

b. How many were still births? _____

c. Average number of days open? _____

d. What was the average calving interval (days)? _____

e. Average duration of lactation? (days) _____ NA [1]

f. Average number of AI services per conception? _____ NA [1]

g. Do you use synchronization techniques? Yes [1] No [2]

h. What is the average daily milk production per cow? (litres/kg – indicate unit) _____ NA [1]

Feeding

83. Please indicate the feed(s) used in operations

Commercial dairy ration [1] Silage [2] Forage [3] Total mix ration [4] By-Product(s) [4]

84. What is the **main** feed used? **(Tick one)**

Commercial dairy ration [1] Silage [2] Forage [3] Total mix ration [4] By-Product(s) [4]

85. What is the **main** reason for using the feed above?

Cost [1] Convenience [2] Availability [3] Quality [4] Other [5] _____

86. Where do you source your feed? Locally manufactured feed [ ] Regional Imports [2] Extra-Regional Imports [3]
Other(e.g. by-product producers) [4] N/A [5]

87. What is your feeding regime? Once a day [1] Twice a day [2] Other [3] _____ N/A [4]

88. What is your feeding strategy? Challenge feed [1] Other [2] _____ N/A [3]

89. Is water always available on demand throughout the year? Yes [1] No [2]

90. How do you dispose of farm manure? Please include saleable value. _____

91. What type of records do you keep? Financial [1] Production [2] Breeding [3] Other (specify) [4] _____ None [5]

CREDIT

92. Are you aware of concessionary financing opportunities for agricultural purposes? Yes [1] No [2]

93. How was your start-up operation financed?

Bank Loan [1] Family Loan [2] Personal Savings [3] Government Institution Loan [4] Grant Financing [5]

Credit Union [6] Mixed Financing [7] Other(specify) [8] _____ N/A [9]

94. Have you borrowed any funds for the dairy operation since start-up? Yes [1] No [2]

95. Do you have plans for expanding the dairy enterprise? Yes [ ] No [2]

96. **If Yes**: In what areas?

Increasing cow numbers [1] Buildings/Land area [2] Equipment &/or technology [3] N/A [4]

97. How will it be financed?

Bank Loan [1] Family Loan [2] Personal Savings [3] Government Institution Loan [4] Grant Financing [ ]

Credit Union [6] Mixed Financing [7] Other (specify) [8] _____ N/A [9]

MARKETING

98. Do you have a contractual marketing arrangement? Yes [1] No [2]

99. What are your channels of distribution?

Barbados Pine Hill Dairy [1] Ice cream Manufacturer [2] Export [3] Other [4]

100. How much of the milk produced is not purchased by main distribution channels? (**state unit**) _____ N/A ☐

What are the three (3) greatest hindrances to dairy farming in Barbados? (In order of difficulty – most difficult first)

1. _____

2. _____

3. _____

102. What types of training would benefit dairy farmers?

Please specify _____

_____

_____

103. In what ways can dairy farmers reduce costs and increase competitiveness?

_____

_____

_____

Comments:

Interviewer: _____

Date: ____/_____/ 2009

Appendix 2. Timeline for the Barbados dairy industry

Table 13. The Barbados dairy industry over the years

	Event	Aim/Outcome
1845	Act of Parliament establishes BAS	To represent agricultural interests
1961	Self-rule	
March, 1964	Pine Hill Dairy established as a subsidiary of Barbados Dairy Industries Ltd.	
1965	An act of Parliament establishes the (Barbados) Agricultural Development Corporation (BADC).	To stimulate agricultural development and support agricultural policy.
1966	Political Independence from England	
1967	Caribbean Free Trade Area (CARFITA) Prime Minister Barrow places an embargo on milk imports	
1970	PHD starts a Scheme of Assistance to dairy farmers. 1st carousel milking machine installed at Hope Plantation, St. Lucy	$50000+ disbursed
1974/75	Severe international recession	
1975	Signing of the Lomé Convention	
March 1982	Major IMF bailout	
1988	Securities Exchange of Barbados (SEB) begins operations. (13 companies listed) Balance of Payments surplus of $71.1 million	
1989	Balance of Payments deficit of $71.5 million (repayment of external debt & rising consumer demand.)	Foreign exchange reserves equivalent to 2.7 months' imports.
1990	Balance of Payments deficit of $105 CARICOM Common External Tariff implemented	Foreign exchange reserves equivalent to 1.6 months' imports.
1991/1992	IMF bailout & Structural Adjustment Programme	
1992	CET takes effect	
1992	Government of Barbados makes 1 million of its shares in Pine Hill Dairy available to the public	Generate government revenues & reduce government expenses.
1992	NAFTA signed by Canada, U.S., Mexico Deadlock over the General Agreement on Tariffs & Trade (GATT) centred on US & European agricultural subsidies final broken.	Uruguay Round expected to conclude in 2003 with goal of rationalising world trade.
January 1995	WTO takes effect	
1997	PHD fully locally owned; BHL controls 83%	
1998	Barbados external position weakened – current account deficit	
February 2010	Government of Barbados public debt exceeds 100 percent of GDP	2008/2009 downturn
2010	Farmers granted a 6.5% (15 cents) increase per kg in December	
2010	Barbados Dairy Industries Limited applies to de-list from the Barbados Stock Exchange.	Effective January 2011

Source: various Barbados government publications; Pine Hill Dairy annual reports, various years.
See http://www.iadb.org/announcements/2009-11/english/idb-confirms-strong-support-for-barbados-and-announces-new-country-strategy-6021.html Online Nov 26, 2009

Appendix 3. Background to the quota system

The Barbados quota system was initially proposed during a time of high production, high imports, coordinated imports and domestic price controls. Local leaders relinquished price and import controls so as to comply with trade liberalisation rules. Originally called "an entitlement to supply" the system was introduced at a time when the Chairman of PHD's board – Charles O. Williams (now Sir Charles) - was a farmer. Despite some farmers' distrust of the proposed system, the farmer/chairman supported the proposal and believed that farmers could benefit.

Like many farmers who remain in the industry today, Williams envisioned that the quota would represent a tangible asset to be bought and sold - one that would allow ease of entry into the industry. Pine Hill Dairy acknowledges transfers and 'leases' provided both parties notify the processor and the lease is at least 1 year long. There is no legal agreement that binds PHD to any 'quota' commitment.

The Ministry of Agriculture, PHD and the 2 farmers' organisations at the time, BDBPA and BALDECS participated in the negotiations. Pine Hill Dairy used the average of production over the previous 3 production years as the basis for determining initial base quota levels.

The quota system as it stands today is somewhat irrelevant. Quotas work under a triad of import coordination and milk price support. Milk production in Barbados is low and the quota system serves to restrict entry rather than to support farm prices. New entrants must buy a farm, buy or lease quota or convince PHD they are will to accept excess quota prices.

Some farmers leave the industry but continue to hold the quota. There is no fluid market for quota sales. If a farmer keeps a quota without producing milk, he essentially curtails that allocation from another potential farmer. PHD has not recently raised quota levels. In 2009, PHD paid farmer BDS$2.30/kg for in quota and BDS$1.45/kg for quota excess. PHD only pays farmers the in quota price for milk that is actually used as fluid milk. They receive the excess quota price for any milk used in milk products, even if the volume of milk delivered is below the quota amount. In addition, Pine Hill Dairy pays the quota price based on 3 price grades – BDS$2.30/kg for milk containing in excess of 12.2 per cent milk fat; BDS$2.28/kg for milk fat content in excess of 11.49 per cent but under 12.2%; and BDS$2.08/kg for milk fat content below 11.49 per cent. Excess quota prices are based on the cost to PHD of reconstituting imported milk powder into milk.

Appendix 4. Selected OLS results

Table 14. Fresh milk imports and real Barbados GDP

FRESH MILK	1980-1990	1980-1992	1995-2009
GDP Product	.570***	.547***	.875***
Per Capita Income Product	-.256	-.290	-.351
Distance	-.166	-.138	-1.312***
CARICOM	-.188	-.265	3.800***
Common Language	1.180*	1.199**	2.290***
Barbados GDP	8.520**	8.571**	.622
Constant	-204.053**	-203.633**	-36.586
N	155	170	225
R2-a	.187	.186	.407

Note: Results are rounded to three decimal places.
The numbers shown in the square brackets are the standard errors.
Asterisks * on coefficients represent statistical significance at *** 0.001, **0.01, * 0.05 significance levels.
All variables except the dummies are expressed as natural logarithms.

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