

Global Value Chains and Trade in Value Added: Assessing the US Corn and Soya Contribution into the Caribbean Poultry Industry

Govind Seepersad

Department of Agricultural Economics and Extension, University of the West Indies
St. Augustine, Trinidad. West Indies

C. W. Ardon Iton

Department of Agricultural Economics and Extension, University of the West Indies
St. Augustine, Trinidad. West Indies.

Dave Goorahoo

Department of Plant Science, California State University, Fresno, California. USA.

Abstract

Global Value Chains (GVCs) have become the norm in the analysis of trade in today's globalised economy. The process of international fragmentation of production has permitted both developed and developing countries to participate in trade and the creation of wealth. Effective trade policy in the contemporary environment has challenged our conventional wisdom on how trade is interpreted and measured. This study uses the GVC concept to examine the US corn and soya industry as it forms part of the poultry value chain in the Caribbean region. Focus is placed on the Trinidad and Tobago and the Organisation of Eastern Caribbean States poultry value chains. The trade in value added is given special attention in identifying the contribution made at each node within the chain.

Keywords: Global Value Chains; Trade in Value Added; US Corn and Soya Industry; Poultry Meat; Food and Nutrition Security

Introduction

The Organization of Eastern Caribbean States (OECS) is a group of “Small Islands” comprising of ten full Member States: Antigua and Barbuda, Dominica, Grenada, Montserrat, St Kitts and Nevis, Saint Lucia and St Vincent and the Grenadines; and Associate Members: British Virgin Islands, Anguilla and Martinique (OECS, 2016). As is the case with many global small states, commonly defined as a country or island with less than 1.5 million people (Prasad, 2004), the OECS has been seeking to develop strategies to save foreign exchange and expand employment opportunities for its resident population. One area of concern has been the imports of meat products to address shortfalls in domestic supplies, a situation not significantly different from the findings by Walters and Jones (2016) who found that overall food import into the Caribbean was significantly influenced by the per capita value of agricultural production. According to the data accessed from the International Trade Centre (ITC, 2016) indicated that Caribbean poultry imports in the OECS increased by 33% in 2012 when compared to 2007 (Table 1). Overall, the selected meat categories in 2012 increased by 27% when compared to 2007. Policy makers will surely seek to reverse this trend as food and nutrition continue to be of major concern, where foreign exchange becomes scarce and, in a scenario where the decline of bananas have provided very little alternative for agribusiness investors.

Meat	2007	2012
Poultry	32721	43398
Beef	1903	1627
Swine	1679	1480
Sheep & goat	909	577

Data Source: ITC Trade Map Database available at <http://www.trademap.org>

Food and Nutrition Status within the OECS: Food and nutrition security is of particular importance in the OECS, given the wide disparity in agricultural activity and income levels in many of the member states. At the 1996 World Food Summit, food security was defined as existing “when all people at all times, have access to sufficient, safe nutritious food to maintain an active and healthy life”¹ (FAO, 2006). Since then, there have been several modifications/variations of the definition depending on the perspective of the researcher (Pinstrup-Andersen, 2009). A more comprehensive definition of food security by the United Nations relate to the condition “when all people at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (IFPRI, 2016). This definition hinges on four pillars:

- (1) Food Availability – sufficient food is available;
- (2) Food Access – social and economic access to food;
- (3) Food Utilization – safe and nutritious food can be utilized;
- (4) Food Stability – food for all people at all times.

Focusing on pillar 1 – Food Availability – this consists of two main components, domestic food production and food imports. The average supply of protein of animal origin is shown Table 2 for the OECS member states. Antigua and Barbuda, Dominica and St. Vincent displayed an increasing trend for the average protein supply of animal origin for the period while the remaining member states showed a declining trend.

Country	2004-06	2005-07	2006-08	2007-09	2008-10
Antigua & Barbuda	53	57	58	60	60
Dominica	50	51	53	54	55
Grenada	50	50	49	48	48
St. Kitts & Nevis	48	44	44	43	43
St. Lucia	57	57	55	54	53
St Vincent and the Grenadines	45	46	47	48	48

Source: FAO Statistics Division<<http://www.fao.org/faostat/en/#home>>

Another important indicator of the diversity of the food supply is the average protein supply (3 year moving average), as shown in Table 3. Here Antigua and Barbuda, Dominica and St. Vincent again displayed an increasing trend for the average protein supply for the period, while the remaining member states showed a declining trend.

Country	2004-06	2005-07	2006-08	2007-09	2008-10
Antigua & Barbuda	77	82	83	85	85
Dominica	91	93	94	95	95
Grenada	76	76	75	74	75
St. Kitts & Nevis	76	72	73	73	73
St. Lucia	91	91	89	88	88
St Vincent and the Grenadines	81	83	84	86	86

Source: FAOSTAT (2017) Statistics Division<<http://www.fao.org/faostat/en/#home>>

Justification for the Study: Utilization of Foreign Exchange and Prevalence of Undernourishment: Where is the solution?

The changing global economic environment has challenged traditional approaches to addressing hunger. Social safety nets and other measures that provide targeted assistance to the most vulnerable population groups have received growing attention. The importance of such targeted measures, when combined with long-term and structural interventions, lies in their ability to lead to a virtuous circle of better nutrition and higher labour productivity. Direct interventions are most effective when they target the most vulnerable populations and address their specific needs, improving the quality of their diet.

¹ FAO Policy Brief. Food Security<<http://www.fao.org/forestry/13128-0e6f36f27e0091055bec28ebe830f46b3.pdf>>

Even where policies have been successful in addressing large food-energy deficits, dietary quality remains a concern. Southern Asia and sub-Saharan Africa remain particularly exposed to what has become known as “hidden hunger” – the lack of, or inadequate intake of micronutrients, resulting in different types of malnutrition. This has also been a cause for concern in many parts of the Caribbean region² (FAO, IFAD and WFP, 2015).

Prevalence of undernourishment can be defined as a state lasting for at least one year of the inability to acquire enough food³ (Roser, 2017). This indicator provides an insight into the proportion of the population at risk of not covering the food requirements associated with normal physical activity. The Prevalence of undernourishment is one of the official Millennium Development Goal (MDG) indicators to monitor the “hunger” target. Prevalence of undernourishment in Table 4 illustrates the pervasiveness of undernourishment for the OECS member states for the period 2006 to 2013. As illustrated in Table 4, Dominica has the lowest proportion of its population at risk of caloric inadequacy for the period. The <5% achieved in Dominica is the same percentage determined for developed countries. The average for the world in 2013 was 12%, so Antigua & Barbuda, Grenada and St. Kitts & Nevis still have to stride to make the world average.

Country	2006-08	2007-09	2008-10	2009-11	2010-12	2011-13
Antigua & Barbuda	26.7	25.1	23.2	20.8	17.2	13.9
Dominica	<5	<5	<5	<5	<5	<5
Grenada	26.0	25.1	23.1	20.6	19.2	18.7
St. Kitts & Nevis	20.0	18.4	17.8	17.1	14.3	10.2
St. Lucia	11.7	11.7	12.8	13.7	13.8	12.2
St Vincent and the Grenadines	6.8	6.2	6.0	5.7	5.4	5.5

Source: FAOSTAT (2017). Statistics Division<<http://www.fao.org/faostat/en/#home>>

Trade in Value Added: Pascal Lamy, the former Director-General of the World Trade Organization (WTO)⁴, as cited by Duval et al., (2015), stated that “the statistical bias created by attributing the full commercial value to the last country of origin can pervert the political debate on the origin of the imbalances and lead to misguided and hence, counter-productive decisions”. Precisely measuring and quantifying trade in value added remains a challenge, but the lack thereof has served to distort trade policy formulation and planning as governments look at the end costs—the outflow of foreign exchange from the country rather than contributions or benefit/cost ratios of such expenditures. This paper seeks to provide a cogent analysis of the trade in Value Added (VA) and the benefit/cost (B/C) of such.

Global Value Chains: The concept of Global Value Chains (GVC), basically defined as all the people and activities involved in the production of a goods or service (Van Dijk & Trienekens, 2012) has opened up a new realm of thinking, facilitating a more outward focus from national borders to one of cross-world trade. The concept of measuring final goods has moved to direct focus on trade in intermediary goods and the impacts they may have on economies. Ideally, Global Value Chain studies typically include research and design, inputs, production, distribution and marketing, and sales, and in some cases the recycling of products after use (Gereffi & Fernandez-Stark, 2016). In some cases, the study may be limited to the trade cost components such as international transport costs or costs of moving good from the factory of the deck of a ship at the nearest seaport. For example, the GVC of a product may involve the actual shipping costs of a container to various destinations, or more aggregate CIF/FOB ratio defined as the value of imported merchandise measured on a cost, insurance and freight (CIF) basis in percentage of the value of the same goods measured on a free on board (FOB) basis. In addition, the costs of preparing trade documentation, customs clearance, goods transport and handling at the port may also be included.

²The State of Food Insecurity in the World, 2015. Meeting the 2015 International hunger targets: Taking Stock of Uneven Progress. <<http://www.fao.org/3/a-i4646e.pdf>>

³Max Roser (2017) – ‘Hunger and Undernourishment’. <<https://ourworldindata.org/hunger-and-undenourishment/>>

⁴Yann Duval, Aman Saggi and Chorthip Utoktham (2015), Value Added Trade Costs In Goods and Services, ESCAP Trade and Investment Division, TID Working Paper No. 01/15, 28 May 2015. Bangkok. <<http://www.unescap.org/publications>>

Increasingly, companies and alliances have been dividing business operations around the world and providing rigidity to historical relationships rather than directing trade based on just cost and price competitiveness. This study looks at product development at two levels (i) component manufacture and assembly of food products within the United States of America (USA) for sale in an overseas market and compares it to that of a food assembly chain in another country for sale in the domestic market. The study looks at the finer division of operations, services and labour in two complex international feed-grain / broiler meat production chains.

Methodology

Account of the GVCs in the feed-grainbroiler meat production chain makes use of exports and intra-national trade data on a value added basis. The data was sourced from the International Trade Centre (ITC) Trade Map Database⁵ (ITC, 2016). This database deconstructs trade data into the 8-digit level for various products and its exports to each country, e.g. St Lucia and Trinidad and Tobago, and the changes in values are deconstructed and further accounted using industry information. Intermediate products trade was also taken into consideration.

There are several advantages to using value added data instead of gross shipment and output data. It offers an alternative approach to measuring trade costs and also takes into account both goods sector and services sector. The most challenging part of calculating trade costs was obtaining gross output data that was comparable across countries and as such, a unit cost value-added component was adopted for each country in the analysis.

Value-added export of product from a country “I” to a country “J” in a particular industry (sector), was calculated by summing up all the value-added export of that source industry (sector) from source country “I” across all the destination industries (sectors) in the destination country “J”.

Countries in the Study: Three CARICOM countries are covered in this analysis which includes (i) St Lucia (ii) Trinidad and Tobago and (iii) the USA. The USA is used as the datum for the study. Here, the feed grains and broiler chicks value chains begin and extend at various reaches across the different countries of the study. St Lucia is a net importer of broiler meat; Trinidad and Tobago is an importer of feed grains, finished feeds and broiler eggs for hatching into chicks. The value added for each chain is computed, and shadow prices were used for consistency.

Feed ingredients are broadly classified into cereal grains, protein meals, fats and oils, minerals, feed additives and miscellaneous raw materials such as roots and tubers (Poultry Hub, 2017). Protein is provided from both vegetable and animal sources, such as oilseed meals, legumes and abattoir and fish processing by-products. Vegetable protein sources usually come as meal or cake, the by-product of oilseed crops. The main oilseed crops include soybean, rapeseed/canola, sunflower, palm kernel, copra, linseed peanut and sesame seed. Oilseed meals make up 20-25% of a poultry diet. Inclusion levels do vary among formulations for different species and for the same species in different regions (Table 5). The study seeks to analyse the value added by a country (USA) in the production of a good. In this case, feed grains are either exported or converted to feed; broiler meat may also be exported. The study seeks to derive a fuller picture of commercial relations between nations; moving beyond the concept of trade driven by competitiveness but rather that of value added and benefits to the country.

Data Used in the Study

The various levels of HS 6 level data used in this study were obtained from the ITC Trade Map Database (ITC, 2016) as well as the United States Department of Agriculture (USDA) database (USDA, 2017). Data was also collected from a major integrator in the Trinidad and Tobago’s broiler industry.

⁵Trade Map. Trade statistics for international business development <<http://www.trademap.org/Index.aspx>>

Feed Stuff	Broiler Starter	Broiler Finisher
Corn	20	25
Rice tips	50	50
Wheat	20	30
Sorghum	5-7	7
Rice Polishing	10 -12	10 -15
Soybean meal	20	20
Fish meal	2 - 5	2 - 5
Poultry by-product meal	1 - 2	1 - 2
Blood meal	1 - 2	1 - 2
Tallow	1 - 2	1 - 2
Vegetable oil	1 - 2	1 - 2

Source: WinFeed (2012). The Cheapest Least Cost Feed Formulation Software
 <<http://www.winfeed.com/knowledgebase/a01.shtml>>

Value-added export of a country **X** to a country **Y** in a particular industry (sector) is calculated by summing up all the value-added export of that source industry (sector) from source country **X** and comparing the sum of all value added across all the destination industries (sectors) in the destination country **Y**. For the importing country, the sum of all the value added imported will be a cost to that country while the sum or all the value added in the destination country will be the benefit to the importing country. The value added that the importing country enjoys represents savings in foreign exchange, added employment to its residents, services and the multiplier effect in the economy.

Using the formula:

$$VA\ BCR = TVA\ Importing\ Country\ X / TVA\ Exporting\ Country\ Y.....(1)$$

Where,

VA = Value Added

BCR = Benefit Cost Ratio

TVA Benefit = Total Value Added in Importing Country (grow out = processing cost)

TVA Cost = Total Value Added in Exporting Country (eg. Feed cost + Chick Costs)

Feed for chickens meant for meat: Chickens meant for meat production require feed with a higher content of Digestible Crude Protein (DCP)⁶ (Business Ideas, 2017). From the first to the fourth week, the chicks require feed with a DCP content of between 22 to 24 %. From the fourth to the eighth week, the chicks require feed with a protein content of 21 to 22 % crude protein.

Broiler/feed ratio is the number of pounds of broiler grower feed equal in value to 1 pound of broiler, live weight. The methodology utilizes major raw feed component prices from Agricultural Prices, published by USDA's National Agricultural Statistics Service (Tables 6 - 8). The major feed components of corn and soybeans account for 83-91 % of the total ingredients in the rations⁷ (USDA, 2016).

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Avg 2/
2011/12	7.50	6.98	6.97	6.57	6.94	7.10	7.13	6.96	6.84	6.79	8.46	8.44	7.22
2012/13	8.15	8.16	8.18	7.85	7.70	7.70	7.85	7.11	7.50	7.58	7.10	6.07	7.58
2013/14	5.27	5.13	5.06	5.06	5.03	5.32	5.65	5.65	5.51	5.14	4.64	4.48	5.16

Source:USDA (2016) Feed Grains: Yearbook Tables; USDA ERS <<http://www.ers.usda.gov/data-products/feed-grains-database/feed-grains-yearbook-tables.aspx#26761>>

⁶Business Ideas (2017).Poultry Feed Formulation Methods For Broiler And Layer

PDF<<http://www.practicalbusinessideas.com/2014/09/poultry-feed-formulation-methods-for.html>>

⁷USDA (2016).Feed Grains Database<<http://www.ers.usda.gov/data-products/feed-grains-database/documentation.aspx>>

Table 7: Feed-price ratios for livestock, poultry, and milk

Ratio and mkt yr 1/	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Avg 2/
Broiler-feed 3/ 4/													
2011/12	2.80	3.00	3.20	3.30	3.20	3.40	3.60	3.10	3.20	3.10	2.60	2.50	3.08
2012/13	2.80	2.90	3.20	3.40	3.60	3.50	3.70	3.80	3.90	3.80	3.40	3.30	3.44
2013/14	3.70	3.90	4.20	4.10	4.20	4.00	4.60	4.60	4.90	4.80	4.90	4.80	4.39
2014/15	5.90	6.10	5.80	5.20	5.40	5.00	5.40	6.00	6.20				

1/September-August. Latest data may be preliminary.
2/ Simple average of monthly prices for the marketing year.
3/ National average prices are used in the calculation. Effective January 1995, prices of commercial feeds are based on current U.S. prices received for corn, soybeans, alfalfa hay, and all wheat.
4/ Pounds of broiler-grower feed equal in value to 1 pound of broiler, live weight.
Source: USDA-NASS (2016). USDA, National Agricultural Statistics Service, Agricultural Prices.<<https://www.nass.usda.gov/>>

Broiler/feed ratio is the number of pounds of broiler grower feed equal in value to 1 pound of broiler, live weight. This study used a conversion of 5.90:1.

Table 8: Byproduct feeds: Soybean meal, high protein, Central IL

Average wholesale price, bulk, specified markets (dollars per ton)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg 2/
2011/12	301.45	292.22	281.66	310.65	330.37	365.96	394.30	415.17	422.60	515.83	564.69	529.37	393.69
2012/13	488.46	466.16	460.09	431.39	440.67	437.33	422.07	465.72	496.78	544.59	464.91	500.39	468.21
2013/14	443.63	451.13	498.31	479.54	509.25	497.82	514.01	519.38	501.72	450.79	490.33	525.72	490.13

Source: USDA-NASS (2017), National Agricultural Statistics Service, Agricultural Prices<<https://www.nass.usda.gov/>>

Table 9: Benefit of Producing Broiler Meat vs Imports of Chicken Parts

	Cost Item (US\$)	USA Export Feed Ingredients to Trinidad and Tobago (TT)
USA Value Added	Corn	
USA Value Added	Soya Meal	
	Feed Cost/kg liveweight	0.60
	Meat Leg Qtr (\$/kg), Georgia Dock	
	Meat W/Bird (\$/kg), Georgia Dock	
USA Value Added	Freight Cost	0.12
USA Value Added	Feed Mill Wholesale Feed Prices	0.72
USA Value Added	Chick Cost	0.63
TT Value added	Grower Cost	0.50
	Liveweight (kg) at market	2.95
	Feed Conversion Ratio	2.00
	Feed Consumed (kg) (Liveweight * FCR)	5.90
	Feed cost/bird (liveweight * Feed price)	3.54
TT Value added	Medication	0.06
	TC: Broiler Cost of Production (\$/kg) Live Bird (Feed cost + grower + Chick+medication)	4.73
TT Value added	Transport	0.22
TT Value added	Grow out plus transport to processing plant	4.95
	Cost of production / kg = (TC /Livewt)	1.68
	Dress %	0.70
	Cost of Meat (kg) / bird	2.40
TT Value added	Processing Plant Cost plus margin	1.09
	Wholesale Selling Price ex-plant Whole Bird (\$US/kg)	3.49
	TVA: Total TT Value Added (\$/kg)	1.87
	Imported Whole Bird (Ex USA)	2.42
	Imported Wholesale Leg Quarter (Ex USA)	1.21
	Benefit (Market Price)	3.49
	Cost (Cost of Prod'n)	2.40
	B/C Ratio (Cost of production : Selling price ex plant)	1.46
	B/C Ratio (local cost price : Shadow Price whole bird)	0.99
	B/C Imported whole bird shadow price : Imported leg quarter shadow price)	2
	VA BCR=TVA/TE	1.39

3. Results and Discussion

This study compared bilateral trade costs, both between countries and / or regional groups in the year 2014. The value-added trade costs are calculated using data from the USDA database and local industry data. The trade costs were used to provide a datum for computation of the value added. The study began by comparing trade costs on a cross-section basis in 2012/14 average and bilaterally between countries in the goods sector. The study then analysed the relationship between increasing involvement in the global value chain of intermediate goods using costs and finally extend the analysis to the policy effect – Net Economic Benefit to the various countries as case studies (St Lucia and Trinidad and Tobago). The results are presented in Table 9.

The study found:

1. Using the shadow price of whole bird of \$2.42/kg at Castries, St Lucia cold storage plant (thus assuming no border protection), the Benefit to Cost (B/C) ratio was 0.99.
2. The Trinidad and Tobago (TT) Model value added was equivalent to \$1.87/kg broiler meat. That is the cost of grow out, medication, transport, plus processing plant. Should St Lucia decide to grow birds using the TT model and achieve economies of scale, (plus border protection), they can benefit from this level of value added. This translates to a Benefit /Cost ratio (B/C) of 1.46.
3. St Lucia currently imports large volumes of leg quarters from the USA. Should St Lucia decide to import feed ingredients and process feeds in the country and grow out birds in lieu of purchasing leg quarters, the B/C ratio at the shadow price is estimated at 2.0, that is (\$2.42 / \$1.21) on a quality of meat basis.
4. BCR to importing country: Using the formula: $VA\ BCR = \frac{TVA\ Importing\ Country\ X}{TVA\ Exporting\ Country\ Y}$

Where:

TVA Benefit = Value Added in Importing Country (grow out = processing cost)

TVA Cost = Value Added in Exporting Country (eg. Feed cost + Chick Cost) VA BCR = 1.39

St Lucia can therefore consider using the foreign exchange it uses to import leg quarter and set up a feed mill and grow out operation in the country, given the net positive benefits. Benefits accrue more from the trade in value added concept --- spending on raw materials and adding value in the country. Benefits at each node include grower employment, transport services, processing services, and investor gains. Expenditure on primary commodities and moving other parts of the USA feed grain chain into St Lucia will accrue more benefits through the availability of a fresh broiler bird and healthier meats in terms of protein: fat ratio, thus providing a healthier nutritional base for its population.

1. The trade in final goods (FG) provided less benefits to St Lucia on a product basis; impacted negatively on quality (whole bird vs leg quarter) and access to high quality meats.
2. The trade in a segmented, inferior final product (leg quarter) dampened the incentive to invest in intermediate goods (IG) such as corn and soya meal, the latter of which has the potential to yield greater value added benefits.
3. The benefits from trade in IG yielded greater benefits in terms of VA to the final economy.
4. The trade in FG benefitted the USA to the detriment of USA's consumers (the cost of legs quarters are sold at a cost that is less than the cost of production of a whole bird and thus, consumers of chicken breast conceptually subsidizes the leg quarter consumers).
5. The trade in FG represented transfers from the USA to St Lucia.

This study sought to assess whether it makes sense to continue the current access to protein model (from the USA) or seek to add value within the country (St Lucia), much along the system used by its neighbouring country – Trinidad and Tobago. Using this unconventional trade analysis, it should ideally be advised that St Lucia should change this access to protein model given the net outflows and the limited benefits and adopt the trade in value added model as utilized by Trinidad and Tobago.

References

- Business Ideas. (2017). Poultry Feed Formulation Methods for Broiler and Layer PDF. <http://www.practicalbusinessideas.com/2014/09/poultry-feed-formulation-methods-for.html>. Last accessed on Feb 2017.
- Duval, Y., Saggu, A., & Utoktham, C. (2015). Value Added Trade Costs in Goods and Services. ESCAP Trade and Investment Division, TID Working Paper No. 01/15, 28 May 2015. Bangkok. Available at <http://www.unescap.org/publication>. Accessed Jan. 2017.
- FAO. (2006). Food Security. *FAO Policy Brief*. Food and Agriculture Organization (FAO) of the United Nations. <http://www.fao.org/forestry/13128-0e6f36f27e0091055bec28e830f46b3.pdf>. Last accessed Jan. 2017.
- FAO, IFAD and WFP. (2015). The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. Rome, The Food and Agriculture Organization of the United Nations (FAO), International fund for Agricultural Development (FAD), and World Food Programme (WFP). Available at <http://www.fao.org/3/a-i4646e.pdf>. Last accessed Jan. 2017.
- FAOSTAT. (2017). FAO Statistical Yearbooks. Statistics Division of Food and Agriculture Organization (FAO) of the United Nations, <http://www.fao.org/faostat/en/#home>. Last accessed Feb. 2017.
- Gereffi, G., & Fernandez-Stark, K. (2016). *Global value chain analysis: a primer*. Center on Globalization, Governance & Competitiveness, Duke University.
- IFPRI. (2016). Food Security. International Food Policy Research Institute (IFPRI). Available at <http://www.ifpri.org/topic/food-security>. Last accessed Jan. 2017.
- ITC. (2016). Data on Importing Markets in 2016. International Trade Centre (ITC) Trade Map for trade statistics for international business development. <http://www.trademap.org/>. Accessed Dec. 2016.
- OECS. (2016). About the OECS. Organisation of Eastern Caribbean States (OECS). Available at the following website (Last accessed Jan 2017): <http://www.oecs.org/homepage/about-us>
- Pinstrup-Andersen, P. (2009). Food security: definition and measurement. *Food security*, 1(1), 5-7.
- Poultry Hub. (2017). Feed Ingredients. Online Resource for feed ingredients for poultry diets. Available at <http://www.poultryhub.org/nutrition/feed-ingredients/>. Last accessed Feb. 2017.
- Prasad, N. (2004). Escaping regulation, escaping convention: development strategies in small economies. *World Economics*, 5 (1), 61-65.
- Roser, M (2017) Hunger and Undernourishment. *Published online at OurWorldInData.org*. Retrieved from: <https://ourworldindata.org/hunger-and-overnourishment/> on Feb. 2017.
- USDA. 2016. Feed Grains Database. United States Department of Agriculture (USDA) Economic Research Service (ERS) website. Last accessed on Dec. 2016. <http://www.ers.usda.gov/data-products/feed-grains-database/documentation.aspx>
- USDA-NASS. (2017). United States Department of Agriculture (USDA) & National Agricultural Statistics Services, Agricultural Prices. <https://www.nass.usda.gov/>. Last accessed Jan. 2017.
- Van Dijk, M. P., & Trienekens, J. (2012). *Global value chains*. Amsterdam: Amsterdam University Press.
- Walters, L. M., & Jones, K. G. (2016). Caribbean Food Import Demand: An Application of the CBS Differential Demand System. *Journal of Food Distribution Research*, 47(2), 19-37.
- WinFeed. (2012). The Cheapest Least Cost Feed Formulation Software. Least Cost Feed Formulation for Poultry. <http://www.winfeed.com/knowledgebase/a01.shtml>. Accessed on Nov. 2016