Estimating the Predictive Effects of Price Subsidies and Organizational Ties on

Tree Fruits Production in Haiti

By

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Dedicated to the memory of my beloved sister Kettia Polynice who provided me her support and smile.

To my love Laura and my daughter Taiga, for their love, encouragement and support.

To my parents Bona and Claudette, for their unconditional love. To my siblings, friends and relatives, for encouraging me throughout this journey.

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Abstract

This dissertation uses a two-phase estimation approach to analyze the impact on willingness to increase production of tree fruits (mango) and to allocate land, by considering price subsidies and key factors influencing household choices. The first phase estimates the likelihood that a producer is willing to accept the offered price and computes the share of land that the producer is willing and capable of dedicating to grow more trees. The analysis also determines the realistic number of trees that the allocated land can accommodate. The second phase deepens the conversation by including the effects of producers' organizational ties on willingness, land and trees.

The analysis draws from household surveys of more than 780 Haitian mango producers and interviews of 30 producers in northern and southern Haiti. It analyzes the willingness to produce under three price scenarios by performing *Ex-Ante* economic impact analysis through the use of double-bounded (DB) Contingent Valuation (CV) approach. The results shed some light on whether the push to increase mango exports can translate into increases in production and meaningful endowments. The net effect is that a reduction in price variability through price subsidies, coupled with social ties, results in an increase in willingness to produce, to allocate land and to grow more trees. The findings emphasize the needs for policy interventions in Haiti's fruit tree sector.

Acronyms

ACDI/VOCA	Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance
ANEM	l'Association Nationale des Exportateurs de Mangues
APHIS	Animal and Plant Health Inspection Service
APTA	Asia-Pacific Trade Agreement
ASPVEFS	Association des Producteurs-Vendeurs de Fruits du Sud
AVSF	Agronomes et Vétérinaires Sans Frontières
CAC	Conseil d'Action Communautaire
COPACGM	Coopérative de Production Agricole et Commercialisation Gros Morne
CPHST	Center for Plant Health Science and Technology
CV	Contingent Valuation
DBDC	Double-Bounded Dichotomous Choice
EDH	Electricité d'Haïti
FAO	Food and Agriculture Organization of The United States
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FDI	Foreign Direct Investment
FNAPCOM	Fédération Nationale des Associations de Producteurs pour la Commercialisation de la Mangue
FNE	National Fund for Education
GCC	Global Commodity Chains
GDP	Gross Domestic Product
GFP	Système de Gestion des Finances Publiques
GNP	Gross National Product
HASCO	Haitian American Sugar Company
HOPE	Hemispheric Opportunity Partnership Encouragement Act
HTG	Haitian Gourdes (Haiti's currency)
HUM	Hôpital Universitaire de Mirebalais
IDA	International Development Association
IFC	International Finance Corporation
IHRC	Interim Haiti Recovery Commission
IHSI	Institut Haitien de Statistique et d'Informatique
IMF	International Monetary Fund
KNFP	Konsèy Nasyonal Finansman Polilè
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural
MERCOSUR	Southern Common Market
MIF	Multilateral Investment Fund
MLE	Maximum Likelihood Estimates
NAFTA	North American Free Trade Agreement
NGO	Non-Governmental Organization
NRM	Natural Resource Management
OAS	Organization of American States

ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
PDAE	Paris Declaration on Aid Effectiveness
PIH	Partners In Health
TNC	Transnational Corporations
TVA	Tennessee Valley Authority
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
WDI	World Development Indicators
WFP	World Food Program
WTA	Willingness-To-Adopt
WTO	World Trade Organization
WTP	Willingness-To-Pay
ZL	Zanmi LaSante (Friends of Health)

Chapter 1 - Introduction

Haiti is looking for ways to increase and diversify its portfolio of economic opportunities, to

raise the value and volume of its tree fruit production, and to increase income. A critical

economic development challenge for Haiti is to find sources of financing other than foreign

assistance from the North and to actively invest in growth sectors to fuel its economic growth

potentials. For a small economy like Haiti, diversifying the sources of capital investment to

attract international bond market and foreign investors can be a tall order. In absence of an

outstanding reputation for reliability and performance, a reasonable approach is to start valuing

and to make good use of available domestic resources. Whether they are human resources in the

form of population growth, manufacturing resources, or natural resources, valuing local assets

for their potential economic impact on welfare can go a long way in attracting investments and

generating income.

For many decades, Haiti has registered a significant decrease in foreign direct investment (FDI)

and a surge in foreign assistance to support the reversal of economic decline and to absorb

natural disaster shocks.[1] The culture of foreign aid presents Haiti not as 'half-empty,' but as an

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[1] See Polynice's (2012) analysis of Official Development Assistance (ODA) grants from the top

three bilateral donors to Haiti where he emphasizes the post Paris Declaration on Aid

Effectiveness (PDAE) period to argue that aid-financed consumption of goods and services

originating from donors' countries greatly contributes to repress local assets. He analyzes the

issue of aid program harmonization, with a focus on the relationship between the aggregate

disbursement amount and the number of programs that the bilateral donors initiate.

empty glass, setting up the unfavorable expectation that the country is only passing its hat around. Therefore, policy makers and leaders who are seeking to place Haiti on a development path have overlooked meaningful local endowments that have become lost in the clouds of ephemeral foreign aid. The general context of production has diminished, mainly due to politically-induced unstable market and harsh natural disaster shocks that also affected services and infrastructure. These circumstances team up with the political economy to inflict diminishing returns to small producers and to fade the traditional image of Haiti as an agricultural exporting country.

Some critics blame Haiti's languishing economic condition on the early colonizers for retracting wealth to the metropolis (Corbett, 1995) or for isolating and plunging the country into heavy debt right after independence (Zéphir, 2004). Others point to the malfunctioning of the state, widespread corruption, ineffectiveness of aid, and the lack of resources as contributing factors to the state of instability (Buss & Gardner, 2008; Fatton Jr, 2002). More specifically, in a Wallerstein's (1979) line of thinking, Trouillot (1990) sees it as a case of "state against nation" and as an alliance of political leaders and merchant bourgeoisie, where the rural farming population represents the periphery subject of a tiny local metropolitan elite. Today, this relationship reproduces itself in the forms of market-friendly relationships between producers and buyers that often mask the real winners and losers. In other terms, the structural makeup of the country produces self-servicing leaders who are concerned with power and maximizing their pockets. Trouillot maintains that, "the touchstone of Haiti's socioeconomic system has thus been a peasantry that worked more and more but produced less and less, as population increased and the availability of fertile land decreased" (1990, p. 84).

In addition to the above-mentioned perspectives, there is an array of writings that provides different perspective and varying assessments of the character of the Haitian state.[2] To paraphrase Scarano (2007), to many contemporary Haitian scholars, the demographic literature seem "tainted with the obsession over run-away population growth," which may have far-reaching implications.[3] For instance, focusing more on the economic aspect, Lundahl (1992) attributes Haiti's conditions to the interaction between population growth and erosion and the resistance to innovation. Lundahl maintains that, "it is impossible to explain Haiti without making reference to the growth of the population as the triggering factor" (p. 58). With that growth comes an increased demand for charcoal, due to the limited use of the country's plentiful renewable energy, such as wind, solar and biomass. Collier (2009, p. 4) connects the "acute pressure of land" to the population growth thesis, to convey a similar message to Lundahl's that Haiti's increasing population represents a liability rather than an asset. The premise that Haiti's population is more of a liability than an asset seems to be attributed to ineffective management of domestic resources, rather than in population growth.

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[2] For different prospective and varying assessments of the Haitian state, for example, see the work of: (Anglade, 1982a; Castor, 1988; Dubois, 2012; Dupuy, 1989a; Fass, 1988; Nicholls,

[3] For a different and insightful perspective, refer to the work of Scarano on the study of population patterns and the impact of demographic stratifications on Puerto Rico's population history (Scarano, 2007).

Dupuy (1989b) counter-argues that Haiti's soil erosion is mainly the result of commercialization

of wood that served primarily as an export crop during the nineteenth century. Anglade (1982b)

joins Dupuy to state that the root cause of Haiti's deforestation is not tree cutting for charcoal,

per se, but the wood export. In the past, tropical trees, such as campêche and mahogany, were

available throughout the country. Today, many of these tropical hardwood species have virtually

disappeared from Haiti's soil, which records almost 90 percent deforestation. Although the rural

farmers are left to bear the bulk of the responsibility of deforestation and domestic resources

mismanagement, tropical hardwoods – especially that of mahogany and campêche trees – were

exported make pricy furniture for wealthy clients in developed countries. Ineffective governance

and mismanagement generally breed corruption and to often lead to the inability for a country to

attract meaningful investment, to create employments and increase income.

The wood-cutting and lumber businesses started with the colonial powers who then passed the

baton to elite exporters, starting from the 1700s to the second half of the 1900s. Exports of

mahogany hardwoods, once the most profitable export crops from Haiti, "were channeled

through foreign mercantile houses that were allowed to operate out of eleven open ports,"

suggesting high volume of hardwoods leaving the tiny island of Haiti (Fiehrer & Lodwick,

1997). [page #] In 1808, an estimated 40,000 mahogany trees left Haiti for Europe (Malte-Brun,

1827). Foreign companies, such as Lloyd & Cy, in complicity with the Haitian government,

received lucrative contracts to cut and export trees, as Moral (1978p. 50) explains:

> The tree cutting contracts also generate material political rewards. The companies that
>
> benefit from these contracts flourish; the government grants leases for 10 to 60 years to
>
> exploit areas that are still untouched, that is to say "adjacent islands, " of *La Gonâve, La*

Tortue, l'Ile à Vâches and even les *Cayemites*, are surrendered to the devastation. The island of *La Tortue* was the object of four consecutive contracts (in 1862, 1875, 1892, and 1899), none of which ever reached their normal terms, which attracted foreign investment from the British and the French...

In addition, in 1891, Moral reports that 165 million pounds of campêche were shipped out of Haiti; and of the 35,000 mahogany trees exported from the country, 75 percent were shipped out from the port of Gonaives. Today, the Gonaives region is one of the most deforested areas of the country. The lumber export business seems to have left more significant and lasting negative impacts on Haiti's landscape than dictatorships and coup d'états. Simple rain causes major damages to basic infrastructure. Among the many devastating natural disasters, on September of 2008, hurricane Hanna inflicted major pain to the city of Gonaives, causing flooding and the lost of human lives, livestock, and crops. As a result of the tree cutting business, torrential rains that would otherwise benefit agricultural production become a nightmare that causes erosion. Even moderate rainfall often carries away fertile land to the ocean and causes rivers to overflow, cuts roads and brings down bridges.

It is also necessary to mention that the deforestation and soil degradation phenomena have been occurring throughout history along with agricultural expansion and economic growth (Sunderlin et al., 2005), which arguably have benefited the human race. Striking the harmonious balance between maintaining natural forests and livelihood seems to be at the heart of these arguments.

Although it is important to understand the root causes of an issue to avoid its eventual repeats, it is even more significant to find possible solutions. Similar to other countries that effectively manage their human and natural resources to achieve economic growth, in the right policy environment, Haiti can do the same. Nearly twenty percent of the world population lives in China; at the same time China's greatest asset is its population (Asia for Educators, 2009). China's population growth preceded its recent economic growth. The doubling increase in China's population occurred well before it became an industrial and a manufacturing powerhouse. In spite of the challenges to meet the resource demand from its population, China simultaneously managed its population and successfully achieved economic growth because of its people. Even today, after implementing its contentious "One-Child Policy," the annual net increase in China's population is greater than the entire Haitian population of 10 million. One could argue that there territorial and structural differences between the two countries; However, effective resource management is a common denominator that transcends territorial differences.

From a population density standpoint, South Korea, Israel and the Netherlands, to name a few, are more densely populated than Haiti. For instance, South Korea's population density is 503 per km^2, in comparison with Haiti's 385 per km^2. At the beginning of the 1960s, South Korea joined the ranks of developed nations, with impressive industrial advances. Presently, the country tops the list of developed countries with the best education systems. South Korea managed to effectively upgrade its comparative advantage in labor to transform its economic structure and systematically boost value-added contents of its exports and imports (Kim, 2011). Particularly relevant to the discussion on erosion and environment management, reforestation was an integral part of South Korea's development plan. Kim reports that after World War II and after the

Korean War, South Korea's entire forests were cut down for lumber to build ships and to satisfy domestic demand for lumber. This lumber exploitation had similar environmental effects to that of Haiti, in terms of deforestation and erosion. Again, in some ways similar to mountainous Haiti, "Korea's mountains sit on bedrocks made of granite or granite gneiss that make its landscape prone to weathering and soil erosion" and its terrain makes it "susceptible to landslides and floods during the rainy season and droughts during the dry season" (Kim, 2011, p. 245). Yet, Korea managed to effectively repair its environment; because of the productive use of its human resources. Above all, the notion of effective management and valuing of domestic resources remain the recurring themes in these examples.

The broader issue of Haiti's development attracts policy makers and generates diverse thoughts on placing the country on an economic growth path. Among the leading prescriptions for this quest is the production of tree fruit exports. Increased international demand for agricultural/natural resources and diversification into nontraditional exports is a strategy that leaders often advocate as a way for developing countries to use their comparative advantage in lower labor costs and to achieve growth in the agricultural sector. For Haiti, this advantage seems to be in tree fruit production. Given the predominantly rural nature and the pressing need to generate income and improve welfare, many consider fruit exports as an ideal mechanism to extend the benefits of commodity trade directly to rural communities. Particularly, the widespread ownership of mango trees across the country and the recurring seasonal waste of various mango varieties seem to argue that these 'low-hanging fruits' have the potential to generate broad-base income increase.

United States consumers pay a price premium of approximately 50 percent over its regional competitors for Haiti's unique mouth-watering Madame Francis mango variety, making it one of the highest prices on the export market.[4] Consequently, the country seemingly has a comparative advantage in producing first-rate quality mangoes. Based on USDA data and direct interviews with the producers, there is a significant price spread from the producing node to the consumer node. On average, during the 2011, 2012 and 2013 seasons, the Haitian producer received U.S. $1.00 (45 *Gourdes*) for one (1) dozen of Francis mangoes. The exporter received the average FOB (U.S.) price of U.S. $8.29 per box of 10 lb.[5] The average U.S. market terminal price is $10.55. Finally, at the retail point, the consumer pays an average of $31.80 per dozen of Haitian mangoes. At a glance, the price spread from the producer to the consumer warrants an empirical analysis to determine the effects of price changes at the farm level.

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[4] Based on USAID market data, the unit of measure for the exports of the Francis mango is the dozen (USAID, 2010). The standard exportable weight of a single (1) Francis mango is approximately 700 grams and, accordingly, one (1) dozen of Francis mangoes weighs approximately 8.40 kilograms or 18.48 pounds.

[5] See the USDA market news for additional details on price, volume, and receiving points at http://www.marketnews.usda.gov/portal/fv. The USDA explains FOB (free on board) price as representing the "open market (spot) sales by first handlers at point of production or port of entry on product of generally good quality and condition." In this instance, it refers to port of entry price. The Terminal Market price represents "sales by first receivers to retailers or other large users of wholesale lots of generally good quality and condition."

Policy debate still tends to advocate welfare increase through production increases, while sidestepping the price factor. Advocates of growth generally leave it up to the market to drive prices – based on free-market principles – even though Haitian producers are operating in constraining conditions while struggling to negotiate markets and mitigate risks. The key issue is not the advocating of a production increase, *per se*, under the assumption that the market demand will also increase. On the contrary, Haiti needs as many trees as possible to make up for centuries of tree cutting for export and for fuel. Given the local demand for fresh fruits, juice, puree, and dried fruits, increasing production while minimizing waste remains imperative. The introduction of agro-processing plants would significantly increase the demand for raw materials, in addition to adding value to the remaining non-export varieties. Rather, the contention dwells in the neglecting of the fundamental factors conducive to that increase. The decision to intercrop staple crops and tree fruits places producers in the middle of a constant search for suitable means to satisfy household demand while meeting the market challenges. These challenges generally surface in the forms of agrarian asset constraints, credit access, information asymmetry, and postharvest loss.

To that end, producers' interactions with peers and their ties to organizations are means of overriding some of these challenges that often create a conundrum in the decision to produce the cash crop. Certainly, most Haitian producers are well aware of the advantages of organizational ties and networking with peers. Indeed, the degree of economies of scale, the transaction costs and their ability to meet requirements are likely to influence their willingness and capacity to produce for the export market. In general, producers agree that farming delicate landscape with rudimentary tools would be more laborious without the joint effort of family labor and neighbors

and the absence of networking and ties with organizations. Each of these challenges may carry enough weight to induce the aversion effects on small producers. The combined effects of these factors may impede the general adoption process and create the adverse income effects.

Despites the shock waves that affected the Haitian economy in recent years, the country manages to be one of the major exporters of organic mangoes in Latin America and the Caribbean region. Currently, Haiti exports approximately 2.5 million boxes of USDA-certified Francis mangoes to the U.S. market, a number that USAID and various agents are looking to increase to 5 million boxes by 2015 (USAID, 2010). Achieving this increase is well within the realm of possibility, given the current production and postharvest loss of more than 50 percent of the total yield.

These conditions entice policy makers to advocate a greater integration of the country into world markets by promoting export-led production of tropical fruits. The common discourse is that the production of tree fruits for the export market has the multi-faceted benefits of generating income and providing much-needed environmental repair. Particularly, mango production attracts the interest of local agents, international agencies, multinational corporations, humanitarian organizations, and governments, in an effort to spike some degree of economic growth in Haiti. In recent years, USAID representatives have deployed efforts to rehabilitate mango production and to promote export. The agency supports the implementation of fruit fly detection and control programs and provides technical assistance to local organizations to improve their services and to increase their capacity. They also assist in the deployment of improved packing material and launch campaigns to support the use of new techniques that are based on measurable parameters. The continuance of such rehabilitation efforts seems to provide

a substantial boost to Haiti's production, capacity to sustain its export market share, and maintain its price premium.

In March, 2010, two months after the devastating earthquake, The Coca-Cola Company launched the Haiti Hope Project with the introduction of its Odwalla Haiti Hope Mango Lime-Aid to support producers. The total investment in the Haiti Hope Project is 7.5 million dollars, with 3.5 million from The Coca-Cola Company, 3 million from the Inter-American Development Bank's Multilateral Investment Fund (MIF) and 1 million from the United States Government (CommodityOnline, 2010). This public-private initiative aims at developing a sustainable mango industry in Haiti. Whether or not these efforts will lead to meaningful and lasting endowments is a question that is beyond the scope of this study, however, they speak to the importance of this topic to various agents and to mango producers.

To reap the potential benefits of their mango trees, producers gravitate toward networking and organizing to circumvent the constraints and the lack of growth-oriented policies in the agricultural sector. When producers network with one another, they have access to technical assistance, knowledge, tools, and a range of services that would otherwise be unreachable to the resource-scarce producer in a weakly-functioning market. The organizations overcome some of these obstacles to reducing costs in the midst of market failure. What is less evident, however, is the producers' willingness to produce additional units at a given the price and how mango producers use their organizational ties to counterbalance market failures and acquire economic value. Also unclear are the actual impacts of these ties, coupled with subsidy-induced price changes, on production, on land allocation and on the number of trees.

Aims and Questions

The main purpose of this dissertation is to determine how a prospective policy to subsidize producers' selling price, considering organizational ties, influences the average producer's decision-making process. The subsidies mimic market price changes, where a demand increase or a disruption in supply could apply upward pressure on prices and *vice versa*. The rationale for analyzing the expense-subsidy effects is based on prior positive effects of similar programs on supporting struggling farmers, on land allocation for the subsidized crop, and on the much-needed reforestation (Chibwana, Fisher, & Shively, 2012; de Graaff & Eppink, 1999; Dolisca, McDaniel, Shannon, & Jolly, 2009). I am also aware of the adverse effects of unsuitable subsidy-policies that sometimes have led to over-production and shifted wealth away from small producers that the program intended to help (Dimaranan, Thomas, & Roman, 2004). In the Haitian context, despite the overwhelming constraint-induced waste from current production and the market risks, the case of over-production of tree fruits is far from being an issue. Besides, the Haitian population consumes subsidized food on a regular basis, either through foreign assistance or through the liberalization of the markets that facilitates imports from OECD countries where agriculture is heavily subsidized. It seems fitting to assess the impacts of similar programs on struggling Haitian households through expense subsidies that could ultimately affect the price that producers receive for their products.

With respect to price, two main groups bear the bulk of the risks of positive or negative market price variability: growers and exporters. These two groups constitute the main drivers of mango production, marketing, sales, and distribution. A third group could be part of the list, if the agro-

processing sector was developed. Myers (1993) drew similar subdivisions in analyzing coffee price risks in Costa Rica. This study, however, focuses on offering subsidies to small-scale producers to minimize their risks, which in turn has direct affect on exporter's costs of doing business. Producer's investments in mango trees are sunk and thus irreversible. As a result they tend to be more vulnerable to negative price change (Dixit & Pindyck, 1994). For instance, to paraphrase Dixit and Pindyck, if the price of mango falls to the extent that growing mango tree turns out, ex post, to be a catastrophic investment for the producer, it will also be considered a catastrophic investment by other producers; consequently, the ability to market the trees will diminish, resulting in sunk costs. Even more pronounced is the long gestation period before realizing actual production. When a producer delivers mango to an export-packing plant, he or she does not know in advance neither the price of the current delivery nor the price of subsequent deliveries. Therefore, the producers bear most of the risk of negative price changes. As a result, the proposed expense-subsidy would act as an assurance of a minimum price for the current and future harvest.

In terms of long-term investment in export-packing facilities, the sunk costs are also applicable to exporters. A key difference is that, compared to small-scale producers, exporters are in a position of bargaining strength. Another difference is that the exporters have the ability to sell before making a purchase, and they have the latitude to decide the speed of transmission of world prices to domestic producers. Consequently, these types of postharvest expense subsidies seem more appropriate for the producers.

I divide this quest into multiple specific aims. The first aim is to determine the impact of price changes and producers' characteristics on willingness to produce additional mango trees. This forward-looking assessment of how adding or subtracting a few cents to the price that producers receive per dozen of mangoes can potentially influence their decision to grow mango trees. Given the widespread ownership of mango trees among producers, what are the effects of a perceived price change and characteristics on mango producers' willingness to produce additional mango trees?

Another aim of the study is to assess the effect of price changes and producers' characteristics on willingness to allocate owned land and purchased-land to produce additional mango trees. Considering that number of trees depends on available land, it is complementary to also determine the predictive effects these factors of trees on owned land and/or on total land share. The questions I would ask are to what extent do price and household characteristics influence the predictive land share and the number of trees that the producer would produce? The assumption is that landed producers have a relatively low shadow price for growing additional trees, compared to the land-constrained producers; therefore, constraint-reducing policies, such as agricultural credit access and local agro-processing plants that could absorb the production, could lead to higher value to producers and some level of activation of rural land markets.

Lastly, the typical Haitian farmer is very familiar with networking with other farmers, in the form of informal *konbit* or formal organization. This paper attempts to assess the impact of organizational ties on a producer's decision-making process. The corresponding questions to this aim are: To what extent do organizations exert influence on producers' willingness to produce?

Can ties be too strong to the point of being a hindrance to price appreciation? I argue that organizations do exert considerable influence on a producer's decision-making process. By virtue of having a loyal membership body, organizations are less likely to influence upward change in price. Especially for organizations that serve as intermediary agents between the producers and buyers, too strong of ties may be a hindrance rather than a promoter of price appreciation.

To address these questions, this paper analyzes both qualitative and quantitative data. I analyzed the qualitative interviews through a reflexive interpretative analysis to ascertain the plausibility of each producer's experience and account. To analyze the quantitative survey data, I developed a series of econometric models that include Tobit and Maximum Likelihood Estimates (MLE).

Organization of the Dissertation

Chapter 2 presents a contextual framework of the study by reviewing the historical and contemporary elements in search of clues that could help explain Haiti's production environment and market. It reviews how historical factors influenced the availability of infrastructure and the necessary services for a prosperous agricultural sector. Establishing a spatial and temporal context is important to providing a broad view of the characteristics of Haiti. In addition, the chapter outlines the market forces and structural changes that applied downward pressure of income and general livelihood. Despite years of neglect, recent efforts to rebuild basic infrastructure seem to bear positive results in forms of new roads connecting various departments of the country.

In chapter 3, I present the market framework, from a commodity chain analysis that includes key related concepts, linkages and actors. Particularly, it presents the linkages from the production to the consumption point by considering local market dynamics, global market governance structures, constraints, competition, and the new trend to consider building local capacities. This latter point seems to dominate Haiti's economic growth discourse, in terms of capacity to process fresh fruits locally to diversify sale channels. Investment in agroprocessing could increase market diversification, enhance producers' competitiveness and bring about economic value.

Chapter 4 presents the data collection and methodology of this study. The field research took place in two different regions of Haiti, with participants who are exclusively mango producers. It uses a mixed-method approach to gather and analyze the data. The qualitative data analysis utilizes a reflexive interpretative analysis, while the quantitative analysis uses economic models.

Chapter 5 and 6 contains the empirical results. In chapter 5, I present the first set of empirical results by focusing on the main effects of the producers' characteristics on willingness to produce. It provides a conceptual framework of the economic models and reviews the literature on Contingent Valuation (CV). The chapter summarizes the survey and presents descriptive statistics of dependent and independent variables before formulating the models and sharing the results. In chapter 6, I provide a more detailed analysis that includes interaction terms between organizational ties and farm size and between organizational ties and region. I purposely omitted these variables to present various comparative levels of the study.

The dissertation concludes with a summary of the results and policy recommendations. In sum, this study is not only about trickling down a few cents to producers for growing more mango trees. It is about economic growth and the promotion of positive externalities that generally derive from adding more trees. Throughout the paper, I use the term 'price changes' pertaining to the nominal subsidy offers and I refer to 'price variability' in reference to market prices fluctuation.

Chapter 2 – Context of Production

The past is an easy target toward which to toss our present shortcomings. Haiti's unique past is a notoriously wide target containing layers of events that make it difficult to miss. The impact of infrastructure and services on producers' productivity and on Haiti's participation in agro-export during the last centuries could be a reference for what might go wrong. A large body of literature on development confirms that public expenditure in rural infrastructure represents a powerful tool for fostering economic growth. Investment in railways, roads, ports, airports, energy, communications and other infrastructure services stimulates productivity in agriculture and in other sectors of the economy. Equally important is how Haiti's past has influenced the role and availability of the infrastructure and services needed for agro-exports. In the regional context, given the relatively small size of many Caribbean countries, infrastructure development entails connecting interior land to seaports and represents a practical way to move goods from one location to another. Achieving this level of transportation means enabling coastal trade, enhancing productivity and reducing supply-side transaction costs.

The purpose of this chapter is not to take cover under history's umbrella or hide the present deficiency in infrastructure and services in Haiti. Rather, it is to review how some historical factors influenced the limited availability of infrastructure and services needed for a flourishing fruit and vegetable sector. In the context of nineteenth-century global commerce, infrastructure mainly refers to railways and primary products processing. In the current context, infrastructure and services encompass access to roads, ports, airports, railroads, electricity, functioning institutions, and education. Although numerous scholars study the cultural, social, commercial and political characteristics of Haiti (Plummer, 1984; J. Price-Mars, 1919; Young, Oct., 1959),

the infrastructural aspects related to the enabling of agro-processing and export, have limited coverage in the general discourse of Haiti's development. Understandably, relaying the adverse effects of infrastructure deficiency requires a spatial and temporal assessment. In discussing infrastructure and services, I divide this section into two parts: historical dimensions and contemporary context. For the purpose of this review, I consider the 1990s as the break between historical and contemporary characteristics of Haiti.

Historical Dimensions

Many of the factors that outwardly define the characteristics of Haiti and its food production system started to take shape during the early days of independence from colonial powers. The tiny colony on the island of Hispaniola was the engine that propelled commodity trade toward metropolis countries. Since agricultural machineries were almost nonexistent at the time, large-scale plantations (the hallmark of the Caribbean colonies) required large labor forces. To meet the production requirements, Europeans brought African laborers to the colonies to mass-produce commodities that were in high demand. Specifically, Hispaniola contributed a significant percentage to France's Gross National Product (GNP) in the 1750s (Corbett, 1995). In his well-known publication *The Wealth of Nations*, Adam Smith declared the French colony of Saint-Domingue "the most important of the sugar colonies of the West Indies, and its produce is said to be greater than that of all the English sugar colonies put together" (A. Smith, 1902 p. 319). The French exported a range of primary products to the metropolis for subsequent processing. A general understanding of the change from this large plantation and free labor system, to small-scale production and waged labor, can shed some light on our perspective of the current market and production structures of Haitian producers.

During the colonial era the division of labor represented the structure of industrialization; it forced the working masses into primary commodity production (McMichael, 2008). The principal European colonial powers of the sixteenth century – Spain, Portugal, Holland, France, and Britain – and their merchant companies, as McMichael enumerates, reorganized the world in terms of human trafficking and the exchange of manufactured goods for primary products. This reorganization of the world order shifted the lens of economics to zoom in on labor, production, consumption, and their geographical locations. These four economic pillars constituted the guiding principles that forged the colonial structure of the Western Hemisphere, specifically Haiti.

Production of raw material and foodstuffs took a great leap forward during the latter part of the nineteenth century, as Wolf and Erikson (2010) explain, in parallel with escalating demand and expanding world markets. Certain regions specialized in the production of raw materials, primary products, food crops, and stimulants that were unavailable in metropolitan Europe. Subsequently, these products served as industrial inputs and foodstuffs. These peripheral regions served as suppliers for the core markets that specialized in manufacturing, marketing, distribution, and consumption of fine products (Wallerstein, 1979; Wolf & Eriksen, 2010). Latin America and the Caribbean region characterize the "metropolis-satellite" relationship that existed during the colonial period (Frank, 1969 p. 10). Today, this relationship seems to reproduce itself within Haiti in the relationship between traditional commodity exporters and small producers.

During the seventeenth century, the peripheral region that extended from the southern land of

Brazil to the northern region of Maryland specialized in the production of goods that core

countries could produce (Wallerstein, 1980). The three main products – sugar, tobacco, and gold

– provided economic benefits to core states, including the Dutch Republic, England, and France.

Mintz (1986) delineates a clear connection between the sugar producers in the Caribbean and the

transatlantic consumers in Europe, between the plantation laborers and industrial workers.

Although all three commodities epitomized the core-periphery relationship, a single commodity,

sugar, exposed human behavior and defined power relations between the entities. The structural

components of Caribbean sugar production – including trade relations, processing plant

ownership, marketing, and distribution – prevented workers from tasting the fruits of their labor.

Today, within the structural framework of global market trade, advocates of Haiti's economic

growth push for a single variety of a single commodity export, the Madame Francis mango,

bringing to bear some striking similarities with the Caribbean sugar and banana trade of the last

two centuries.

However, the Haitian revolution of 1791 that led to independence in 1804 turned the large-scale

production structure upside-down by inflicting severe economic shocks to the world sugar

market and by deeply rooting the foundation for human rights. This revolution gave birth to the

modern human rights movement in the western hemisphere (Farmer, 2006; S. W. Mintz &

Trouillot, 1995) and put an end to the large-scale plantation system of production in favor of

small family-based landholdings (Dupuy, 1989a). These defining characteristics of Haiti's

agrarian structure started to take shape during the Pétion's administration. Haiti undertook Latin

America's first, and perhaps most radical, land reform in 1809, under the presidency of

Alexandre Pétion, by breaking the plantations into small parcels to donate to officers, soldiers,

and emancipated workers (Lundahl, 1996; Trouillot, 1990). Since then, for better or worse,

landholdings remain firmly grounded in the concepts of private property and the free market.

Although land distribution was a pacifying tool that was favorable to some and inequitable to

others, the reform was a stamp of modernity that ended the plantation system and began the

formation of a peasantry. Afterward, Chile implemented its agrarian reforms between 1965 and

1973, and there are some similarities to that of Haiti in terms of the interplay between a changing

class structure and a shifting agrarian structure (Santos & Sayer, 1979). An argument from

Locher (1988) states that land distribution is much more egalitarian in Haiti than has been found

elsewhere in Latin America and the Caribbean.   Farmers who do not have enough land use the

de moitié (sharecropping) system, which may take many forms.[6]   Large estates are virtually

absent in the country, except in a few cases (Locher, 1988). Systematic data concerning land

tenure in Haiti derive from the 1950, 1971, and 1982 censuses, which found that the distribution

of land was relatively even in the country, within the context of Latin America and the Caribbean

(Lundahl, 1991). Today most farmers own at least some land, with or without title, even in very

small plots.

The dismantling of the large-scale, export-led plantation system led to a decrease in sugar and

coffee exports in absolute value terms. Some critics point to the decrease in aggregate economic

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[6] *De moitié* is a sharecropping system that can take many forms in Haiti's farming community; it

varies from landowners providing the land and the inputs to tenants providing the labor and

inputs.

value from exports, resulting from land distribution, in order to blame Pétion for starting Haiti on the wrong development path. Notably, Leyburn (1980 p. 53) claims that although Pétion is worthy of eulogy, "his country was rich when he came to power and poor when he died; united in 1806 and divided in 1818." For Leyburn, many of Haiti's calamities, including social and economic mismanagement, can be traced to Pétion's mishandling of the country's assets. This is meant to convey that Pétion should have left the old plantation system intact to facilitate the continuation of large production for the export market. After all, the new Haitian proletariat and small producers remained integrally linked to the larger world economy.

During the early nineteenth century in the Americas, it would have been inconceivable to achieve *liberté, égalité, fraternité* without battling the colonial powers and without destruction of some physical infrastructure. A pacific demand for freedom and justice, verbal or written, would not have sufficed. Particularly in a lucrative colony like Haiti that exported valuable commodities to the metropolis, and where dialogues between masters and subordinates were nonexistent, reversing the old order to form a waged-labor society entailed significant destruction of existing infrastructure. Even after independence, the country resisted multiple attempts by the colonizers to restore the free labor system and large-scale plantations. However, against all odds and at the cost of significant destruction, Haiti emerged as a torchbearer of freedom and as a threat to colonial dominance in the region and beyond. Some argue that Haiti still bears the scars of its painful birth from slavery to independence, during which colonial infrastructure was destroyed. However, I would argue that, while key historical facts constrained Haiti for generations – such futile debts – and the knowledge of these facts is paramount in

understanding the present and in shaping future path, Haiti's major constraints derive from the contemporary era and not from the revolutionary epoch.

For more than two centuries, Haiti was an indebted nation, in one form or another. The country became a creditor nation when the French monarch Charles X pressed Haiti's President, Jean-Pierre Boyer for 150 million francs indemnity for the losses of the plantation owners and reduction of import and export taxes by half (Arthur, 2007, p. 21; Schoelcher, 1845, p. 276). By choosing to cave into the 1825 demand from King Charles X, Boyer place Haiti on a path of debt entrapment which severely diminishes the country's ability to build lasting capacities for years to come. This choice worsened the prospect of having access to education, to paved roads, and other meaningful capacities that could reduce postharvest transaction costs for smallholder. The debt agreement led to decades of French domination of Haitian finance, and had catastrophic effects on the new nation's delicate economy. Despite its nominal independence, Haiti could not escape the shackles of foreign domination (Farmer, 2006, p. 67). This massive amount represented ten times the country's entire national revenue, and it was only paid by borrowing from European bankers (Arthur, 2007). By the end of the nineteenth century, an estimated 80 percent of national revenue was devoted to the repayment of debts. To meet the first payment of 30 million francs under the terms of the ordinance, the government of Haiti was constrained to borrow the full amount from a private French bank, MM Ch Ternaux Grandolphe et Cie (Robinson, 2007, p. 21). In return, France finally officially recognized Haiti's independence.

To service the early debts, while maintaining some level of prosperity and independence, the strategy of the leaders was to increase agricultural production through the return of mass

production and free labor. Those who since the Revolution deserted agriculture were ordered to return to their respective work in the plantations (Moral, 1978).[7] Many newly freed slaves went into hiding and reverted to *marronage* to escape the plantations to evade mobility restriction (Sheller, 2000), to uphold cohesion of their *Lakou* (Ramsey, 2011), and to maintain autonomy over their own land and their own agricultural production.[8] The governments took all the necessary measures to increase the number of agricultural workers in the fields in the hope to increase output, a strategy that encountered various setbacks and resistance during the revolutionary period.

The early leaders imposed the legislative framework of *"Caporalisme Agraire"* (agrarian militarism), a system where former slaves were forced to work on properties seized by the leaders of the revolutionary war (Anglade, 1982a). Various governments in the early nineteenth century carried out this framework. Severe penalties were imposed on violators. The administration of Jean-Pierre Boyer, for example, went as far as restriction mobility with the enactment of the *Code Rural* of 1826. The *Code Rural* of Boyer was a set of ordinances that contained no provision for broad initiatives that could benefit the population in terms of physical capital, education, and services. Instead, it contains a series of ordinances to regulate farm labor and restrict mobility around the country. Workers were confined to specific areas. Most of these laws were carried over from that of Étienne Polverel and Léger-Félicité Sonthonax. Sonthonax and Polverel were French Civil Commissioners sent in 1793 to pacify the country and restore public tranquility after the massive slave revolt of 1791. In addition, Boyer followed the

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[7] Article III, *Code Pénal et Rural* of Toussaint Louverture. See also the Haitian Constitutions of 1801, Title VI, art. 14, 15, 16, and 17.
[8] Kate Ramsey defines *Lakou* as, "a group of conjugally realted families occupying their own dwelling places on an inalienable piece of land" (Ramsey, p. 68).

agricultural economic footsteps of his predecessors – Jean Jacques Dessalines, Toussaint Louverture, King Henry Christophe, and Alexandre Pétion – with a tighter military grip than before. For example, Article I of the 1826 *Code Rural* stipulates, "Agriculture as the principal source of prosperity of the state will be protected and encouraged by civilian authorities and military."[9]

This early debts have been the subject of indignation among Haitians. The venerated Haitian anthropologist Jean Price-Mars (Price-Mars, 1953, pp. 167-170), "The incompetence and frivolity of its leaders had turned a country whose revenues and outflows had been balanced, until then, into a nation burdened with debt and trapped in financial obligations that could never be satisfied." Many Haitians ask the pointed question: What was Boyer thinking? I ask, was this debt part of a grand marketing and sales strategy to gain access to world markets? If such was the case, the strategy was a complete failure that burdened Haiti for generations.

While Haiti's revolution strategically destroyed much of this colonial infrastructure, historical evidence shows that the newly freed leaders built new physical structures to continue the country's participation in agro-export. Global trade partners regularly sent ships to Haitian ports to unload manufactured goods and to load primary products.   Trouillot (1990) recalls that numerous ships from Europe and America anchored the ports of Haiti throughout the nineteenth century. By 1851, ahead of other Latin American countries, including Mexico, Haiti was the number one buyer of United States goods (Farmer, 2006; Trouillot, 1990). Both Trouillot and Farmer report that during the last decades of the nineteenth century, more vessels docked at the

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[9] *Code Rural d'Haïti*, 1826.

Haitians ports were from the United States than from all of Europe. Progress in primary

products production, particularly between 1870 and 1890, stimulated by the favorable conditions

of the export markets, gave the republic of Haiti a relatively sound budget (Moral, 1978). Coffee

export, for example, was very prosperous and amounted to 60 million pounds in 1860, 72.5

million pounds in 1875, and 79 million pounds in 1890.

During the post-independence period, Haiti fortified its defense infrastructure as a deterrent

against eventual invasions by the metropolis. Decades following Haiti's independence, the

leaders poured capital investment into building military infrastructure in the form of massive

forts and cannon artilleries. These fortresses are typically located on secluded mountaintops that

are hard to reach and often hidden from sight. Even healthy horses have difficulty reaching these

forts. The healthiest athletes would face a rigorous workout on their narrow, steep and unpaved

roads. The strategy was to create a bird's-eye view, with a perspective overlooking the

Caribbean Sea, in order to uncover unfriendly ships. From one perspective, this military

infrastructure was needed to defend the country against invading forces that on several occasions

have attempted to take control and return the country back to the plantation system. From

another perspective, while these military fortifications served as deterrents then and a source of

national pride now, they added little value to the total sum of the country's economic capacity.

Instead, they drained capital from other sectors of the economy that have been latent ever since.

For instance, widespread access to education took a back seat in the national defense agenda.

Only a privileged few could afford the luxury of a primary school education, a situation that has

haunted Haiti's economy for centuries.

However, all is not lost. These historical forts are important amenities, as Green (2001)

describes them, that can attract tourism and bring economic benefits to communities. Decades

prior to the 1986 uprising that toppled the Duvalier dictatorship; Haiti led the Caribbean in

tourism, partly due to its historical attractions, such as *La Citadelle Laferrière*, the largest

fortress in the Western Hemisphere, *Le Palais Sans-Souci*, and many others. But not everything

boils down to economics. Haitians are proud of the Citadel and the many other historical

facilities, even when no tangible value derives from them. The simple existence of these

amenities and their bequest value is priceless.

In comparison to other countries of the region, Haitian peasants adapted subsistence farming as a

way of life outside of the plantation system and far removed from external developments. In a

concerted effort to preserve the traditionalism and resilience of its peasantry, Haiti managed to

be noticeably different from other Caribbean islands, "some of which like Puerto Rico and Cuba,

were forcibly brought back into the mainstream of world development in the same century in

which Haiti withdrew from it" (2007, p. 270). Mintz argues that the Haitian peasantry pays a

high price for its traditionalism in the form of low agricultural production, poor land use, erosion,

population growth, and low consumption. He sums it by stating that for the Haitian people, land

is valued above all else, even when the capital and labor to work it are lacking, it is sometimes

held "uneconomically" (2007, p. 274).

However, in today's Haiti, land value is relative to economic opportunities. The notion of land-

cherishing at all cost no longer prevails over capital access. Many families are eager to sell their

parcels to start off-farm businesses and to finance children's education, in hope of reaping future

economic gains. Land market activation is constrained not by traditional values that landholders place on their land, rather by market conditions and ownership complexity. The latter presents itself in the form of inheritance of land tenure between family members. Another form of complexity derives from obtaining legal title. Although the law requires that land ownership transfer must be registered through the proper legal channels, in some cases, land acquisition are informal. The seller may draft of bill of sale and provide a receipt to the buyer without the formal registration process.

In terms of value-added infrastructure and services, with direct impacts on transaction costs, the United States occupation brought some level of transition and Foreign Direct Investment (FDI), among other consequential implications, such as the dismantlement of the indigenous army and the creation of a U.S.-trained military force. Whether these "external developments," as Mintz phrases it, brought meaningful newness and goodness to the Haitian society, or lasting setbacks, remains a contentious debate. In contemporary Haiti, the stocks of available infrastructure – in the forms of available paved roads, electricity-generating capacity – and services that are necessary to drive economic growth seem to lag that of population growth and income.

In both Haiti and the Dominican Republic, during the nineteenth and early twentieth centuries, the lack of infrastructure hindered agro-export growth. Due to the high cost of transporting heavy and perishable nontraditional exports such as fruits and vegetables, Haiti excelled in coffee and timber while the Dominican Republic specialized in tobacco and timber. Haitian leaders acknowledged the importance of infrastructure in increasing access to external markets and in reducing supply-side transaction costs. They attempted to resolve the bottleneck at

various times in its history, with very limited success (Montague, 1966). Haiti was among the first Caribbean nations to build railroad tracks in its capital, Port-au-Prince, in 1876. They even had an aerial railway system built in 1898 to transport dyewood from the mountains to the coastal city of Port-au-Prince. Subsequent railway projects followed during the 1900s. For being one of the pioneers of the railways system in the Caribbean, Haiti failed to properly manage and establish long-term infrastructure systems to enable economic growth. Although mismanagement has a lot to do with the lack of achievement in this sector, reliance on foreign capital investment with concessionary strings attached has rendered the path to success even thornier.

During the early twentieth century, while Haiti was still unstable and deeply in debt, the United States started to increase its political and economic footprint, elbowing out European governments' dominance in the region. Throughout Latin America and the Caribbean, the U.S. invested heavily in agricultural, transportation, electrical, and telephone companies. The agricultural landscape of several countries in the region started to change, favoring large-scale production for the export markets. New telephone poles and electrical grids adjacent to railroad tracks started to emerge in various productive zones. Several U.S. companies increased their stake in Haiti by gaining government contracts to help build the necessary infrastructure for the agricultural system, educational and social services, and other projects.

Haitian entrepreneurs of the *Compagnie Nationale des Chemins de Fer d'Haiti* (The National Railroad Company of Haiti) started an ambitious project to build a railway network connecting key agricultural regions in the countryside, including Port-au-Prince, the Cul-de-Sac Valley,

l'Etang Saumâtre, Port-de-Paix, and Cap-Haitian, to facilitate the growth of the sugar production

sector (Dubois, 2012; Dupuy, 1989a; Moral, 1978). After the project stalled, the James P.

McDonald Company of the United States acquired the Haitian railroad company to continue the

project. The North American investors requested significant incentives to develop both sides of

the rail tracks with large-scale banana plantations.[10] The concessions of April, 1910 stipulated

that upon failure of the railroad company to meet its expenses, the Haitian government would

guarantee 6 percent interest and 1 percent amortization on National Railway of Haiti bonds; to be

issued at the exorbitant rate of up to $33,000 per mile of track constructed (Schmidt, 1995, p.

37). The incentives also comprised the exclusive right to develop the 20 kilometer-wide belt of

land on either side of the rail tracks for a period of 50 years, at a leasing price of $1 per year per

carreau (1.29 Ha) of cultivable land (Millet, 1978; Moral, 1978). This monopoly would

consolidate the most fertile land of the entire country under the control of McDonald, who

wanted to take advantage of the Central American banana boom. Over and above these

advantages, he also secured the right to establish a monopsony on all banana exports from Haiti.

This project was very similar to the United Fruit Company's project in Central America during

the same period (Striffler & Moberg, 2003). The enactment of this contract would transform

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[10] In their book "Banana Wars," Striffler and Steve (2003) examine banana-producing regions of

Latin America and the Caribbean and the processes that brought bananas from the jungle to

being one of the most commercially valuable fruits in the world. Banana companies carved

roads and railroads, cut trees and changed landscapes in order to bring bananas to breakfast

tables and lunchboxes in Europe and America.

Haiti into a "banana republic" by removing peasants from their small plots of land and establishing a plantation labor system.

The Haitian government welcomed the foreign capital investment to build the railroads network and gave McDonald the requested land concessions. For the government, the investment presented an opportunity to jump onto the development bandwagon and to diversify the traditional sugar trade with bananas. After all, these types of concessions for development were 'business as usual' for many Latin American and Caribbean governments lacking the resources and the know-how to lay tracks through mountains and across rivers. The banana companies were well-known for using the "carrot and stick" approach to lure governments, gain power over small producers and competitors, and control resources and rents of the banana enclave sector.

United Fruits extracted favorable concessionary landholdings for tokens or free of charge from Central American governments, in exchange for the construction of roads and railroads (Striffler & Moberg, 2003). Between 1908 and 1912, Striffler and Moberg report that the banana company Cuyamel Fruit laid tracks in northwestern Cortés, Honduras, to transport bananas to export points. United Fruits followed suit and began building railroads and banana plantations after securing significant land concessions from the Honduran government. During the early 1900s in Guatemala , United Fruit became the largest landowner, functioning as "a state within a state," writing its own contracts with the government, leading and controlling major infrastructure projects, and operating virtually unrestricted by any regulation. Next door to Haiti, in the Dominican Republic, leaders recognized the need to lower transaction costs through infrastructure improvement. In 1882, they granted the Samaná-Santiago railway concession to a

Scottish entrepreneur in order to benefit tobacco, cacao, and coffee growers of the Cibao

province (Baud, 1995). While the railway did not live up to its name by joining Samaná to

Santiago, it did link the town of Sánchez with La Vega in the San Francisco de Macoris area.

After observing the foreign capital inflows to countries of the region for building railways, roads,

ports, and airports, the Haitian government wanted to take advantage of these foreign direct

investments for reducing transport costs through infrastructure improvement. However, the act

of balancing local values – private property rights, labor rights, individual freedom, and national

sovereignty – with foreign interests took a virtual back seat in the government's economic

growth agenda. Notwithstanding the strong international current that Haitian leaders were

swimming against, the perceived benefits of modernization took precedence over these cherished

values. Small farmers, however, saw the McDonald infrastructure project very differently than

the government did.

The small farmers of Haiti resisted the railway-banana project in all possible forms. For them,

the plan represented an interventionist act geared toward displacing them from their small plots

of land that they fought for, as well as the end of their cherished autonomy as they knew it.

Currently, farmers are still reluctant to concede tiny pieces of their land to build public roads

which would facilitate postharvest transportation and market access. In the early 1900s, the

farmer-land relationship was even more pronounced. Land possession was synonymous with

autonomy and freedom from coercive labor. To start the implementation of the McDonald

project in 1911, the government began to evict smallholders from their land and their homes;

many of these farmers had inherited their parcels from previous generations without legal titles

but with a common understanding of their ownership. The government leaders added fuel to the

fire by not developing a systematic plan of compensation for the landholders prior to finalizing

the railroad contract. The farmers retaliated and took collective actions against the government

and the foreign interests (Gaillard, 1982; Millet, 1978). They destroyed equipment, burned down

facilities, and went on strike against railroad *corvée* work. Consequently, the peasants' uprising

forced the complete derailment of the railroad project, after the completion of some sections

located in flat land areas. McDonald failed to develop the banana plantations, causing the halt of

the railway project.

Now that the project had stalled again, what happened to the contract and the already accrued

expenses? McDonald cleverly sold the toxic contract to two Wall Street firms: National City

Bank of New York and Speyer and Company, both of which previously owned Haitian railroad

bonds. The Haitian government declined to make payment for the railroad work that had begun,

claiming that the contract was not fulfilled because the work was not completed (Schmidt, 1995).

In turn, National City Bank argued that the frequent peasant uprisings prevented the fulfillment

of the contract and that, therefore, Haiti would have to pay the full cost of the incomplete

railroads at the rate of $33,000 per mile of track.[11] Indeed, Haiti did pay the full payment for the

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[11] According to a protocol (Treaty No. 643) signed on October 3, 1919 between Haiti and the

United States, Haiti agreed to pay the bond issued to McDonald for the unfinished railroads plus

interest. At that point, an interest of $3,544,548.74 had already been accumulated and come due

(refer to Article III (3). To start making payment on all its debts, Haiti took a USD $40 million

"gold" loan, payable in thirty years without the possibility to prepay before fifteen years (United

States, 1922).

unfinished railroads projects during the U.S. occupation that started in 1915, after accumulating more national debts (United States, 1922). This series of events triggered the *Cacos* war.[12] While "American and European merchants could rely on assistance from their respective governments in advancing their interests" (Plummer, 1984, p. 130), the Haitian smallholders had to rely on one another to save their land from expropriation, even at the cost of world trade marginalization.

Similar to the 150 million francs compensation that the French monarch Charles X pressed Haiti's president, Jean-Pierre Boyer, to pay, the railroad debt helped render Haiti a creditor nation without the needed infrastructure to participate in agro-export at a greater capacity. Hyppolite (2006) argues that Boyer's administration undermined the prospect of a stable and prosperous Haiti by adhering to the 1825 deal with King Charles X of France. For Price-Mars (1953), the incompetence and frivolity of its leaders turned Haiti's well-balanced revenues and outflows into a nation burdened with debt and financial entrapment. Nevertheless, Haiti's agro-export and mining sectors continued to flourish and absorb the debt as much as possible.

Well into the 1930s, Haiti remained a valuable trading partner of Europe and America, possessing the adequate ports infrastructure to support a booming export market (Anglade, 1982a; Dupuy; Farmer, 2006; Trouillot, 1990), even though the basic inland infrastructure and services to support the local population were lacking in many ways. A minimum of eleven

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[12] The Cacos are rebels in the countryside who rose up against unfair labor and agrarian reforms. During the American occupation of Haiti (1915–34), the Cacos of northern Haiti confronted the U.S. marines in order to resist forced labor and the expropriation of lands.

regional port cities had vibrant export operations (Fiehrer & Lodwick, 1997), and they compared favorably with the capital, Port-au-Prince. Adequately dispersed economic activity rendered agricultural export feasible in the capital and in the countryside. But new export-led policies after 1915 reconfigured these key infrastructures by shifting many regional ports and agro-processing to Port-au-Prince. American companies expanded and modernized the wharf of Port-au-Prince to consolidate the regional ports into a single center (Anglade, 1982a).

The consolidation of the ports and regional administration services implies greater dependence of the rest of the country on Port-au-Prince for commercial, industrial, social, and cultural activities, a condition that still persists today. For example, all mango exporters are concentrated in Port-au-Prince, where they have packing facilities and the convenience of a major shipping port. As a result, the export of nontraditional fruits from distant farms becomes taxing for smallholders.

The U.S. also built Haiti's first electrical company and led the efforts to build a new railway network to facilitate intra-farm connections to the Haitian American Sugar Company (HASCO) and to the export shipping points. HASCO was the largest sugar mill in the country, established in 1918 by American investors to process sugar for the domestic and international markets. The railway network transported sugarcane from distant farms directly to the mill and transported sugar from the mill directly to either the wharf of Port-au-Prince for export or to the *Magasin de l'Etat* (State Own Wholesale Store) for domestic market distribution (Michel, 1989, p. 69). HASCO is arguably the most significant Foreign Direct Investment in Haiti during the twentieth century, for its multiple effects on various sectors of the economy, including infrastructure, agro-processing, and agriculture. In the 1970s, Haiti exported about 40 percent of its total sugar

output (Bourdet & Lundahl, 1991). During that period, however, a series of conditions negatively impacted Haiti's sugar industry and its related services. Falling world prices, competition, lack of technological improvement, and the unscrupulous nature of management in state-owned companies, all rendered the sugar industry less competitive. Even though the production and exportation of sugar were dramatically reduced during the 1980s, Haiti could still produce 100 percent of its sugar need.

However, in May of 1987, HASCO closed its doors in order to carry out the financial austerity conditions of international financial institutions (namely the World Bank and the IMF) influential enough to shape financial and economic policies (Cloutier, 1987). The recommendations to privatize were without apparent contingency measures to facilitate a favorable transition from public to private ownership, which resulted in sending thousands of workers to the already long unemployment lines (Polynice, 2012). The closure of HASCO seemingly did not take into account the broader implications for sugarcane growers, on-farm and off-farm employment, and the Haitian economy as a whole. An estimated 3,000 full-time employees and more than 20,000 workers involved in seasonal activities were laid off (Cloutier, 1987). Subsequently, individuals dismantled the rail tracks and sold them piece-by-piece for building construction. As of August 2012, there were still ten-foot to twenty-foot sections of the tracks available for sale.

In addition to the closure of the sugar mill, Haiti's only cement plant was sold to private investors, who decided to close the plants. Thousands of workers lost their jobs and many small business owners lost their livelihood. The circumstances leading to the closure of the cement

plant are similar to those of the sugar mill and other state-owned enterprises. Cross-regional studies from Fan and Rao (2003) present the adverse impact of structural adjustments on public spending on infrastructure. In Latin America and the Caribbean, these adjustment programs may have significantly reduced infrastructure investment. Particularly in Haiti, where infrastructure expenditures were relatively negligible prior to the implementation of the programs, they became almost nonexistent afterward. The dual result of privatization – success in some cases and failure in others – indicates that a "cookie-cutter" approach could prove more detrimental than constructive in developing countries like Haiti (Polynice, 2012). A public-private partnership could be an ideal pilot approach preceding any long-term solution.

In the telecommunication sector, Haiti started with the telegraph, with installation of marine cable by the *Compagnie Française du Télégraphe* in the 1880s. The French Cable Company that was operating in Haiti had majority ownership and control of a U.S.-based subsidiary, the United States and Haiti Telegraph Company (Winseck & Pike, 2007). Haiti then leapfrogged from having very limited telephone lines in the early 1990s to having widespread cellular phones and Internet access in every corner of the country. Neither the telegraph, nor the telephone, nor the Internet has had the same impact on direct costs as railways have (Bulmer-Thomas, 2012), but they greatly contribute in providing up-to-date pricing information to exporters and producers. The implications of timely market information for providing competitive advantage remain paramount, especially in today's information-centric global market. I will address this aspect in a subsequent chapter.

Deforestation and Infrastructure

The lumber business has made more significant and lasting effects on the availability of physical

infrastructure than dictatorships and coup d'états combined. The natural resources that Haiti

exported went beyond common agricultural commodities to include clear-cutting and exporting

of various types of trees without any systematic replanting method to replace them. The

woodcutting and lumber business started during the 1700s with the colonial powers, which

passed the baton to elite exporters. Tropical trees, such as campêche, logwood, and mahogany,

were available throughout the country. Exports of mahogany hardwoods, one of the most

profitable export crops from Haiti, were funneled through foreign mercantile houses that

obtained license to operate out of several open ports (Moral, 1978). This suggests that a very

high volume of hardwoods left the tiny island of Haiti. In 1808, an estimated 40,000 mahogany

trees left Haiti for Europe (Malte-Brun, 1827). Foreign companies such as Lloyd & Cy, in

agreement with the Haitian government, received lucrative contracts to cut and export trees.

Moral (1978, p. 50) explains:

> "The timber contracts also generate material political rewards. The tree cutting panacea
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> benefit the contracts holding companies, which the government grants leases for 10 to 60
>
> years to exploit areas that are still untouched; those include adjacent islands of *La*
>
> *Gonâve, La Tortue, l'Ile à Vâches* and even les *Cayemites*, are surrendered to the
>
> devastation. The island of *La Tortue* was the object of four consecutive contracts (in
>
> 1862, 1875, 1892, and 1899), none of which ever reached their stated terms, which
>
> attracted foreign investment from the British and the French... "

In 1891, 165 million pounds of campêche were shipped out of Haiti, and of the 35,000 mahogany trees exported from the country, 75 percent were shipped out from the port of Gonaives (Moral, 1978). The tree export business continued to flourish during the mid twentieth century, gradually transporting arable land to the sea. Today, the tropical hardwood species have virtually disappeared from Haitian soil. Gonaives, which used to be one of the active shipping ports for tree export, is now one of the city's most vulnerable to natural disasters.

The notion that Haiti exported hardwoods for centuries sounds perplexing, since it is one of the most deforested countries in the western hemisphere. Yet as the Haitian geographer Georges Anglade (1982a, p. 45) explains, "this cycle of timber export is fundamental to understanding the ecological disaster of the Haitian space." However, the general discourse tends to point to small farmers as being the cause of erosion by cutting trees to make charcoal for cooking fuel. Rural farmers merely carry out the effects rather than being the causes of deforestation that preceded them. The tropical hardwoods exported from Haiti, especially Mahogany and campêche, went to make luxurious chairs and dining tables to serve wealthy individuals in developed countries, while the small farmers bear the bulk of the blame for clear-cut deforestation, erosion, and the destruction of infrastructure.

A review of anthropogenic disturbance – notably extraction without restoration – finds that regeneration of ecosystems (forest and mangal) is slow even on single hectare clear-cuts due to rapid soil acidification (Ellison & Farnsworth, 1996). This crucial outcome of the patent destruction of Haiti's major tree species – an obvious man-made phenomenon – persists in a fragile landscape prone to natural disaster shocks. Rainfalls that could benefit farmers generally

turn into a nightmare of opposite effects in the form of landslides from scenic mountain tops, erosion that carries away fertile land to the ocean floor thereby destroying mangroves, and raging rivers that cut roads and bring down bridges. Torrential rains and hurricanes become lethal weapons of widespread destruction for Haiti's soil and mangal.

During the 1950s, the government of the venerated Dumarsais Estimé, who many Haitians consider to be one of the most skillful and competent civil servants, attempted to make a difference. Estimé promoted agriculture, infrastructure, and education throughout the country and called on Haitians to develop the country with or without foreign assistance. The population answered the call through a popular national campaign during which employees from the public sector agreed to reduce their salaries. Businesses and individuals voluntarily donated funds to support the government's programs. However, under pressure from a triad of forces – the economic elite, fringe elements of the Haitian armed forces, and international influence – Estimé resigned and went to exile without realizing these projects.

After Estimé, some of the services that could enhance smallholders' competitiveness existed on paper but not in practice. For example, the service inclusion favoring agricultural cooperatives of the *Code Rural* of François Duvalier contains an article mandating state financial support for agricultural cooperatives.[13] Article 82 states:

> "Agricultural cooperatives, legally constituted, shall receive technical assistance and
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> financial assistance from the state and will receive certain privileges, including:
>
> 1) Priority for leasing all vacant lands of the private or state domain

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[13] See the *Code Rural* of François Duvalier (Haiti Département de la Justice, 1963, p. 17). In addition, the *Code Rural* contains stipulations for maintening basic infrastructure in articles 270-282.

2) Preference for obtaining credits from all institutions of the state or municipality

3) Exemption from payment of Income tax."

The Duvalier governments did not apply these laws, even though much of Haiti's external debt occurred during their dictatorships. Had most of the funds that Haiti received – either through capital generated, loaned, or donated – not been mismanaged or diverted back to private accounts in international banks, the application of these laws could have increased productivity and enhanced infrastructure. International assistance programs of various forms became rampant while domestic capacity went dormant; the desire to feed the children took precedence over equipping the parents.

Foreign assistance to Haiti grew at a fast pace during the 1970s and 1980s, with emphasis on food aid rather than infrastructure building.[14] According to a report from the U.S. General Accounting Office (GAO), the United States provided substantial development assistance to Haiti during these two decades, mainly in the form of food assistance. The funds went to purchase U.S. agricultural commodities on highly concessional terms, through Public Law 480, under Title-I.[15] The Haitian government sold the food in the local markets, undercutting local producers, in order to collect development funds. A Food for Development program (Title III)

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[14] See, for example, Polynice (2012) for an analysis of Official Development Assistance (ODA) grants to Haiti from the top three bilateral donors.

[15] See the U.S. General Accounting Office report from June 12, 1985, titled "U.S. Assistance to Haiti: Progress Made, Challenges Remain by the honorable Walter E. Fauntroy, House of Representatives.

was enacted in May of 1985 to replace the Title I program to support policy reforms. As Hancock reminds us:

> "Food aid, for example, is eminently fungible because it frees the recipient government from the tiresome necessity of ensuring that its own people do not starve. While well-meaning foreigners feed the hungry, the leaders of a country afflicted by famine can spend other funds at their disposal on whatever they like: they can buy advanced weapons with them, they can overpay their civil servants, or they can make some more hefty deposits into their Swiss or Californian bank accounts" (Hancock, 1992, p. 181).

This description seems to match what has been happening in Haiti during the last few decades. Foreign assistance dis-incentivized Haitian governments to build basic infrastructure that could lead to long-term development. For instance, roads leading to many farming regions – such as Jeremy, Thiotte, Côtes-de-Fer, Hinche, and Port-de-Paix that grow great quantities of staple food for the country – remained impractical for transporting food to market. Instead of enhancing agricultural production and self-reliance, the mismanagement of these programs contributed to further erosion of producers' incomes and rendered the national economy even more dependent on the international markets.

Contemporary Context

During the last few decades, mainly from 1985 to 2010, Haiti has been riding an extremely agitated rollercoaster – with more downs than ups – propelled by coup d'états, international sanctions, production reduction, balance of payment augmentation, natural disaster shocks, and some welcoming signs of reform in public administration. More than anything else, the

reduction in production volume is primarily due to the political and economic instability of the contemporary period.

Haiti's political instability has widening ramifications on the economy, notably on available infrastructure. Self-servicing Haitian leaders fight each other to obtain and keep the belt of power at all costs (Polynice, 2012). The international superpowers continue to force their will on the people with a "my way or the highway" approach to democracy. Local elites continue to benefit from the widespread debacle, capitalizing on their relationship with international allies and enriching themselves to the detriment of the masses. Meanwhile, they have left Haiti hanging in the balance, to paraphrase Buss and Gardner (2008).

From 1985 to 1995, military interference in civilian affairs and in politics set Haiti further back than before. Soldiers joined with the police to benefit from unfair practice in handling civil and judicial matters. The terms "protection" and "service" favored the highest bidders and, in some cases, they totally disappeared from the lexicon of the corps seemingly structured to protect and serve the population. Even more strenuous were the multiple coup d'états that the military and its allies inflicted on the bourgeoning democracy. To make matters worse, from 1992 to 1994, international sanctions landed severe blows to Haiti, knocking it further down the economic ladder. During that two-year period, real gross domestic product (GDP) declined by an estimated 30 percent, and inflation more than doubled to 52 percent by the end of 1994, causing further decline in the standard of living conditions.[16]

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[16] Under the leadership of the Inter-American Development Bank, 12 organizations carried out a Joint Assessment Mission, in mid-October, 1994, to evaluate how best to tackle Haiti's economic and social

These financial constraints exacerbated the inability of the municipalities to maintain the already

inadequate basic infrastructure. Many roads were built without effective maintenance plans,

costing the state more money to rebuild them within a truncated life expectancy of the pavement.

Throughout the country, physical facilities deteriorated at an alarming rate, in response to years

of neglect compounded with weak public institutions. Potholes went without repair, resulting in

wider potholes that forced the need to rebuild entire roadways, in both the capital and the

countryside. Due to lack of well-maintained roads, drivers and commuters spent millions of

dollars in extra fuel consumption, in addition to time spent in traffic congestion and in

purchasing vehicle spare parts. Ports and airports became personal piggy banks for customs

officials. Chronically deficient water supply, inadequate drainage systems, and erratic solid

waste collection and disposal reached appalling conditions after multiple coup d'états. Human

capital stock drained out of the country toward developed countries. These self-imposed

negative externalities weighed heavily on the Haitian economy, suffocating it year after year.

Had the country generated self-sufficient capacities to maintain existing infrastructure, these

negative externalities would have reversed, to the benefit of the entire country, in the form of

vehicle durability, fuel efficiency, and travel time reduction.

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problems. They drafted the Emergency Economic Recovery Program (EERP), a blueprint for economic

reconstruction conducive to various sectors, including macroeconomic, agricultural, industrial, private,

financial, social, environmental, and infrastructural. See, for example, (Inter-American Development

Bank, 1995; International Monetary Fund, 1995; United Nations, 1995).

Access to energy has been a political tool rather than an economic necessity. Haiti's largest source of electricity, after biomass and fossil fuel, is a U.S.-financed hydroelectric dam, Le Péligre.[17] The U.S. Export-Import Bank loaned the needed capital to implement the large-scale multipurpose development project during the 1930s. The stated intention of the Péligre dam, which was modeled after the Tennessee Valley Authority (TVA) program, was to deliver technologies to small farmers in the fertile Rivière Artibonite, in the form of hydroelectric power production, flood and erosion control, and agricultural production support to increase income and to foster economic growth (Ekbladh, 2002).[18] The company Brown & Root of Texas began construction of the dam in 1956 and completed it 15 years later, in 1971.

Hydroelectric power generation through dam construction received a very warm reception from many countries and from international grassroots development organizations implementing modernization projects. The ethos of these multifaceted development programs dwelled in the promise of raising the standard of living in the developing world and total inclusion in the democratic process. The inclusion and democracy discourse fell on fertile ground of many countries that carried out these projects. At the time, these programs presented favorable

[17] Refer to the "Uses of Haiti" of Paul Farmer for an extensive report of the impacts of the dam on small farmers (Farmer, 2006, p. 216, 263). See also recent work by Jeb Sprague on the use of the Péligre power plant as a political weapon.

[18] The United States Congress created the TVA in May, 1933 to provide economic development to the Tennessee Valley, which was particularly affected by the Great Depression. The program became part of the New Deal, a series of overseas economic development programs enacted in the United States between 1933 and 1936. For more details, see (Ekbladh, 2002).

occasions for grassroots organizations to ride the high tide of modernization to the shore of developing countries.

The Péligre hydroelectric plant, which Electricité d'Haïti (EDH) manages, remains one of the most ambitious, impactful and lasting technology projects and has been serving Haiti for more than four decades. During the 1980's the plant used to provide continuous electrical power to certain parts of Port-au-Prince, especially to manufacturing plants areas and to *bourgeois* neighborhoods. After four decades of operation, the renewable energy that the Péligre plant generates continues to produce many economic benefits. Despite its benefits to specific parts of the country and to special groups, however, the dam produces severe untreated side effects to many people of the Plateau Central region of Haiti.

Péligre displaced many farmers who used to live off the flooded fertile land, growing rice, beans, corn, millet, and various staples to sell in nearby farmers' markets. Production of rice and other staple crops sharply decreased. Ironically, while the dam may have controlled the floods of the river, cheap imported rice flooded the Haitian market, forcing internal migration toward the cities in search of factory work. "The project was costly and, ultimately, a failure, and it caused untold suffering in the now-inundated valleys behind the dam" (Farmer, 2006, p. 264). The dam did not even provide electricity to the nearby villages. Instead, electrical power lines ran high above ground to deliver energy to urban Port-au-Prince, where there are factories, government offices, and the bourgeoisie. To make matters worse, in a manner similar to the McDonald railway project that preceded it, the project leaders did not compensate the farmers. Where would they get money to purchase the imported rice? Many farmers rely on migration and tree

cutting to procure basic necessities. Today, many of the Péligre-displaced farmers live in the village of *Kay* with absolutely nothing to show for it.

During the last two decades, the plant has become less efficient, mainly due to age, lack of regular maintenance, and inadequate soil conservation resulting in sediment buildup from erosion. In May of 2003, the Péligre dam suffered physical assault from a paramilitary group, who "set fire to the plant's control room" (Sprague, 2012, p. 180). Some attribute the blatant attack on the plant to political opponents hostile to democratic rules, while others point to those who have a vested interest in keeping Haiti dependent on fossil fuel and generators. At the beginning of 2012, the plant was operating at less than one third of its rated output of 54 megawatts (MW) (Alstom Group, 2012). Efforts to overhaul the hydroelectric dam are underway, thanks to the $46 million (€60 million) contract that the transnational Alstom Group signed with EDH.[19] Although the Péligre hydropower plant has caused adverse social and environmental effects in the communities of the Plateau Central region, it represents a value-added big idea for the country.

Beyond hydroelectric power, Haiti is both windy and sunny enough to generate most of its own energy needs. With the development of wind and solar farms, the country could become a net exporter of energy. Several studies conclude that Haiti has significant potential for a variety of

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[19] As part of the contract, Alstom will fully restore the hydromechanical and electromechanical equipment of the plant, including the installation of new hydraulics, civil works, and cooling and drainage systems, as well as the refurbishment of the gates. The firm will also automate the plant with the installation of a new SmartControl SX system (Alstom Group, 2012).

clean, cost-effective, alternative energy, including wind and solar.[20] Currently, the country has less than 200 MW of power. Since wind is a promising source of energy for Haiti, a single onshore wind turbine can generate 2.5 MW; the offshore model goes up to 4 MW. The installation of 50 offshore wind turbines could double the electrical capacity of Haiti. Assuming improvement in economic conditions and supply will over time meet demand, unconstrained peak demand for electricity is projected to increase from its 2008 peak of 215 MW to around 570 MW by 2028 (Nexant, 2010). With conducive investment in the alternative energy sector, Haiti could meet its energy demand, create several thousand jobs, and provide additional market opportunities to farmers while weaning out tree cutting with solar and electric stoves.

Skeptics tend to underestimate the capacity of many Haitians to afford electric or solar stoves. These assertions partly derive from foreign aid propaganda that markets Haiti's economy as aid-dependent, in need of aid as opposed to investment (Polynice, 2012). They made similar predictions for the telecommunication sector prior to the introduction of the cellular phone to the market. The reality on the ground proves entirely different. As demonstrated in the telecommunication sector, even the most remote peasants have access to cellular phones and are spending cash on a regular basis to purchase phone cards.

Far from being a hindrance, Haiti's deficiency in available infrastructure represents opportunities for new investment. For instance, the Digicel telecommunication company entered the Haitian

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[20] See the Haitian government and 3E report "*Etude des vents dans trois sites en Republique d'Haiti*" at www.bme.gouv.ht and "Caribbean Regional Electricity, Generation, Interconnection, and Fuels Supply Strategy" World Bank and Nexant's report at www.caricom.org.

market in 2006 with an initial investment of $260 million, the single largest FDI made in Haiti, in the midst of dilapidated infrastructure. The company planned to sign no more than 400,000 clients within five years of its initial market entry. Surprisingly, Digicel achieved a milestone of 1.4 million customers during its first year of operation (Digicel Group, 2007, 2009). Partners In Health and Zanmi Lasante (PIH/ZL) made significant investments in building Haiti's best hospitals in the Central Plateau region, which is located a relatively short distance from the Péligre dam. The roads were almost impassable and electricity was almost nonexistent (PIH/ZL, 2011). A few years later, PIH began construction of the *Hôpital Universitaire de Mirebalais (HUM),* a new state-of-the-art teaching hospital and the largest public hospital outside of Port-au-Prince. The 1,800 solar panels have the capacity to generate more energy than the hospital consumes in a given sunny day, feeding surplus energy back to EDH's electrical grid. According to PIH, the hospital will provide primary care services mainly to the central and western regions of Haiti, with the capacity to receive 500 patients every day. Based on publicly available data at the time of its inauguration on November 6, 2012, HUM is the largest solar-powered hospital in the world.

Neither Digicel nor PIH waited for infrastructure to be in place before investing valuable resources in the country. Instead, they invested in building the needed infrastructure for their operations. This lends support to the idea that investment can enable infrastructure development. Globally, there are similar success stories to support the thesis that infrastructure is not a prerequisite for economic growth and the attraction of FDI.

Remarks

Overall, results seem to suggest retrogression rather than progress. The market forces and the structural forces that led to the sale and closure of Haiti's largest sugar mill sped up the dismantling of the railway system. These forces apply downward pressure on the per capita income of small producers by increasing idle land where sugarcane and other staple crops were once produced. Currently, Haiti has absolutely no railway. The roads that lead many farming communities – for example, Thiotte, Côtes-de-Fer, and Port-de-Paix that produce great quantities of staple foods – remain arduous. However, despite years of neglecting existing infrastructure, there have been recent efforts to build new roads toward the Central, North, and Grand'Anse departments. Widespread availability of the latest technologies in telecommunication, and efforts to administer previously nonexistent social services to support families are positive signs that may add to the total sum of physical and human capital. However, continued reliance on external donors to finance major infrastructure projects will most likely lead to the same dismal results, in the absence of domestic policies that enhance productivity gain.

Chapter 3 – Market Framework: Linkages and Actors

Global Framework

The linkages between production and consumption take diverse intricate relational arrangements across space and time that enable transactions of goods and services. In the contemporary global economy, the production of agricultural goods goes beyond fresh consumption within the producing countries to include processing, additive, and consumption points across borders. As the interconnected components move across national boundaries, the economies of many developing countries remain highly dependent on natural products. Whether a country is at the producing or consuming end of the spectrum, the value of natural products can help elevate or cripple its entire economy. This conundrum around the value of commodities ends up involving Haitian mangoes, for better or worse. The talking points, however, seem to guide the general discourse toward a "win-win" situation. Shedding light on these points requires an analytical framework to discern the patterns and trends of the Haitian mango commodity within a global context.

The global commodity chains (GCCs) framework captures the spatial features, the time, and the linkages among these processes. Commodity Chain analysis is a multifaceted process, which historically comprises elements from a range of theories, models and processes. Depending on what angle one approaches it from—an economic, social, or business standpoint—elements of various theories such as supply and demand, capitalist world system, dependency, structuralism, growth, and trade, could surface in the analysis. This chapter will consider the most relevant

aspects of the commodity chain approach as a guide for describing the market structure of the mango trade that connects Haiti to the world market.

One prevalent definition refers to a commodity chain as "a network of labor and production processes whose end result is a finished commodity" (Gereffi & Korzeniewicz, 1994; Hopkins & Wallerstein, 1986 p. 159). Gereffi and Korzeniewicz further describe GCCs as multiple "interorganizational networks clustered around one commodity or product, linking households, enterprises, and states to one another within the world-economy" (Gereffi & Korzeniewicz, 1994 p. 2). The commodity chain approach grew from the capitalist world-system framework, which is a unitary economic approach to economic growth that began in sixteenth-century Europe and expanded to encompass the world. World system theory sought to explain the spread of capitalism in terms of a stratified global market containing three levels – a core, semi-periphery, and periphery – that function as a single capitalist world economy (Morley & Petras, 1990). Wallerstein defines world-system as "a social system, one that has boundaries, structures, member groups, rules of legitimation, and coherence. Its life is made up of the conflicting forces which hold it together by tension and tear it apart as each group seeks eternally to remold it to its advantage" (Wallerstein, 1974 p. 347). Prior researchers of dependency theory lent intellectual building blocks to Wallerstein's new capitalist world system approach. Particularly, the notions of declining terms of trade and *échange inégal* (unequal exchange) constitute instrumental elements of the theory (Emmanuel & Bettelheim, 1962; Prebisch, 1950; Singer, 1950).

The Prebish-Singer thesis magnifies the trade relationship between the developed and the developing world, and between the producers of manufactured goods (core) and the producers of

primary products (periphery), in terms of *declining terms of trade* in commodity exchanges. On one hand, Prebisch presents a supply-side argument that points to monopolistic behavior by firms and trade unions in the core, which enables them to maintain productivity gains, higher prices and profits. Meanwhile, the peripheral regions that specialize in primary product exports, without the manufacturing intermediaries, end up in the losing side of the equation because of the relatively low price of primary products. On the other hand, Singer presents the demand-side and argues – based on Engel's Law – that as incomes rise, the percentage increase in demand for primary products increases less quickly than it does for manufactured goods. Therefore, rapid rise in demand for manufactured goods will cause their prices to rise at a faster rate than the prices of primary products. As a result, when the income of mango-loving individual increases, her/his mango consumption may not increase at all. The increase may even produce the adverse effect of switching from mango to another fancy fruit like pomegranate. Singer's approach is related to the Export Pessimism view, which promotes protectionism and inward-oriented policies. Despite looking at two different sides of the equation, Prebish and Singer describe declining terms of trade and slow productivity growth as two principal results of the international division of labor that hinders economic development in peripheral regions.

In the wake of the Prebish-Singer hypothesis, dependency theorists emerged to uphold the core view that terms of trade for countries in the periphery will decline over time. The literature reveals two trends of thought around the dependency approach to commodity exchange. On one end of the spectrum, Frank (1969; 1970) asserts that much of the poverty in Asia, Africa, and Latin America stemmed from the exploitative capitalist world economy. Frank went so far as to propose that Latin America break ties with the industrialized world in order to unlock their

potential. On the other end, Cardoso and Faletto (1979) and Sunkel (1993) emphasize inward

development, also known as import-substituting industrialization (ISI).

Emmanuel coined the term *unequal exchange* to describe the unfavorable trade position of a

certain category of countries, which, "whatever they undertake and whatever they produce,

always exchange a larger amount of their national labor for a smaller amount of foreign labor"

(Emmanuel, 1972 p. 175). A key supporting argument for this concept refers to factors of

production in the global capitalist economy, where capital is mobile but labor is immobile. For

example, U.S. investors are free to invest capital in Mexico and other countries in the form of

foreign direct investment (FDI), while workers from Mexico and other countries are not free to

come to the U.S. and work. Because of this mobility of capital, Emmanuel argues that profit

rates tend to equalize and that the prices of two different commodities tend to be proportional to

the labor time necessary to produce them. Although Emmanuel discusses unequal exchange in a

world system context, the foundation of his argument rests on the premise that the exchange

value of commodities is determined by rewards to factors of production – particularly labor.

Certain critics of the world system theory claim that it does not effectively answer key

theoretical and conceptual questions. It tends to be teleological; it places emphasis on exogenous

over endogenous forces (Sanderson, 2005); and it simplifies capitalism as a single integrated

system (Chase-Dunn, 1981). "In the world system the whole is the sum of the parts and the parts

representative of the whole. The actors are therefore abstract and deductive: classes are objects,

not subjects" (Morley & Petras, 1990 p. 40). These critics also profess that world system

theorists adopt a Weberian approach to power, which is extremely structural and not necessarily

representative of reality. The world system takes a simplistic tripartite view of a complex world, where yesterday's power concentration and wealth spread among nations do not necessarily represent today's power and wealth concentration. Several historically developing nations, which used to be mostly primary products producers, have diversified their output into services and manufacturing to become providers of foreign investment. In the 1960s, several Asian countries – namely the so-called Asian Tigers – including Singapore, South Korea, Hong Kong, and Taiwan, started to rapidly develop their economies and become wealthy, with an educated and highly skilled workforce. During the 1990s and 2000s, the bourgeoning economies of the BRICS countries – Brazil, Russia, India, China and South Africa – emerged as influential economic powerhouses, while power economies like the U.S. and European countries struggled to stay afloat through bailouts.

During the first 6 months of 2010, China increased its investment in Brazil tenfold, to US$20 billion, surpassing the U.S. and becoming Brazil's largest trading partner and largest foreign investor (Moyo, 2012). To satisfy its appetite, China is securing commodities around the world in ways that are different from nineteenth-century colonial power, Moyo reports. "Its strategy has been less to plunder the natural wealth of the countries it deals with than to strike long-range cash for commodities agreements" primarily from Africa and Latin America and the Caribbean regions (Moyo, 2012 p. 96). Meanwhile, many African countries, including Angola, Nigeria, Ethiopia, Chad, Mozambique, and Rwanda, traditionally known as 'peripheries,' – now, the so-called African Lions – are becoming just as fierce as the Asian Tigers (The Economist, 2011). From 2001 to 2010, *The Economist* reports that six of the ten fastest-growing economies in the world are from Africa, with annual average GDP growth rates of around 8 percent or more,

making Africa one of the fastest growing regions in the world. These countries are mainly

primary products producers satisfying the high demand for commodities coming from China,

India, and Brazil, as opposed to traditional metropolis countries in Europe. As such, the 'old'

power relations that existed during the colonial era no longer prevail. Rather, new partnerships

with mutually advantageous trade agreements are shaping the world economic landscape.

Contemporary trade relations in the form of conglomerate geographical blocks – North American

Free Trade Agreement (NAFTA), Asia-Pacific Trade Agreement (APTA), Southern Common

Market (MERCOSUR), to name a few – link nations and leverage their comparative advantage

in productive factors. The classical economists refer to land, labor, and physical capital stocks as

basic factors that condition economic growth and trade relations. But the Heckscher-Ohlin

theorem of comparative advantage contributes to the international trade debate with the notions

of (a) proportion of productive factor endowments among countries and (b) different factor

intensities of production methods for different goods. The model boldly asserts that factor

endowments drive trade flows between nations. It presents the basis for free trade that enables

nations to make the best use of their abundant resources (export) in exchange for their relatively

scarce resources (import). The core assumptions of the H-O model reveal significant similarities

to the neoclassical and the structuralist approaches in the sense that all countries have access to

technologies and learning possibilities. In addition to the traditional factors of production, these

technology and learning components further stratify the intricacies of the commodity-trade

discourse (Foster & Rosenzweig, 1995; Gereffi, 1999; Ruttan, 2001). In specific terms,

according to the H-O model, free trade promotes both ends of the commodity chain spectrum: (1)

the possibilities for high commodity production across industries and (2) increased consumption across borders.

Beyond its theoretical lineage, several studies apply the GCC multifaceted framework to assess a range of commodities. With empirical data from the apparel industry of Asia, Gereffi (1999) uses a GCC perspective to assess the mechanisms by which organizational learning occurs in trade networks to facilitate industrial upgrading from assembly to full-package networks. In information technology services, Miozzo assesses the circumstances that shape the nature of forward linkages between multinational IT services firms and their client firms located in Argentina and Brazil (Miozzo & Grimshaw, 2008). Contrary to the usual focus on upstream linkages that induce growth in the supply of inputs and services, Miozzo uses the GCC framework to look at the downstream linkages of services that extend the clientele. Apart from its usage in the manufacturing and services sectors (Jack, As-Saber, Edwards, & Buckley, 2008), scholars apply the GCC approach extensively in studying agricultural goods, and in primary products in general (Gibbon, 2001; Jackson, Ward, & Russell, 2006). Raynolds analyzes the implications that global trends in the organic market have for small producers, and she concludes that increasing global competition and export requirements represent some of the countercurrents flowing against small producers in the Dominican Republic (Raynolds, 2008). The findings of this study seem to characterize the challenges that Haitian producers are facing, in terms of the structure of commodity production and trade.

Market Governance Structure

The literature refers to distinct types of governance frameworks that define the market structure

for global commodity chains, which include "producer-driven," "buyer-driven," "international

trader-driven," and "fair trade," among others. In formulating the producer-driven governance

structure, Gereffi (1994) emphasizes the role of transnational corporations (TNCs) in controlling

the production system across a range of integrated industrial enterprises of different sizes and

types, including backward and forward linkages. This governance structure further includes the

dimension of "authority and power relationships" that determine the allocation of financial,

material, and human resources, and it "identifies how local, national, and international conditions

and policies shape the globalization process at each stage in the chain" (Gereffi, 1995 p. 113). I

would argue that, above and beyond the relationship between firms, the authority and power

relationships between North and South, as well as the influence of global institutions such as the

IMF, the World Bank, USAID, and the WTO, guide the allocation of financial, material, and

human resources. This notion is suitable for the mango trade, because, as I will explain,

countries can set product and trade guidelines and institutions can allocate capital, which

determines the structure of various nodes.

A buyer-driven governance structure refers to labor-intensive and trade-led industries in which

trading companies play the pivotal role in setting up decentralized production networks in

various exporting countries, generally located in the developing world (Gereffi & Korzeniewicz,

1994). In such a case, the leading firms may not own any production facilities and may remove

themselves from human resource management. Instead, the main tasks of the core firms in a

buyer-driven structure are to trade, distribute, design, research, imagine, and finance operations

along the chain to enable the movement of products from production to consumption. While this conceptualization usually refers to industries such as garments, toys, footwear, consumer electronics, housewares, and handcrafting, it presents certain attributes that are appropriate to agricultural products. In particular, the hands-off approach to production and human resource management shifts risks and liabilities to small farmers.

Gibbon (2001) adds a new twist to Gereffi's dichotomous view of the governance structure of GCCs by presenting the "international trader-driven" framework, which mainly applies to primary commodities. Some of the key characteristics of the trader-driven commodity include the relatively low value-to-weight ratio, major annual and seasonal variations in availability, low barrier to entry for new suppliers, low price-elasticity of demand, and dispersed demand side. The core firms are deep-pocketed international trading companies that procure continuous volume and coordinate a range of commodity chains from various countries. They typically order a plentitude of commodities, including a mix of coffee, cocoa, bananas, mangoes, and cotton, to name a few. Because profit margins are low for most primary commodities (except for specialty or premium products), these companies make their profit on volume rather than margins. With the advances in communication and information technologies, these firms keep up-to-date information with exporters to minimize inventories and retain a high level of responsiveness to demand. Timely and reliable market information gives them an edge in reducing risks while increasing profits. They maintain "a loose and indirect form of governance over their suppliers, based mainly on price, volume, and reliability" (Talbot, 2004 p. 10). Yet, this loose and indirect relationship is strong enough to affect all nodes of the chain, from small producers in developing countries to consumers in the North.

Certain characteristics of the international trader-driven governance structure fit the mango trade like a glove. However, due to the presence of international agencies, NGOs, state-specific regulations, microfinance institutions, and direct-buyers, the mango trade requires a multi-faceted approach to understanding its governance structure, one that encompasses the Gereffi-Gibbon typology. Adding to this web of complexities and "social regulations" (Raynolds, 2012, p. 276) are the trends in free trade agreements and fair trade organizations, all aiming at trickling down additional income to producers at the bottom. Yet for many smallholders, income improvement remains a moving target. This social attribute, Raynolds argues, seems fitting since these institutional arrangements function beyond the traditional bounds of private and public (i.e. corporate and state) domains and are implemented by individual actors and collective actions. Consequently, in recent decades, mainstream commercial importers, corporate retailers, and marketing consultants have begun to carry fair trade certified products to increase sales and to attract socially conscious, environmentally responsible and label-aware customers, while demanding price premiums. Although the fair trade concept and its application are fairly new to Haitian mango producers, many producer organizations are keen to jump onto the fair trade and organic bandwagons. Not surprisingly, the field is crowded with companies that create their own labels in an effort to cash in on the price premium of fair trade and organic fruits.

Although fair trade and/or organic products demand a price premium, many studies call for cautious optimism about their perceived widespread benefits. Smallholders who participate in these schemes do not reap a better economic result (Muradian & Pelupessy, 2005 p. 2030). In the Dominican Republic, market trends toward organic push the tide against small-scale

producers and in favor of buyers, causing disenfranchisement and marginalization (Raynolds, 2008). Raynolds finds that strong producer associations and transnational movement connections help counter these trends with some degree of success in the Dominican Republic. These results lend support to the efforts of many mango producers to utilize their social ties as a counter-balance to lower the adverse effects of market forces. Chapter six of this study focuses on the effects of producer organizational ties on production and on land allocation for mango production.

While charging a higher price offers some potential to direct additional income to small producers, the literature cautions about transformative economic gains through higher prices alone (Barham et al., 2011; Raynolds, 2012; Weber, 2011). Unless they are part of a broader portfolio that encompasses training, credit access and general infrastructure improvement, these initiatives only function as layers of profit-oriented market structures. As such, the consensus leans toward classifying these market structures on a continuum of complexity, rather than as divergent camps of dogmas.

The Export Market

In 2009, the top four mango exporters were respectively India, Mexico, Thailand, and Brazil. A significant aspect of mango export is the price to quantity ratio. During that year, Haiti was ranked 15th, with an export quantity of 9,010 tons for a value of nearly eleven million dollars. The price that exporters receive is a direct function of multiple variables, including the mango variety, the quality, the importing country, the season, and most importantly, the demand. Supermarket aisles in North America display a substantial increase in the availability of mango

products to meet the increase in consumer demand. Processing companies and multinational beverage corporations transform fresh mangoes into juice, dried mangoes, pickled mangoes, mango salsa, mango chutney, mango pulp, mango puree, mango paste, mango flour, and mango curry. The United States is not a major producer; however, it is the world-leading importer of various types of mangoes, mainly from Mexico, Latin America and the Caribbean. A large percentage of the fresh mangoes go to processing plants in the U.S. to make juice and other products. The European Union region is one of the major mango importers. Although China is the second largest mango producer in the world, it is also the largest importer of mango juice, a trend that surged to over 2000% from 1999 to 2010 (FAOSTAT, 2010).

Haiti's mango sector is mainly dominated by 16 groups of producers under the umbrella of FENAPCOM and 10 major exporters under the association of ANEM, according to USAID MarChE (2010). The exporters make substantial investments in their packing facilities, which handle selection, hot water treatment, and packaging. In particular, the single export variety, the Madame Francique of Haiti accounts for 15% of total production in the country. It possesses the ability to withstand hot water treatment to comply with the United States Department of Agriculture (USDA) and the Animal and Plant Health Inspection Service's (APHIS) certification requirements. Upon arriving at the packing plant, fresh mangoes undergo several steps before receiving the stamp of approval for export shipping. Haiti exports approximately two million boxes of USDA-certified Madame Francique mangoes at an average FOB price range of $5 to $6 per box (USAID MarChE, 2010). In 2009, the *Madame Francis* was Haiti's top ranked export crop and one of the most important commodities produced in the country (FAOSTAT, 2010). Although the country exported 9,010 tons during the 2009 season, the mango sector has to the

potential to expand to over $100 million a year, representing more than twice the amount of

foreign aid provided by France in 2009 and nearly a third of U.S. aid to Haiti during that same

year (refer to Polynice (2012) for more details of foreign aid to Haiti).

The export of commercial-quality mangoes from Haiti provides a significant proportion of rural

farmers' revenue in many areas of the country. This increase in income is seemingly due to

favorable trade terms between Haiti and the U.S. as well as the growth in mango consumption in

developed countries over the last two decades. In value terms, mango imports into United States

and European markets grew an average of 6 percent annually over the past decade, making it one

of the fastest growing segments of the fresh fruit market (Pay, 2009). In a sound policy

environment, the widespread distribution of mango ownership by local farmers could result in

equitable aggregate benefits from trade. However, the terms of trade are very dynamic. They

may decline based on political climate and/or economic relationships between trading partners.

In other instances, they may totally disappear based on policy changes.

The Haitian Mango Market

The activities linking small mango producers to world consumers consist of eight major

interrelating modules (refer to Figure 3-1 and 3-2). As related to Haiti's participation in global

market, these modules are highly dependent on the dynamics of (1) territoriality and production,

(2) sales and distribution, (3) packing plant and export, (4) regional competition, and (5) price.

Given that the United States is the largest external market for Haitian mangoes, I focus this

section on the movement of fresh mangoes from the Haitian producers to their point of

consumption in the United States.
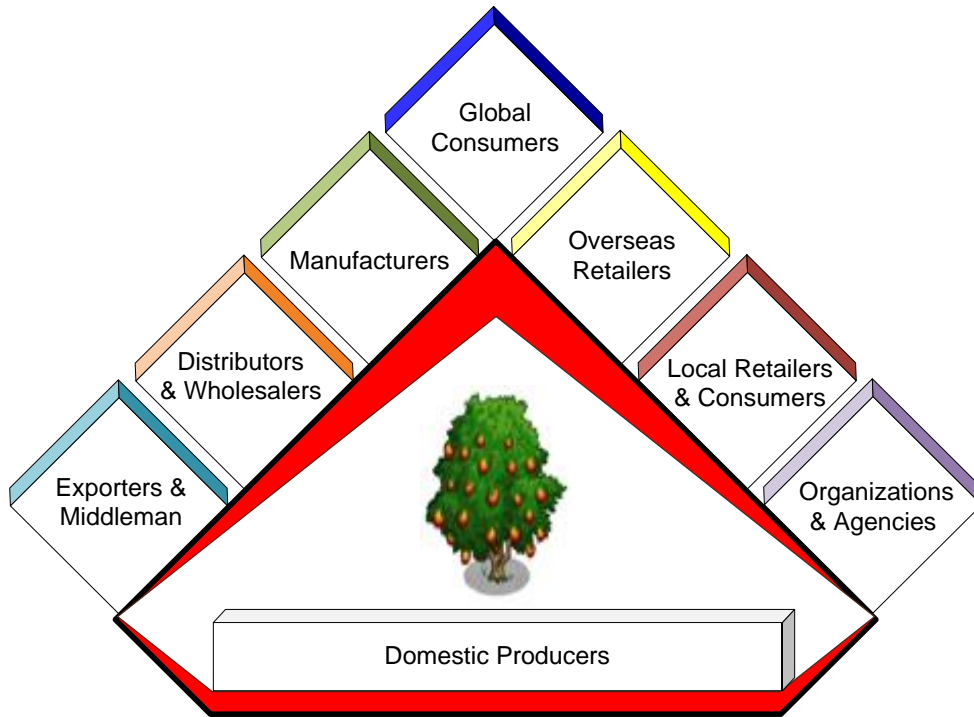
Figure 3-1: The mango production and consumption pyramid - linkages and actors
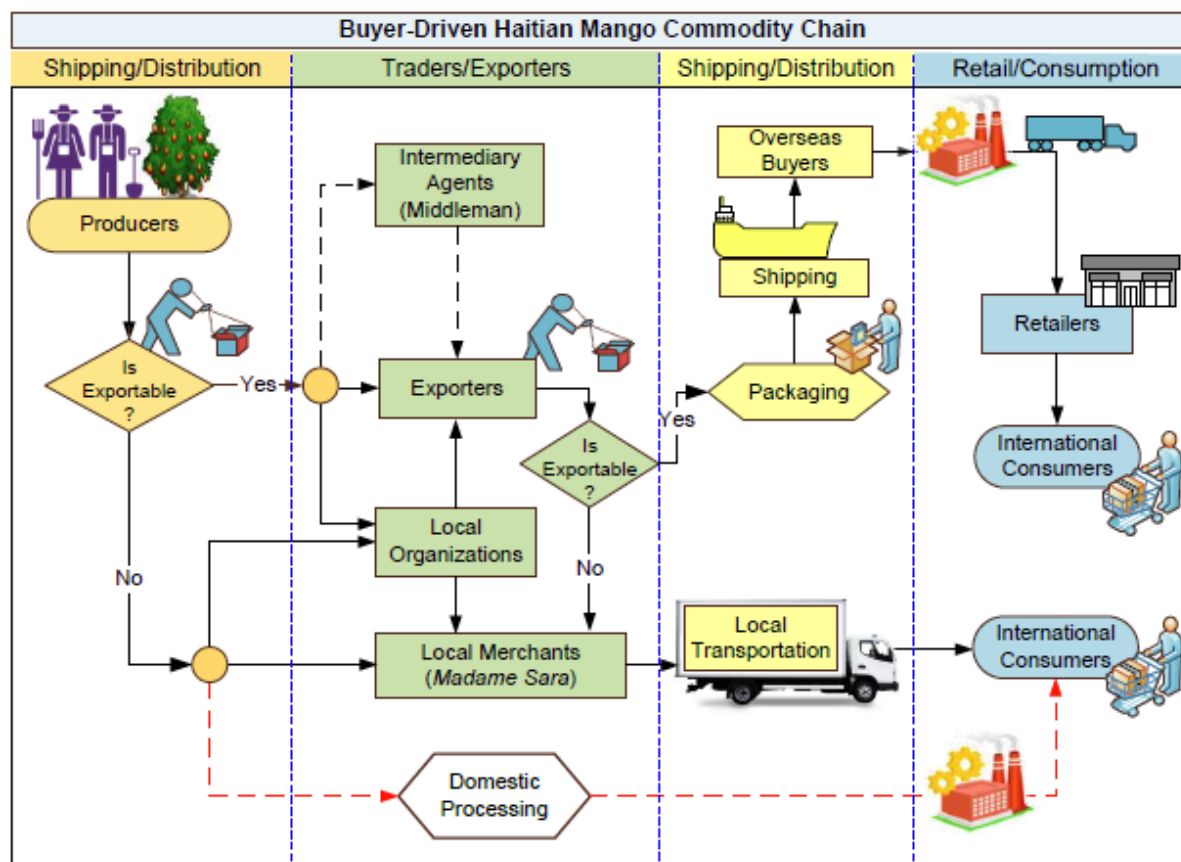
Figure 3-2: The commodity chain flowchart

Territoriality and Production

For centuries, Haiti's primary economic activity has consisted of small-scale agriculture. Haitian peasants reject large-scale farming, which, for them, is a constant reminder of the plantation system. Other key industries such as tourism and manufacturing attempted to take hold at various periods in history, but their roots failed to run as deep as farming, mainly due to market disruptions along the way. As the population grows farming becomes more significant for the economy. Currently, the domestic market faces a tremendous increase due to urban population growth. The imports of basic foodstuffs, such as rice, eggs, poultry and pork, increased sharply over the last few decades. During the early 1980s the share of food imports was less than 19

percent of domestic consumption, and national production covered more than half of food needs

until the end of the 1980s (MARNDR, 2010). Although the symptoms of economic decline and

political instability became more observable during that period, preexisting conditions started to

take hold many years earlier. From 2003 to 2005, domestic production accounted for 43 percent

of food consumption, while imports accounted for 51 percent and food aid was at 6 percent.

Currently, the country imports 80 percent of its food needs, with rice at 82 percent, eggs at 96

percent, poultry at 94 percent, and dairy at 65 percent. Not long ago, Haiti used to export fresh

produce (tomatoes, onions, carrots, potatoes) and, of course, sugar. Now the country imports all

of these commodities. Corn, sorghum, tubers (cassava, yams, and sweet potatoes), beans, pigeon

peas, and bananas are among the main local staples, with limited exports or imports between

Haiti and Dominican Republic (MARNDR, 2010).

Most mango farmers practice subsistence farming in units composed of several dispersed and

relatively small plots of land. This agrarian structure of widespread land ownership results in

scattered mango production throughout the country. This territorial configuration of mango

production results in a diverse range of varieties spanning multiple regions. Haiti's different

microclimates make it conducive to producing a large variety of tree fruits year-round, including

mango, avocado, citrus, soursop, guava, sugar apple, star fruit, passion fruit, and many others.

Of all these fruits, mango remains the main export attraction. The export demand persuades

farmers to produce the boom crop by planting new trees and by replacing non-export varieties

with the export one through grafting. One concern is whether the demand for a single export

variety – reminiscent of sugar production – will alter the cultivars' diversity and bring about

additional income benefits to small farmers, or expose them to additional risks.

Haiti's position varies between 17th and 10th largest producer of mangoes among 90 producing

countries worldwide (USAID MarChE, 2010), with the top five producers respectively being

India, China, Thailand, Mexico, and Indonesia (FAOSTAT, 2010). The total production share is

divided between Asia with 75%, the Americas with 14%, Africa with 11%, and Oceania with

0.15%. In the Americas, Haiti is the 5th largest producer, with production that varies between

200,000 and 400,000 MT per year over an area of 40,000 hectares (USAID, 2010b). During the

last five years, many Haitian producers have planted new mango trees, with the ultimate goal of

participating in the export market rather than in local processing, which is almost nonexistent.

Growing organic mangoes is considerably less labor intensive (less than 50 days per hectare)

than other fruit and vegetable crops such as asparagus or strawberries (more than 300 days per

hectare) (Carter, Barham, & Mesbah, 1996). As long as the appropriate land is available,

growing mangoes does not require a large capital investment by small farmers. However, land

and capital are not enough. Many other factors could jeopardize the seemingly fruitful future of

mango production in Haiti.

The mango is one of the most common trees in Haiti. Virtually all of the geographical

departments produce some varieties of mangoes at different seasons of the year (refer to Table 3-

1). Across the departments, researchers have identified over 140 different mango varieties,

making it one of the most diversified tree fruits (USAID, 2010). The push to export a single

variety without opening the additional local market channels – other than raw consumption –will

likely expose small producers even more to uncertainties of the export market. For the time being, farmers view the marginal benefit of Madame Francique as greater than the value of the other varieties. Therefore, from their perspective, a rational choice seems to be seeking the current higher price now and bearing the possible consequences later.

Table 3-1: Mango production seasonality in Haiti

Mango Production Seasonality in Haiti												
Département	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
West												
Léogane/Petit-Gôave	Y	Y	Y									
Arcahaie and Cabaret				B	B	B						
Fond des Blancs								Y	Y	Y		
Croix-des-Bouquets						B						
La Plaine de L'Ouest		Y	Y	Y	Y							
L'Artibonite												
Gros-Morne								B	B	B	B	
St Michel de l'Attalaye								Y	Y	Y	Y	Y
St. Marc and Verettes			B	B								
South-East												
Jacmel and Bainet						Y	Y	Y				
Cayes-Jacmel/Marigot												
Nippes												
Miragôane/Baradères							Y	Y	Y			
South												
Aquin/St Louis du Sud												
Camp-Perrin/St Jean							Y	Y	Y			
Plaine des Cayes							B					
Plateau Central												
Mirebalais/Saut d'Eau								Y	Y	Y		
North												
Limbé							B	B				
Grande Rivière Nord								Y	Y	Y		
Grand'Anse												
Jérémie									B	B		

During my field research, I visited Mr. Louis' house to conduct an interview about his mango production. Louis is a typical mango grower who has about 2 ha of farmland in his backyard for growing bananas, corn, beans, and other staple foods. He also has three additional pieces of land in other locations. We talked about farming in general, his family, mango production, and his participation in grassroots development organization. Of course, Louis has a few mango trees scattered in his backyard, and I asked him how many. He answered, "I have 4 in the backyard and 18 in three other locations." At a glance, I could see more than 4 mango trees, a total of 9 in the backyard. I asked him why he did not count the remaining 5 mango trees that are even larger and taller than the others. "Well," he replies, "I only count Madame Francique as mangoes because the organization and the exporters pay in full for them. I plan on grafting Francique to the other trees because that's where the money is." This was an eye-opener for me to learn about the high value that farmers place on the export variety while they neglect and replace other varieties that local markets could consume in various ways. Then, I asked Louis how many non-Francique mango trees he has. He replied that he has more than 30 other varieties for the local market and family consumption.

In both the southern and the upper Artibonite regions, almost 100% of new mango trees are of the export variety. Producers, local organizations, and international agencies promote Madame Francique as the wave of the future and the way to harvest the fruits of global trade. In addition to planting new trees, organizations train technicians in the proper methods for grafting the export variety into the non-export ones. These skills become valuable, not only for mango producers, but also for farming communities in general. The grafting process generally succeeds, but not without the obvious consequence of cutting mature producing trees for the sake

of possibly increasing income. The goals are to increase production of the export variety to supply distant consumers in the mango niche market and to increase small farmers' income. In the absence of sound policy measures, this new development strategy to place Haiti on firm export ground may have adverse consequences by excluding small producers. However, it may be possible to supersede the trade-off between positive macroeconomic and negative sectoral effects by implementing all-inclusive microeconomics policies (Barham et al., 1992).

Sales and Distribution

There are many stakeholders in the Haiti mango chain. In between the small farmers and the consumers are the collectors, the field carriers, *Madame Saras*, exporters, NGOs, domestic and international government agencies – namely the Ministry of Agriculture and USDA/APHIS – distributors, and retailers.[21] However, the private sector ensures the sales and distribution of agricultural products. The sector is divided into three major sale channels: (1) the domestic market for local consumption, (2) socio-agricultural organizations, and (3) exports.

The first channel, which supplies domestic consumption, consists of small business individuals, mainly women, commonly named *Madame Saras,* who ensure the marketing, sales, and distribution of locally produced food for domestic consumption. Englade provides an insightful

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[21] Madame Saras are small business owners who travel long distances to purchase agricultural products. They call them "*Madame Saras*" (Weaver Birds) because they talk a lot when they are buying and selling products. They also ride and hang on top of commercial trucks just like weaver birds hang on trees.

account of the activities of the Saras and the functioning of local markets (Englade, 1982).

Better than the export commodities that mainly enrich a minority; the movement of local

foodstuffs enriches the daily activities of farmers and merchants, who make up over 80 percent

of the workforce. In addition to the marketing system of the *Saras*, Englade describes the overall

role of regional markets and the mode of production as the foundation of the Haitian farmers and

the basis of economic development. From the point of production to local consumption, typical

agricultural products may go through three different markets (rural farmers markets, regional

markets, and urban markets) and two levels of Saras before arriving at the retail locations.

The rural markets have a concentration of fresh products from nearby farms. Typically, they

occur once a week, on a specific weekday for each specific region. This weekly occurrence is

generally sufficient to meet the demand of the surrounding residents and to facilitate travel for

long distance buyers and sellers, such as the Saras. The regional markets, which are larger than

the rural ones, generally occur twice a week. They receive fresh products from the rural markets

and manufactured goods from various points. The Saras and certain producers load daily

shipments from the rural and regional markets to the urban markets where wholesalers and

retailers purchase their products for redistribution throughout Haiti. This rotating market

schedule allows traders to sell their goods in different locations and to purchase products that are

region-specific. Some *Saras* specialize in specific products and specific regions. As the seasons

and the availability of certain products change, so does the purchasing pattern of a *Sara*. For

example, on Saturdays, the farmers market of Forêt des Pains offers fresh vegetables, potatoes,

and onions, while on Tuesdays, the farmers market of Archahaie contains bananas, plantains, and

coconut. By going to the regional markets on different days of the week, *Saras* and carriers

replenish the urban markets on a regular basis. The urban markets, such as Croix-des-Bossales and Marché en Fer (Iron Market) in Port-au-Prince, are open daily. They constitute major commercial centers for local and imported products. Beyond their significant role in the Haitian economy, the urban markets exhibit cultural values, present the state of the political atmosphere, and display social relations. Particularly, the Iron Market landmark embodies these uses.

Local Traders (Madame Saras)

Before arriving at retail locations, most agricultural products go through two levels of *Saras*. The first purchase their products from the producers to sell at the rural farmers markets. They use horses, mules, and donkeys as their main means of transportation. These animals are capable of negotiating tough and narrow roads better than all-terrain vehicles and without the unwanted emissions. The *Saras* who have large portfolios establish relationships with producers, and they go to multiple farms to pick up their products. Some producers choose to entirely bypass the *Saras* and bring their harvest directly to the rural, regional, or urban markets.

Saras at the second level typically travel long distances to purchase agricultural products at the rural farmers markets, mainly from first-level *Saras*. Rarely do individual consumers travel the long distance of a *Sara* to rural markets to purchase goods for their household consumption. The ones who do are generally the well-to-do. Above and beyond transporting products to retail points, *Saras* also sometimes provide agricultural credits to producers in order to ensure the continuity of procurement and to make profits. Especially when the terms are beneficial to both parties, the value of such a service is of utmost significance in countries where access to capital

and credits presents a hindrance to small farmers. Food trade is one of the most significant sectors of the Haitian economy, with hundreds of thousands of street vendors, small shops, and ambulant merchants who carry tens of pounds of foodstuffs on their heads for miles. By all accounts, this sector constitutes the supporting pillar of the Haitian economy.

Producer Organizations

The second channel consists of socio-agricultural organizations of producers. In recent years, they have emerged as a strong support structure for the fruit commodities by providing key services to producers and buyers. The buying community includes local individuals, street vendors, *Saras*, and fruit exporters. Similar to bananas and avocados, mangoes are highly perishable fruits that require technical knowhow to cultivate and careful postharvest handling prior to consumption. Many of the organizations have trained members who can reduce the risks of postharvest loss, which often occurs due to the delicate nature of the mango fruit. Occurrences of sap burn, mechanical damage during transportation, discoloration, pest, and disease damage require technicians who know the mitigation techniques to minimize their negative effects. The producers' organizations provide the experts to manage these factors, with the ultimate goals of increasing producers' income and improving the environment.

When producers are members of organizations and are part of a network that specializes in fruit production, they benefit from a labor pool that can manage production, harvest, marketing, and distribution to substantially reduce the risks associated with fresh fruit production. Social relations among producers foster an environment of resource sharing, knowledge transfer, and information diffusion that helps to absorb shocks that may occur along the commodity chain.

In addition to providing services to producers, many of the organizations are also buyers of mango, under the broad umbrella of economic development. They become the mango reference points for the exporters and for the local market. They build treatment centers to select, wash and preserve fruits. They possess attributes that could promote the decentralization of small manufacturing units across the country and reduce loss. However, they have the will but not the way to implement such small scale processing centers. These centers could produce juice, puree, salsa, and refrigerator fruits for a long period of time, thereby reducing postharvest loss. In some cases, international organizations, such as USAID and NGO's, provide some of the operational funding. Some of these organizations have started to value the proposition of building local capacity, besides simply focusing on exporting the fresh fruit.

In the buying capacity, the organizations tend to displace the *voltigeurs,* who generally look for profit in a relatively short period of time (a one-day trip to producing areas), without building a long-term relationship with producers. By contrast, the organizations may provide services from one end of the spectrum to the other. They build long-term relationship with producers and are an integral part of the community. Although they may not procure the mangoes from producers for profit per se, one can imagine that these organizations are not totally selfless. They have personnel, equipment, and operating expenses, just like for-profit companies do. That may explain why some producers opt out. In particular, those who have a pool of family labor they can use to take care of harvesting and transportation, often see value in 'keeping it in the family.' In subsequent chapters, I will expand on both the social and economic impact of producer organizations in the mango production and export sectors.

Exporters

The third channel is made up of exporters and private investors who put in place the structures to enable mango export. Without this important sector, Haitian mangoes could still be a livestock feed. One of the oldest organizations, which includes 10 exporters, is l'*Association Nationale des Exportateurs de Mangues (ANEM).* Under the broader umbrella of export, I divide the exporters in two groups: the Traditional Exporters and the Fair-Exporters. The traditional exporters – or the so-called upper class elite – include wealthy individuals who have connections with international importers and trading houses. Some accumulate wealth from inheritance, by controlling the import-export sector and by having exclusive access to financial institutions. They take advantage of their social position to access foreign capital and foster relationships with international government agencies, which sometimes results in lucrative benefits. Apart from having economic power, they exert a great deal of influence over the political process and leadership, even when they appear to be mere spectators in the political ping-pong match that has hurt Haiti for generations. Others climb from the lower or middle class, because of their education level, to arrive at the ranks of 'movers and shakers' who wield influence and power in the political and economic sphere. This group also includes migrants who return to Haiti after amassing their fortune overseas. They invest in education, import-export, real estate, and manufacturing. What separates these sub-groups from each other is the source of their wealth. But the line is much more blurry than my expressed classification, because of intermarriage between the groups and the integration of immigrants of American, European, and Middle Eastern descent. Although traditional exporters have a long history of economic privilege, their position is not without challengers in a seemingly open market.

The fair-exporters are buyers who buy directly from producers with minimal use of intermediaries, traditional exporters and importers. They are typically TNCs and deep-pocketed international buyers that establish their own procurement network. Similar to fair trade, they seek to foster community economic development by opening global market access to small-scale producers while paying a premium price for products. They often carry their private labels and collaborate with other labeling organizations to certify products and to ensure that they meet expected norms and standards. They source from growers who are committed to producing quality products with transparent practices of social and environmental responsibility. Unlike fair trade, which tends to favor dealing with cooperatives and producers' associations, these fair-exporters open their supplier networks and their wallets to deal with local traditional exporters, intermediaries, individuals, and families who own one or more mango trees. Since these TNCs are sometimes publically traded companies, it is reasonable to think that the fluctuations of the market and shareholders' expectations dictate the price premium of their socially conscious supplies.

Whole Foods Market can be classified as a fair-exporter, with their initiative to buy organic and Fair Trade Certified mangoes directly from Haitian growers. The publically traded company markets the Haitian Madame Francis mango under the "Whole Trade" label to signal that growers receive equitable prices. They use local export intermediaries to organize producers into cooperatives that ensure fair trade and organic certifications, which incentivize consumers to pay a higher price to supposedly benefit both Whole Foods Market and the growers. The cooperative also represents a channel for negotiating price, quality, and volume prior to the harvest season

and a vehicle for fulfilling volume commitments by way of grouping producers into larger supply units. Although the small-scale growers gain the benefits of a price premium, these arrangements help Whole Foods Market to solidify its vertical integration and reduce transaction costs by bypassing importers, traders, and distributors in the destination countries. In addition to individual growers who seemingly benefit from a price premium, the country as a whole may benefit from the positive externalities resulting from planting additional mango trees.

A holistic view requires factoring marginal costs and risks associated with pushing the production of a single export variety on small plots of land. For example, the perceived positive income effect walks hand in hand with the negative substitution effects (Sen & Turnovsky, 1989) of having fewer plots available to produce foodstuffs, which may lead to an increased dependency on food imports. Considering the additional income and substitution effects, "the resulting behavior depends upon which effect dominates, and neither one possibility, nor the other, can be ruled out a priori" (Sen & Turnovsky, 1989 p. 229). One could argue that farmers can allocate the additional income to purchase food, in the spirit of being malleable to market forces. But the broader factors of market failure – crop insurance, credit access, and transaction costs – outweigh the capacity to purchase food. From a risk standpoint, permanent and temporary deterioration in terms of trade dynamics could have devastating effects on a small open economy like Haiti (Sen & Turnovsky, 1989; Turnovsky, 1993). Recent history reveals that Haiti remains vulnerable to economic embargo target practice. Whether the push to increase income through a single export variety renders small-scale farmers better off or more vulnerable to unanticipated shocks is a question that suggests the need for policy prescriptions that promote a comprehensive approach.

A handful of agricultural exporters ship products to various international markets. Typically, these individuals and companies have access to the resources that facilitate export of diverse products, especially mangoes. They own packing facilities in the Port-au-Prince area with the convenience of nearby shipping ports. The lack of ports and packing facilities in the production areas means that relatively inadequate transportation to Port-au-Prince, in often poor conditions, is necessary before exports can be shipped to international markets. The infrastructure, or lack thereof, as well as high transaction costs, constitute some of the significant barriers to connecting farmers to exporters to consumers. In recent years, the number of exporting firms declined due to financial stress in the sector, including skyrocketing transportation and energy costs and increased requirements and fees from the United States Department of Agriculture (USDA) and Animal and Plant Health Inspection.

The exporters establish implicit and non-contractual relationships with the producers and with local agricultural organizations to procure export commodities such as coffee, essential oil, cacao beans, mangoes, and other tropical fruits. Contract farming refers to an agreement between farmers and buyers that the farmers will provide a certain quantity of an agricultural commodity of a specified quality, at an explicit time, and for a specific price from buyers. Such an agreement may go beyond buying and selling to include integration and sharing of market analysis, management, inputs, information, and marketing services. Contract farming could be beneficial to farmers in terms of providing higher income, employment, and gender equity. In the Dominican Republic, Raynolds (2002) found that contract farming increases the demand for women's labor and provides them with channels to contest the appropriation of their household

labor while enhancing their self-esteem. Although contract farming leads to higher income for farming households in some cases, it also creates bottlenecks in other cases, and farmers exit the arrangements at a high rate.

Mango exporters generally do not deal directly with producers, and they avoid entering contractual agreements because there are no obvious advantages to doing so in a market with many sellers, very few buyers, unreliable supply, infrastructural bottleneck, and weak institutions to enforce policies. To the dismay of many producers, many exporters employ *Voltigeurs* (middlemen) to negotiate lower prices. According to the producers that I interviewed during my field research, the use of *Voltigeurs* to batter down prices is a tactic to avoid paying fair market price. Particularly in the mango sector, producers are reluctant to negotiate with *Voltiguers*. They prefer dealing directly with the exporters for the opportunity to negotiate a higher price, which is very hard to reach, mainly due to the presence of ample sellers and very few buyers for the seasonal export variety. Overemphasis on the export variety – in the midst of weak linkages between buyers and sellers – is one of the factors that render producers vulnerable to monopsonistic rent-seeking agents.

For much of the twentieth century, the United States produced the majority of its own fruit and vegetable supply. As the United States population becomes more ethnically diverse, however, the American food basket diversifies to reflect a growing share of imported tropical fruits, vegetables, and spices. The influx of immigrants from various parts of the world – Africa, Asia, Latin America, and the Caribbean – raises demand for fresh produce that satisfies their native and customary diets. In addition, the inherent climatic and seasonal factors, as well as high

domestic farm labor costs (Nzaku, Houston, & Fonsah, 2010; Wells & Buzby, March 2008),

coupled with information dissemination and research evidence of health benefits of fruit

consumption (Masibo & He, 2008; Ribeiro & Schieber, 2010), drive up the U.S. import of fresh

tropical fruits including avocadoes, bananas, grapes, mangoes, papayas, pineapples and other

fresh fruits. Between 2004 and 2006, imports of various tropical fruits accounted for nearly two-

thirds of fresh fruit imports into the U.S. market (Huang & Huang, 2007). The overall import

share of U.S. fresh fruit consumption continues to expand. International trade agreements

between multiple nations are the driving force behind this increasing trend.

In analyzing the consequences of seasonality and the effects of trade policy on demand, Nzaku,

Houston, and Fonsah (2010) find that the introduction of NAFTA positively impacted

expenditure shares of many products, such as papayas, tomatoes, and peppers, due to improved

accessibility. Especially during the winter, when many produce varieties are out of season,

American supermarkets, grocers, and restaurant menus still feature fresh produce from distant

lands. Even where the 'food miles' are high, technological advances in transportation and

packaging help conserve the freshness and quality of these fruits. The most perishable and

delicate fruits become widely available almost year-round throughout the U.S. market, at

relatively affordable prices. These products arrive by air, land, and sea to various ports and

airports.

Mango imports from Haiti arrive into the U.S. mainly through five major ports and airports:

South Florida and Tampa area ports, Miami International Airport, Philadelphia-Camden Port,

New York's JFK airport, and Newark Liberty International Airport. Some of these receiving

points are equipped with refrigerated warehouses that serve as primary distribution centers to supply supermarkets, grocery stores, and restaurants. Because the United States is becoming increasingly dependent on imports to satisfy fresh produce demand (Huang & Huang, 2007; Nzaku et al., 2010), many exporting countries, including Haiti, are competing to increase their share of the pie. Meanwhile, to keep up with domestic demand for refrigeration and the inflow of imported goods in need of refrigeration, gross refrigerated storage capacity in the U.S. increased from 3.32 billion cubic feet in 2007 to 3.96 billion in 2011, an increase of 19.28 percent within this period (USDA, 2012). Although mangoes can withstand long distance transportation without refrigeration when they are not fully ripe, some level of refrigeration can slow down the ripeness.

MARNDR

The *Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural* (MARNDR) of Haiti is among the key agencies in the mango chain. MARNDR is the government entity responsible for defining development policies in the agriculture, livestock, renewable natural resources and rural sectors. One of the strategic priorities of this entity is to increase agricultural production by ensuring that farmers have access to the necessary inputs and quality agricultural services.

Some of the responsibilities of the MARNDR in the mango chain include, but are not limited to, ensuring plant health and sanitary conditions in production and packaging, controlling fruit flies, providing training to growers, maintaining a list of growers and export packinghouses, and serving as official liaisons to international agencies. For export purposes, and in collaboration

with the exporters, MARNDR organizes mango growers into units of production to facilitate the traceability and sampling of exportable mangoes. In some cases, the Department of Agriculture invests in infrastructure and equipment to add value to the agricultural sector and to bring about economic growth in rural areas. In other cases, they facilitate financing for the acquisition of equipment (tractors, tillers), especially for producers who group themselves in associations, investment units, or as companies.

USDA/APHIS and Preclearance

Besides the local actors and NGOs, the mango chain involves several international agencies. Among them are the USDA and APHIS. The USDA/APHIS is the counterpart of MARNDR in Haiti. Their mission is to provide guidance on agricultural production, food, nutrition, natural resources, and rural development based on science, sound public policy, and efficient management. Their overall mission is to protect and promote U.S. agriculture, food, natural resources and related issues, by mitigating and preventing pests, such as fruit flies, from entering and establishing themselves within the region of U.S. agricultural production.

Haiti benefits from the U.S. preclearance inspection and/or treatment programs, exclusively for mango exports to the U.S. market. APHIS's officers manage the program inside of Haiti to eliminate the threat of fruit flies and other undesirable food-induced pests. Other than such human resources, the Center for Plant Health Science and Technology (CPHST) has developed several adaptive scientific tools to detect, identify, and prevent the risk of disease transfer. The core activities of CPHST provide necessary support mechanisms to APHIS' officers in administering quarantine treatments, training-the-trainer for proper application of treatments,

providing certification to commodity treatment facilities within foreign countries, and conducting quality assurance audits. APHIS' method for ensuring that Haitian mangoes are safe is the application of a hot water treatment, which is also available in Mexico, Brazil, Peru, and Guatemala. According to the USDA, foreign governments and exporter groups may request preclearance inspection and/or treatment by APHIS officers in the country of origin, contingent upon feasibility and export volume.

The preclearance program not only provides protection to U.S. consumers, but it also helps preserve market access for Haitian mango producers. Especially during the mango season, temporary interruption to the program negatively affects exporters and producers. Market shocks, in the form of natural disasters and trade embargoes, often lead to the program's interruption. For example, Haiti's mango preclearance program was temporarily suspended after the January 10, 2010 earthquake, because inspectors were unable to reach damaged treatment facilities (Kiel, 2010). Another significant aspect is that, in connection with the role of the preclearance program in facilitating economic development, there tends to be a preconceived notion to equate the program with foreign aid. However, "the Haiti Mango Preclearance Program is not a U.S. foreign assistance effort. The entire cost of the program is borne by the local export association" (USEP, 2013). The program is a reciprocal rent-seeking economic endeavor between U.S. entities and local actors.

Packing Plants

During the 2011 season, Haiti had ten APHIS-approved packing facilities equipped with hot water treatment systems, nine in the Port-au-Prince area and one in Pont Sondé (USEP, 2013).

In some cases, the exporters provide the means of transporting the mangoes from the rural farms or the farmers' organization facilities to the export packing facilities. In other cases, the producers provide their own transportation, which is generally public transportation, to bring their mangoes to the packing centers. The road conditions often deal severe blows to the fresh mangoes that need tender care for the export markets. In spite of the trucks and the plastic crates the exporters provide, between the farms and the export packing centers, more than 50% of the harvest gets damaged, causing a direct loss of income to farmers and revenue to the exporters.

Upon arrival at the export-packing plant, the mangoes undergo further sorting and inspection. Plant workers sort the slightly immature fruits and screen them to detect evidence of fruit fly infestation, followed by a dip into a hot water bath of 115ºF for 60-90 minutes, depending on size. The goal of the hot bath is to raise the core temperature of each individual mango to 113ºF, the lethal temperature to fruit fly larvae, without causing damage to the fruit. The packinghouses certified more than 20 million pounds of mangoes for shipment to the U.S. market during the 2011 season. However, the fruits that are too ripe or not ripe enough, the ones that are too big or too small, do not obtain their export visas, which are tiny stickers glued on each mango. The fruits that do not pass the export inspection are returned back to the producers for local market consumption or for spoilage in the fields. A robust agro-industrial sector would be essential for transforming non-exportable fresh fruits into more durable products – such as juice, dried mangoes, salsa, jams, pulp, and puree, mango paste, mango flour, and mango curry – and could prevent waste.

Building a packing plant requires substantial capital investment. In the developing world, only a minority has access to the capital needed to build a plant and furnish it with the necessary equipment and the packing supplies to meet the requirements of export. These plants generally employ a great number of workers who sort, wash, pack, load, and ship the fruits. Consequently, obtaining a packing plant license creates seasonal employment and distributes some income to small producers. Also, the plant license endows the exporter with bargaining power and control over "Policy Rents" (Talbot, 2004 p. 20). William (1986) raised these issues in a study of Central America's cattle boom during the 1960s and 1970s. Whether this income distribution enhances or decreases welfare remains an important question. However, the ownership of the export structures – such as processes, packing plants, licenses, and distribution – could determine the degree of income distribution in exports of Haitian mangoes.

Key Constraints

The aim of this study is not to focus on the obvious issues, although the producers point to a number of constraining factors that amplify their risk exposure. The top three constraints that producers indicated during the interview process were credit access, market access and diversification, and farm size.

Credit Access

The literature on economic development presents much evidence that credit access matters a great deal (Conning & Udry, 2007; Foltz, 2004; C. Guirkinger & Boucher, 2008). The mango industry lacks the financial instruments (accounting practice, government subsidies, forward-

looking policies, and sector-specific credit programs) to develop to its full potential. The limited forms of credit that are available often create more hardships than they solve. A few weeks before the mango harvest, some producers sell their trees at a very low price to buyers who want to make a hefty profit within a two- to three-week period. The few existing informal loans are generally short-term for small trade (mainly buying and selling imported goods) or for mango trees that are almost ready for harvest, at a rate that often surpasses 36 percent per year. Informal lenders have the ability to overcome moral hazard and adverse selection by being physically and socially close to borrowers and by providing credit within the realm of activities that they engage in (C. Guirkinger, 2008). That explains why the pre-harvest tree buyers tend to be middlemen who already have a relationship with exporters and *Madame Saras*.

Contrary to Leyburn's (1980) oversimplified assumption, the recurring debate in the literature of economic development emphasizes the role of small-scale farms in fostering economic growth and development. Scholars often cite the highly unequal agrarian structure of Latin American economies, which are lagging compared to the success of Asian economies, due mainly to their more equal land distribution. In reference to the upward effects of relatively equitable land distribution in developing countries, a range of studies confirms robust contributions of small-scale agriculture to widespread economic growth (Lipton, 2009; Loayza & Raddatz, 2010). At the same time, recent debates raise questions about the relative emphasis placed on the role of small-scale versus large-scale farms in fostering economic growth in developing countries. New findings point to the effectiveness of large farms and the pecuniary advantage through economies of scale and competitiveness in a global market for stimulating growth (Byerlee, de Janvry, & Sadoulet, 2009; Deininger & Byerlee, Oct. 2010). Relative to the number of farmers, land

scarcity is very pronounced and parceling widespread in Haiti. Therefore, arriving at some

consolidation of parcels of land into larger farms could be a monumental challenge.

Nevertheless, the defining structural issues affecting mango farmers rest not on the historical

dimensions of land distribution but on the current agrarian structure that has implications for

forward-looking socioeconomic policies.

Widespread land ownership does not automatically translate into meaningful endowments along

the economic spectrum of mango production. A range of factors contributes to hamper

productivity gain and prevent widespread benefits.   Especially in the export crop production

sector, volume matters. Economies of scale often create the "small size" biases that work against

smallholders (Carter, Barham, & Mesbah, 1996; Collins, 1995 p. 1104). Most farmers operate

their farms and practice subsistence farming in units composed of several dispersed field plots.

They own, rent, or sharecrop several plots. To counter the small size effects, smallholders often

create associations and cooperatives to bundle their production, a hedging technique that often

minimizes the risks of isolation that come from being too small to play in the export field. This

counterbalance renders Haiti's agrarian structure more conducive to spreading income benefits to

smallholders than large-scale orchards with concentrated ownership in the hands of a few.

Mango production is considerably less labor intensive (less than 50 days per hectare) than other

fruit and vegetable crops such asparagus and strawberries (more than 300 days per hectare)

(Carter et al., 1996). Production seemingly rests less on labor than on land availability. Given

the widespread land distribution evidence, producing small-scale orchards may not require a

large capital investment. However, many small producers often find themselves in the

conundrum of either being strapped for capital to increase production, or selling their products

and services at vile prices in order to overcome hardships.

Household strategies to relax credit constraints include off-farm work, small business, and

migration (Mendola, 2008). Whether or not the mango industry can count on remittance funding

to flourish is a significant question that I address in this study in subsequent analysis chapters.

The *Konsèy Nasyonal Finansman Polilè* (KNFP) is one of the financial organizations striving to

fill the rural credit void. The organization has affiliates in rural areas and works in collaboration

with international organizations to facilitate credit access for producers. For instance, in 2009,

KNFP collaborated with the IMF and USAID to provide 4 million Gourdes (about US $95,000)

to mango producers in the Gros Morne area. These efforts targeted at rural areas seem to be

increasing, but government credit programs for facilitating producers' credit access are still

lagging.

Market Access and Diversification

In many mango-producing regions of Haiti, farmers encounter difficulties transporting their

harvest to market, due to a lack of paved roads and bridges. Particularly in the Haut-Artibonite

region where there are large rivers to cross, the rainy season often deals severe blows to

producers, causing pockets of surplus and spoilage of mangoes. The Southern region faces

similar issues related to the inefficient movement of goods, costing farmers a substantial amount

of their expected income. Institutional support, such as crop insurance, state subsidies, and

credit, is virtually nonexistent. Famers typically rely on local organizations and each other to

override the adverse effects of market failure and postharvest loss.

Producers would like market diversification in kind and in location. Diversity in kind refers to access to buyers not only for fresh mangoes and exports but also for processing. Competition among different buyers may be one effective way to increase producers' income. Mango production will be more viable when it starts generating linkages and demand from various industries. Diversity in location means decentralization of buying and processing activities. Currently, a very high percentage of economic activities revolve around the capital, Port-au-Prince. The country has a relatively small agroprocessing sector that processes various grains (corn, wheat, and sorghum), tomatoes, and some fruits, notably dry mangoes. The need to process agricultural products is becoming more pressing, as Haiti's food imports continue to grow in tandem with population growth. From a world market perspective, a large percentage of agricultural production undergoes some level of processing between the point of harvest and final use (FAO, 1997).

Despite recent improvement to some of the major roads linking Departments, transportation remains one of the major postharvest challenges for Haitian producers and exporters. This issue persists beyond moving goods within the country, to international shipping conditions. Compared to their regional counterparts, Haitian exporters incur substantially higher freight costs for shipping their products overseas, due to agency fees, carriers' market power, and structural issues that include tariffs and port infrastructure (Table 3-2). In general, international shipping costs vary depending on the goods and the carriers. They are higher for developing countries than for developed ones, partly because cargo carriers exercise market power on the sector (Hummels, Lugovskyy, & Skiba, 2009). Trade routes connecting ports with high cargo volume,

multiple carriers, and ships, tend to have lower shipping costs. These attributes also reduce

carriers' ability to price discriminate based on products. Minimum efficient equipment in

transportation affects prices. Shipping costs closely correlate to the internal characteristics of the

market, which include port infrastructure, services, fees, and the types of goods. Despite Haiti's

close proximity to the U.S. – its main external mango market – the lack of internal infrastructure

and competition between carriers make shipping comparatively costly.

Table 3-2: Shipping Cost to the U.S.

Average cost, insurance, and freight prices for selected varieties from main suppliers to the United States, 2006 (U.S. dollars per kilogram)								
Country of Origin	1998	1999	2000	2001	2002	2003	2004	2005	2006
Brazil	3.43	2.13	2.09	1.74	1.67	1.72	1.65	1.67	1.65
Ecuador	3.21	1.67	1.69	1.65	1.47	1.28	1.83	1.94	1.67
Haiti	N/A	2.24	2.05	2.24	2.13	1.96	1.98	2.11	2.11
Peru	3.61	1.89	1.65	1.85	1.61	1.45	1.43	1.58	1.39
Mexico	2.09	1.78	1.72	1.69	1.61	1.45	1.43	1.67	1.72

Source: (E. A. Evans, 2009).

Developing countries lack the infrastructure to accommodate large vessels, and their ports

operate within strict hours – daytime only – which limit the type and the number of vessels that

anchor there. For example, the port of Port-au-Prince is equipped with large cranes to handle

large shipments, but vessels are not allowed to enter Haitian ports between the hours of 6:00 PM

and 5:00 AM. This situation creates a concentration of vessel activity within a confined space at

a limited time. The limited regional ports are often deficient in the required infrastructure to

handle overcapacity from the capital. In addition to the limited hours of operation, the relatively

high fees and the exchange rate variability contribute to amplify bottlenecks, increase shipping

costs, and intensify the lack of competition among carriers that connect Haiti to world markets.

Farm Size

Lack of access to land is one of the constraints hindering participation in agro-exports. The majority of Haitian mango farms are owner-operated, on fragmented landholdings (G. R. Smucker, White, & Bannister, 2000). Farmers may own, rent, and sharecrop several plots. In some cases, many family members own a single parcel of land, due to an inheritance structure that can complicate land subdivision and distribution. As a result, it is rather usual to find multiple family members owning a single mango tree, since the land is family-owned. Added to the small size factor, land use decisions and complexity in title transfers further constrain participation.

A number of empirical studies show that agrarian assets distribution helps hold back broad economic growth in the Latin American and Caribbean regions (B. Barham, Carter, & Sigelko, 1995; Carter & Barham, 1996; Fort, 2007; Frankema, 2010). In the case of Haiti, the willingness to participate is somewhat widespread, even among growers who only have a couple of trees in the backyard. Obtaining access to large enough plots of land for mango orchards seems to be one of the key barriers that producers face. Furthermore, farm size and credit constraints might be correlated, where the financial institutions may avoid smallholders due to their size, and the smallholders may avoid formal loans in order to minimize financial transaction costs (C. Guirkinger, 2008) and mitigate the risk of losing their property for lack of compliance. The empirical analysis of this study includes farm size among the factors that could influence producers' willingness to produce.

Regional Competition

The availability of information about both the contents of foodstuffs and the health benefits of these contents helps promote the consumption of fruits and vegetables. It stimulates international trade and fuels regional competition. The latter result becomes more pronounced with increased consumer demand for freshness, variety, and the availability of quality products. On the one hand, such an environment pushes producers to increase their yield with the goal of benefiting from the demand. They adopt innovative approaches to minimize postharvest losses and optimize quality. On the other hand, exporters and processors deploy logistical technologies to attain efficient procurement and a reliable flow of supply. They implement adaptive packaging systems and logistical networks to preserve the quality and freshness of fruits and vegetables. The push for market share, coupled with the quest for efficiency, amplifies the degree of competition among regional producing countries. Particularly, in Latin America and the Caribbean, mango production is spread across many countries that are seeking to increase their export volume by reaching the United States market niche to unload their seasonal production. Such a situation helps intensify competition in the region.

Haiti exports mangoes primarily to the United States. The top six regional competitors are Mexico, Peru, Ecuador, Brazil, Guatemala, and Haiti. Between 2007 and 2011, Mexico accounted for 96 percent of total mango imports (in volume terms) into the United States, while Haiti and Brazil accounted for 3 and 1 percent respectively. Being in the top five mango exporters to the world's largest import market implies significant value to the Haitian economy. It also entails additional market pressure to keep up with the competition while improving market standing. However, maintaining or improving market share means bolstering capacities

and improving domestic structural components, which could be daunting tasks for a small economy. Regionally, Haiti incurs among the highest export cost to the U.S. market, mainly due to export fees, lack of suitable infrastructure, and lack of competition among shipping lines. Factors such as higher standards of port compliance, marketing, promotion, and facilities improvement, may enhance competitiveness. Haiti could take advantage of its close proximity to the United States, but it faces strong competition from Mexico, a significant NAFTA partner that has land-shipping access to the United States. Although production size and proximity to markets matter in competition, quality and price could tip the competitive scales in favor of Haiti.

Retail pricing data in the United States shows that consumers are willing to pay a price premium for Haitian mangoes. Compared to the $1.43 per unit price of the competing mango varieties from Mexico, Brazil, Peru, and other countries, the average retail price of Haiti's Madame Francis was $2.75 during the 2011 season. Haiti seems to have a comparative advantage by producing a first-rate quality mango and by maintaining one of the highest prices on the export market. Leaders in charge of formulating Haiti's economic growth policy use this argument to advocate greater integration of the country into world markets, by promoting export-led production of tropical fruits and labor-intensive goods. Particularly, mango production attracts the interest of international agencies, multinational corporations, humanitarian organizations, and governments alike, in an effort to spike some degree of economic growth in Haiti. In recent years, USAID representatives have deployed efforts to rehabilitate mango production and promote export. They have implemented fruit fly detection and control programs, provided technical assistance to local organizations to improve their services and increase their capacity,

assisted in the deployment of improved packing material, and launched campaigns to support the use of new techniques based on measurable and demonstrated benefits to the growers. The continuance of such rehabilitation efforts provides a substantial boost to Haiti's production, as well as its capacity to sustain its export market share and maintain its price premium.

Local Focus

In March 2010, two months after the devastating earthquake, The Coca-Cola Company launched Haiti Hope Project with the introduction of its Odwalla Haiti Hope Mango Lime-Aid to support producers. The total investment in the Haiti Hope Project has reached $7.5 million, with $3.5 million from The Coca-Cola Company, $3 million from the Inter-American Development Bank's Multilateral Investment Fund (MIF) and $1 million from the United States Government (CommodityOnline, 2010). The project is a public-private initiative aimed at developing a sustainable mango industry in Haiti. Some mango producers in southern Haiti and in the Haut-Artibonite regions stated that the Haiti Hope Project seems more like multinational propaganda than meaningful action on the ground. Others claimed that the project does not seem to apply to their circumstances. They very much prefer small to mid-size processing plants in their communities to absorb and transform various types of mangoes and a range of other fruits. Eventual market entry by beverage companies and fruit processing companies to procure locally grown mangoes may be less discordant than the case of Coca-Cola in Belize (B. L. Barham, 1992). These companies could take the pressure off by processing excess supplies, bruised mangoes, and export-rejects to make puree and juice for the domestic market, which imports various types of fruit juices.

Specific support for the production of the export variety of mango is based on the neoclassical Heckscher-Ohlin model of free trade and comparative advantage. The key feature of the theorem is that the opening to international trade means a new set of relative prices and reallocation of production, leading to gains from trade (Appleyard, Field, & Cobb, 2007). Because relative factor endowments determine comparative advantage, the climate, the soil type, and the predominantly rural nature of Haiti make it conducive to producing high-quality mangoes. These endowments appear to present ideal mechanisms for extending the benefits of commodity trade directly to the rural community. But, this direct benefit may not be as direct as many think. One must consider the many twists and turns along the way.

In this line of thinking, Evans (1997) asks whether agricultural commodity-producing countries might be better advised to stop following the 'comparative advantage' model and decide to produce for their domestic markets, to abandon cash crop production and return to food production. However, abandoning the cash crop may not be a practical or advantageous approach for Haitian small producers in need of extra income. Both from policy-making and socioeconomic standpoints, choosing either the cash crop or the food crop presents a conundrum for small farmers.

First, Haiti has a long tradition of mixed farming, due to land allocation that limits producers to growing food for family consumption and cash crops for income on relatively small, scattered plots of land. Farmers face pressure between two "equally" important choices: producing for "food sovereignty" or for income. The country as a whole benefits from the production of cash crops for export, which accumulates foreign exchange reserves and procures imported products,

whether they be manufactured goods or foodstuffs. Besides, small farmers don't live on food

alone, but also on healthcare, transportation, education, entertainment, and every other society-

induced necessity. Therefore, mixing the two types of crops seems to be a rational choice.

Second, mixing tree-fruit crops (mango, avocado, cocoa, and guava) with staples (beans, cereals,

tubers, and vegetables) offers agro-ecological benefits and economic value to small producers.

On one hand, environmental degradation and deforestation would be more pronounced without

the positive impacts of tree-fruits that help maintain soil fertility and prevent erosion in many

parts of Haiti. On the other hand, producers generate income from selling their products to the

local market and to exporters.

Third, the integration of crops and livestock (cattle, goats, and pigs) offers complementary

advantages (Powell & Williams, 1994). The residues of crops serve as significant feedstock for

animals, while the animals produce manure to fertilize crops and meat and milk for household

income. In turn, farmers invest this income back into their farms. Particularly for the unbanked

farmers, livestock such as goats and pigs are the literal piggybanks they use to save capital for

education, healthcare, and social events.

Although many producers strive to gain additional income from selling fresh crops to the export

market, they value the capacity to process their harvest locally, either for the domestic or the

international market. Local processing capacities can diversify the extant sale channels by

increasing domestic consumption and opening access to new external markets. Haiti's traditional

exports consist primarily of agricultural products, including essential oil, cocoa beans, mangoes,

sisal, coffee, and sugar. Manufacturing is limited mainly to textiles, assembly, and some primary products processing. Investment in the fruit-processing sector could increase market diversification and enhance producers' competitiveness. In addition, construction of new processing plants could add value to the non-export varieties that are on the brink of destruction.

For the small farmers, success in the mango field implies some degree of access to land, capital, labor, and market. While the United States remains an attractive and feasible market for Haiti, gaining access to the large consumer base of the European Union could yield benefits in terms of diversification and revenue. In gaining access to the European market, exporters would need to consider the drawbacks of long distance shipping and strong competition from Africa and Asia. Key market agents – notably the exporters, international regulatory agencies, and the producers – remain fixated on increasing exports in order to bring broad-based income benefits to the country. However, the untapped domestic market could hold the secret for an even broader economic growth than the export market can provide. Through the multiplier effects of the domestic value chain, additional economic activity in agro-transformation would generate local employments.

Chapter 4 – Methodology and Data Collection

Site Selection Method

The microclimates of Haiti make it suitable for growing mango trees in virtually all ten departments of the country. To conduct my field research, I selected two sites. Prior to selecting the sites, I defined a set of selection criteria to determine their appropriateness and the portability of the results. I used the following criteria to choose two main sites for the study:

1) The sites should have a track record of producing a mix of mango varieties for the domestic and international markets. More specifically, they should specialize in producing the Madame Francis export variety.

2) Exporters should procure a significant quantity of their shipments from the sites.

3) Apart from mangoes, the sites should produce an array of tropical tree fruits for the domestic market with the potential for processing and tapping into the export market.

4) There should exist in these regions individual producers and local organizations that I would need for the socioeconomic aspect of my research. The agricultural organizations should interact with government workers, NGOs, exporters, and domestic retailers, which would make them rich sources of information conducive to my research.

5) Although the similarities set forth could exist between multiple sites, some differences could enhance their representativeness, in terms of geography, types of staple and cash crops grown, access to the market in terms of ground transportation, and organizational structure.

6) The sites should be large enough to be representative of the country.

Research Sites

From a geographic and administrative standpoint, Haiti is divided into ten departments
(Artibonite, Centre, Grand'Anse, Nippes, Nord, Nord-Est, Nord-Ouest, Ouest, Sud, and Sud-Est)
that contain Arrondissements at the second level of division, Communes at the third-level, and
Section Communales at the forth level. I chose the Departments of Artibonite and South for the
research. After my initial consultation visit with leaders of organizations in the field, I
concluded that several key Communes in these two sites – Artibonite and South – represent a
mixture of the viable attributes for my research (see map in Figure 4-1).

As I describe in Table 4-1, each research site contains multiple Communes that meet the criteria
of this research. In addition to the pre-defined guidelines that support my rationale, empirical
evidence on investment and unemployment further support the choice of the two sites.
According to the *Institut Haitien de Statistique et d'Informatique* (IHSI) of the Minister of
Economy and Finance, the Artibonite region receives among the lowest investment inflow in the
industrial, manufacturing, and infrastructural sectors of the country.[22] Yet the upper Artibonite
area of Gros Morne produces more than 50 percent of the total mango export from Haiti, making
it a significant site of production.

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[22] Information from the *Ministère de l'Economie et des Finances, Institut Haitien de Statistique et
d'Informatique* (Institut Haitien de Statistique et d'Informatique, 2003).

Figure 4-1: Map of Haiti and Research Sites

Off-farm activities generate an average of 34 percent of household income, with industrial, manufacturing, and infrastructural sectors accounting for 5 percent. On-farm activities – for example, agriculture, livestock, and fishery – account for 65.5 percent of household income. The South department generates a higher household income of 40 percent from off-farm activities, which is comparable to the national average. The sources of these regions' household assets seem highly homogeneous and farm-focused, contrary to the consensus in the literature that prescribes a broad range of investment and income strategies – particularly non-farm employment – in order to boost the income of marginalized farmers (De Janvry, Sadoulet, & Murgai, 2002; Reardon, Stamoulis, & Pingali, 2007). Based on the statistical data, the two sites

complement one another, allowing for a comprehensive analysis of mango production and agro-transformation in Haiti. Although some comparative analysis of the sites is necessary, my aim is complementarity rather than comparison.

Table 4-1: Research Sites

Department	Communes and Sections
South	Torbeck, Chantal, Camp-Perrin, Maniche, Ile à Vache, Port-Salut, Sant-Jean du Sud, Arniquet, Aquin, Saint-Louis du Sud, Cavaillon, Coteaux, Port-à-Piment, Roche-à-Bateau, Chardonnières, Anglais, Tiburon
Artibonite	Gros Morne: Boucan Richard, Rivière Mancelle, Rivière Blanche, L'Acul, Pendu, Savanne Carrée, Moulin, Ravine Gros-Morne

Similar to other departments in the country, the economic activities of the South and Artibonite are primarily agricultural, and there are hilly landscapes and large rivers to cross before arriving at the production sites. These conditions add to the complexity of growing food crops on slopes without the necessary natural resource management (NRM) technology and machinery (Smucker et al., 2005). On the bright side, however, these slopes are a conducive environment for producing tree crops. Hence the significance of studying the economic implications of a shift toward a mix of environment conservation and income generation. Lowlands that could serve as a viable alternative to farming remain non-irrigated and underutilized. Despite the high availability of water and the need for irrigation, water resources – rain and rivers – often head straight to the ocean, carrying with them precious soils and worsening the already fragile environment.

The dirt roads toward many of the production sites redefine the notion of "off-roading," with a combination of wide potholes, rocks, and steep hills that require four-wheel drive (4WD or 4X4) vehicles. Even the most experienced drivers negotiating the least resistant path encounter difficulties. The closer one gets to the sites, the more challenging the roads become. Mother Nature generally adds complexity to the conditions by pouring down rain during the harvest seasons. Producers use indigenous means of transporting their harvest to market, including *sac-paille* (saddles) on backs of donkeys, mules and horses, and baskets on people's heads.

Due to lack of suitable roads, getting to some of these production sites presents a logistical challenge. During my field work, I visited Moulin, a production-rich area located across a large river that has no bridge and no clear pathway to cross. Three individuals took the trip with me. Under the direction of someone walking in the water, we drove across an invisible, narrow and barely drivable path during daylight. We spent the day meeting with participants and gathering data. By the time we returned, it was after sunset and dark. Upon arriving at the riverbank, the river reflected the truck's headlights back at me, which made it very confusing to see the narrow pathway to cross. We had the choice to either spend the night in Moulin and wait till the next day or venture into the flowing river with the two-wheel drive vehicle. I decided to drive across the river in the dark, not knowing the exact path. The more I drove the more the truck sank and the less traction the tires received. After about fifty feet, the front tires got stuck in the muddy sand while the back tires were spinning and sinking deeper in the water.

My three passengers jumped out of the truck and started pushing, with assistance from some locals who came to witness the adventure. The more they pushed the deeper the truck continued

to sink, until I could not even open the door due to the pressure of the water. After three hours

of spinning and pushing, the truck could not move one foot. Just in case getting stuck in the

muddy sand was not enough to keep me in the middle of the river, I ended up getting a flat tire.

This added complication sank the truck deeper down into the river and further from getting out.

Finally, to shorten the story, someone took a motorcycle and went into town to get a 1977 army

truck, equipped with a front winch, to pull us out of the river. Now I understand why Haitian

leaders and personnel from NGOs and international organizations drive around in 4x4 SUVs,

such as Toyota Land Cruisers and Nissan Patrols. The cumulative rental and purchase costs of

these SUVs could build roads and bridges. Then again, that would take the fun out of crossing

bridgeless rivers and spinning wheels in muddy roads.

Lately, to counter the difficulties of postharvest transportation and increase efficiency, a few

organizations are adopting new forms of transportation – all terrain vehicles (ATVs). Whether

adoption of ATVs adds value to producers' bottom line remains a question, one that is out of the

scope of this paper. It is possible that the added costs of maintenance, parts, and fuel could

further burden producers.

Haiti is the quintessential small farms country. A 2012 survey, the *Ministère de l'Agriculture

des Ressources Naturelles et du Développement Rural* (MARNDR), reports a total of 1,053,107

farms in the country (MARNDR, 2012b). The South department accounts for a total of 92,868

farms, representing 8.8 percent of the farms in the entire country. They are divided into small

parcels averaging 0.65 CX per farm, nearly all of which (98.4 percent) are owner-operated. The

report also notes that 20.6 percent of producers operate farms that are greater than or equal to 1

CX. The Artibonite department totals 163,588 farms, representing 15.5 percent of the farms in the country, with an average of 0.75 CX per farm (MARNDR, 2012a). The owners operate 99 percent of their own farms. The number of farms operating on more than 1 CX amounts to 24.4 percent. Although the parcels of land are small, a great percentage of cultivable land remains idle due to lack of irrigation and other necessities.

Participants

The primary participants in this study are small landowners, women and men, who grow staples and cash crops. I also reached out to exporters and international organizations working on the mango chain in Haiti. I restricted recruitment to producers who reside in the South and upper Artibonite regions. In addition to being residents of either of these regions, the participants are primarily mango producers and individuals who are influential in the mango sector. During my initial field visit, I had the privilege to get acquainted with two leading community-based organizations that I selected to support my research. I collaborated with these organizations in selecting my sample and administering the surveys.

In the South, I collaborated with the *Association des Producteurs et Vendeurs de Fruits du Sud* (ASPVEFS) to select the sample and to administer to survey. The ASPVEFS organization started in 2004 in Camp-Perrin, with the main goals of reducing portharvest loss of various types of fruits and increasing income through value-added initiatives that could increase price and production. In the context of a developing country, these noble goals are historically complex to reach.

ASPVEFS has taken tangible measures to develop alternative means of growing their markets outside of the regular retail and export channels. They established a network of fruit producers, pickers, washers, packers, and retailers in order to create more opportunities for households across the South department. After a few years of operation, the organization has expanded its initial goals to include strategic planning for opening new markets that can absorb their products, technical training to increase production, knowledge sharing to empower producers in the South, and environmental repair.

Beyond the efforts cited above, ASPVEFS has developed marketing strategies to help increase sales of fruits to domestic customers and to exporters. First, they brand their products under the name "*Cascade, fruits frais selectionnés*," and they have developed a new packaging system that appeals to domestic customers. Second, they built two pre-processing centers to select and wash mangoes prior to transporting them to the U.S-authorized packinghouses and hot water treatment facilities that handle mangoes for export to the United States. With a clientele that includes direct sale and delivery to restaurants, supermarkets, and administration offices in the city of Les Cayes and surrounding areas, ASPVEFS takes its marketing and distribution to a higher level. For instance, during the 2009 season, mango producers in the association sold over 20,000 dozen of the export variety to exporters. They achieved this sale volume by building human capital through technical training that enhances their management skills and increases production, and by adding physical capital to reduce post-harvest waste. The functional and technical training that members of the association receive from Haitian agronomists, agricultural technicians, and NGOs, works to boost the potential of the fruits sector. This knowledge transfer constitutes a substantial contribution in propelling the organization's reputation in the mango chain.

Particularly, *Agronomes et Vétérinaires Sans Frontières* (AVSF) provides meaningful support to the organization in terms of production enhancement, marketing, and management.[23]

To override some of the adverse consequences of market failure – transaction costs, crop insurance, information asymmetry, and particularly credit access – the organization has developed a series of methods. For instance, in order to build the creditworthiness of its members, ASPVEFS keeps records of individuals' portfolios and tracks their credit history. In so doing, the goal is to appeal to financial institutions – farm credit agencies, cooperatives, banks, and microfinance organizations – to request capital, which is not readily available for the agricultural sector. In many cases, the producers have established creditworthiness in terms of funds management and their ability to repay loans. Yet accessing credit from established institutions remains a significant constraint for producers in Haiti.

Local financial organizations, such as the *Konsèy Nasyonal Finansman Popilè* (KNFP), are working on grassroots efforts to promote the decentralization of financial institutions and facilitate credit access for producers in various parts of Haiti.[24] Although the South has made

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[23] *Agronomes et Vétérinaires Sans Frontières* (AVSF) – Agronomists and Veterinarians Without Borders – is a French organization whose main policy is to provide structural and professional support to rural producers of strategic commodities, such as coffee, cocoa, mangoes, and dairy.

[24] Founded in 1998, the *Konsèy Nasyonal Finansman Popilè* (KNFP) is a Haitian organization working to promote and strengthen the financial sector throughout the country, particularly in rural areas where acces to credit is scarce.

great progress by establishing sound organizational structure to manage potential growth, the

volume of their production lags behind that of the upper Artibonite region. This difference

further strengthens the complementarity of the two sites.

In the Artibonite region, I collaborated with multiple organizations and three Haitian

agronomists. The principal organization was *Coopérative de Production Agricole et de*

Commercialisation Gros Morne (COPACGM), a representative organization for 9 localities in

Gros Morne. This organization helped select the sample, and the agronomists I recruited assisted

in administering the surveys.

Members of COPACGM produce the majority of the Madame Francis export variety. The

cooperative officially started in March of 2000 to represent the interests of mango growers and to

promote the production and sale of mangoes from the area. Over the years, the organization has

received some assistance from NGOs and international agencies in the form of collection centers,

crates, and technical training in modes of production, pruning, grafting, and traceability. This

support helps to increase production of the export variety of mango – at the expense of reducing

other varieties – and to increase the relative price. During the last few years, the cooperative has

provided over 100,000 dozens of mangoes per year to exporters.

In addition to reaching out to organizations, I also recruited individuals who are not members of

an organization, through snowball sampling, in order to understand the multifaceted aspects that

influence participation. I visited the South and Artibonite department to comprehend the

household characteristics that influence participation in mango production. It was crucial for me

to collect data from geographic areas that are representative of the country and from organizations and individuals who are producing mangoes. The intersection point between these participants hinges in their desire to increase income and improve economic conditions. The assessment took place in various locations, including participants' homes, at the farms, during organizational gatherings, and via email. But the local organizations channel yielded the most participants and provided the bulk of the data for this research.

Data Collection Method

This study uses a mixed method to collect and analyze quantitative data from in-person surveys and qualitative data from interviews (Hossler & Vesper, 1993; Tashakkori & Teddlie, 2000). The in-person survey approach permits the inclusion of individuals who are disabled or who have inadequate formal education. As I illustrate in the triangulation diagram (see Figure 4-2), the method design uses separate quantitative (as the primary in survey format) and qualitative (as the secondary in interview format) data collection methods, during a single phase, to complement, confirm, corroborate, and cross-validate the findings.
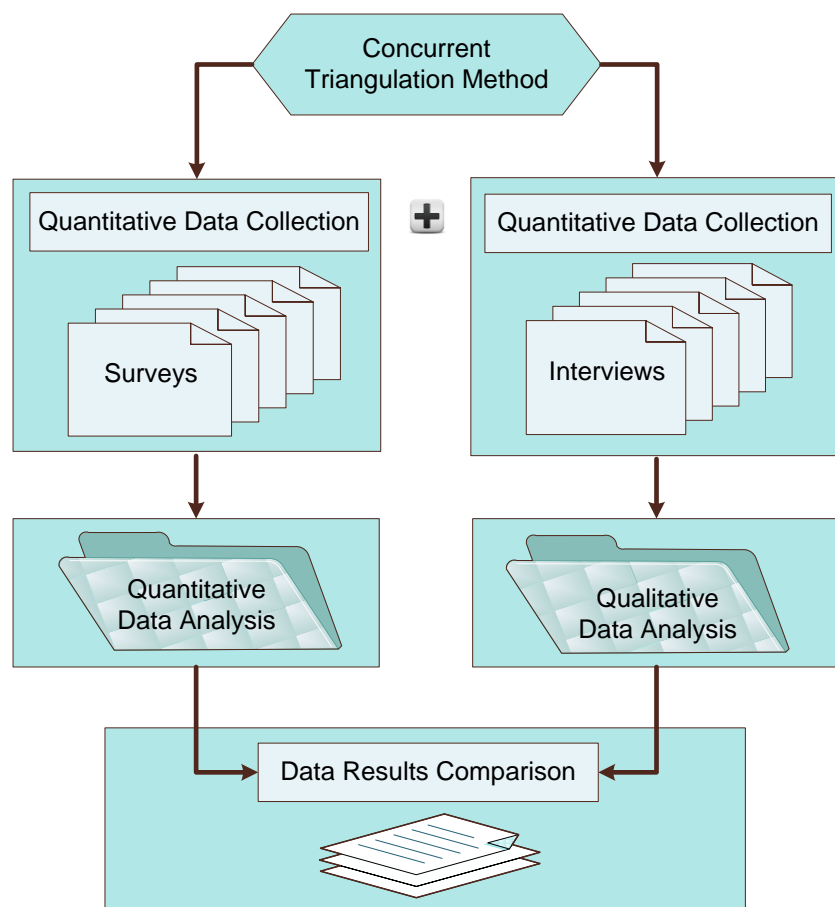
Figure 4-2: Concurrent triangulation diagram

Survey Description

This study uses a household survey of 780 producers in the South and the Artibonite regions of Haiti, between 2011 and 2012 (see Figure 4-3). I proportionally distributed a total of 900 surveys between 26 localities in the two regions to arrive at a response rate of 87 percent, or 780 participants. The survey participants represent a subsample of mango producers from the two above-mentioned sites. The use of a producer-based sample is consistent with the broader aim of this research, which is to determine the effects of price and producers' characteristics (including participation in agricultural organizations) on production.

I used a purposive sampling approach, using the pre-defined criteria, to select the localities and the collaborative organizations. This assured that the sample would represent an accessible and quantifiable 'population' that would hold extensive information on the research questions. "The logic and power of purposeful sampling lie in selecting information-rich cases for study in depth" (Patton, 2002, p. 230) and in the possibility of excluding sites, organizations, and subjects that have absolutely no knowledge and experience about mango production and farming conditions within the context of a developing country. This method also contributed to maximizing the external validity of the results (Balnaves & Caputi, 2001, p. 92).
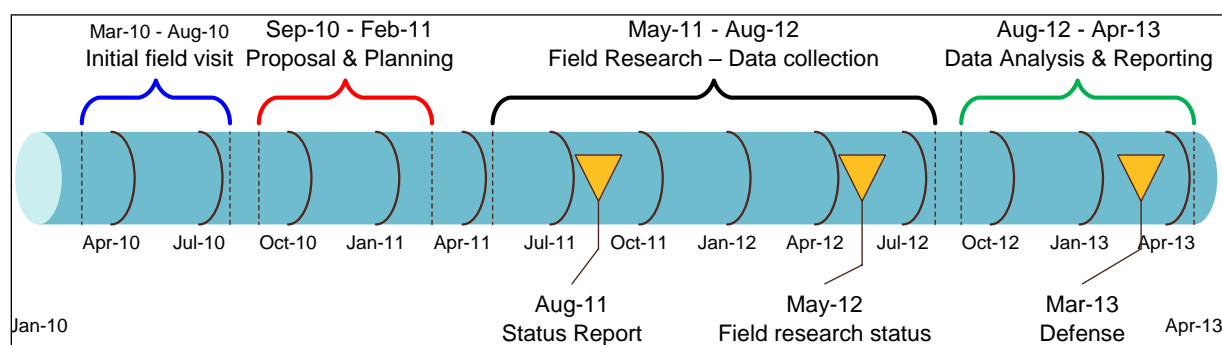
Figure 4-3: Research timeline

The initial design did not include focus groups, because, as the literature suggests, individuals yield more specific information than groups (Terry Bristol and Edward Fern 1996). However, upon arriving in the field, especially in the North where there is a strong collective interest in mango production, I found that many of the producers preferred meeting in groups to convey their collective experiences and expectations. At one point, almost an entire village wanted to

join the meeting and discuss the necessary elements that could add value to the chain and benefit

their households. I did not expect such a "curve bowl" but I made a quick adjustment to

incorporate the format that the participants desired. Scrupulous adherence to my initial plan

could have led to some alienation as opposed to building rapport and trust, which are necessary

elements in gathering objective information from the field.

As a prelude to the survey, therefore, I added focus groups to the data gathering process. This

was an occasion for me to step out of my preconceived theoretical box and be practical by

negotiating with the reality of the field. In hindsight, this change brings to life the theoretical

meaning of triangulation, with the three angles of information: survey, interview, and focus

group. Furthermore, the exploratory purpose of this research supports a flexible approach to data

gathering, to include both individual and collective input (Fern, 2001).

A conducive contingent valuation (CV) survey instrument requires focus groups and in-depth

interviews in order to help convey the understandability of the goods and to relay the plausibility

of the scenario to participants (R. T. Carson, 2000). Consequently, I conducted 4 focus group

sessions between the South and the Artibonite region as a "starting point for the design of survey

questionnaires" (Stewart, Shamdasani, & Rook, 2006, p. 39). The group sessions generated key

themes that added significant depth to the survey questions.

I wrote the surveys in three different languages: English, Creole and French. I translated the

first (English) version into Creole and French to accommodate the participants whose primary

language is Creole and French. Before arriving at the final version, I field-tested a draft of the

Creole and French version for accurate translation, content, understandability, relevance, and

construct validity.

The household survey contains two parts. The first part of the survey requests individual and

household characteristics, such as number of individuals in the household, source of household

income, number of on-farm family laborers, land ownership, organizational involvement,

number of mango trees owned, various constraints to production, and others. The second part of

the survey asks questions about individual willingness to produce more mango trees. I

formulated a scenario that describes a new policy to subsidize all harvest and postharvest costs

related to the supply of mangoes, contingent upon their gaining a specifically stated gross profit.

The format of the questions follows the Double-Bounded Dichotomous-Choice (DBDC)

approach, as depicted in Figure 4-2 (Hanemann, Loomis, & Kanninen, 1991). I ask a "Yes-No"

question about their willingness-to-accept (WTA) a certain price to produce additional mango

trees under the new policy to secure a *gross profit* of 20 *Gourdes* per dozen. I then ask a follow-

up question, dependent upon the respondent's answer. A "No" answer to the initial bid triggers a

follow-up question that increases the gross profit to 28 *Gourdes*, whereas a "Yes" answer

triggers a follow-up question that lowers the gross profit to 12 *Gourdes*. The data analysis

chapter will provide specific details about the use of CV as a data collection technique. The

willingness to produce section draws upon earlier work (R. T. Carson, 2000; M. Hanemann et

al., 1991; Jaramillo, Useche, Barham, & Foltz, 2010) that uses CV as means to measure

nonmarket values (Alberini, Kanninen, & Carson, 1997) and to influence actual market values

and behavior. The use of *gross profit* in the survey signifies that the policy subsidy only covers the transaction costs of goods sold.

The commonly used unit of measure for the Francis mango, and other export varieties from the region, is the dozen. The initial scenario of 20 *Gourdes* represents the average gross profit that producers make per one dozen mangoes. The average market price of one dozen mangos or 40 *Gourdes* represents the average price that exporters pay producers and mango organizations. The harvest and postharvest transaction costs – hand-picking or plucking, collecting, sorting, pre-washing, and transporting – are all included in that price.

In some cases, in order to defray some of the transaction costs that producers incur, exporters opt to provide transportation and plastic crates to bring the fruits from the farms or postharvest centers to the export packing centers. These kinds of arrangements between exporters and producers render the policy scenario of the survey very plausible. Even when the within-country costs of shipping and handling are embedded in the price, the suppliers catch a break for not paying upfront. In addition, the scenario embodies the risks of sharing transportation-related costs. To analyze of the quantitative survey data, I developed a series of econometric models that include Tobit and Maximum Likelihood Estimates (MLE). Chapter 4 and 5 provide more details on the economic models.

Interview Sample

I selected 30 producers for semi-structured in-depth individual interviews through informal conversations. The interviews lasted between 45 and 90 minutes and constituted the secondary

data collection method that derived questions from key variables of the survey. The questions covered three aspects: (1) household characteristics, (2) participation in group-work, producer's organization, and informal labor exchange, such as *Konbit* and *Squad-labor*, and (3) effects of price on production. I conducted all the interviews in person, either at the participants' respective homes or farms, or wherever they were accessible. I had to follow up on 5 of these interviews to obtain further clarification by telephone and by email.

The criteria for selecting the interviewees were based on the farm size variable from the survey responses. I followed a three-step process to ensure a distribution of region and farm size for the interviews. First, I separated the survey responses into the South and Artibonite regions. Second, I used an ordinal classification to group the producers according to their farm size: small (≤ 1 ha), medium (> 1 ha & < 4 ha), and large (> 4 ha). Finally, I selected every twentieth respondent in each group to interview 30 of those who agreed to participate in the process. This three-step process was essential to facilitate the spread of the interviews across the two regions and farm size.

The intersection of the survey and the interviews constitutes the vehicle for exploring the key variables under investigation in great detail. This mixed and flexible approach provides the opportunity to ask open-ended questions about the effects of organization membership on price and the impacts of group work, such as *Konbit* and *Squad-labor* movements, on producers' ability to produce. In particular, the interviews were necessary for capturing personal stories and experiences to complement my understanding of the socio-economic impacts of *Konbit* and

Squad-labor on small-scale farmers' ability to share information and resources to minimize the adverse effects of market failure in the mango sector.

I used tape recording, field notes, and open-jotting techniques to gather the interview data. My prior experience living in Haiti was significant in the inquiry process, and my knowledge of the Haitian languages (Creole and French) provided needed pathways to cultural immersion. These previously acquired skills allowed me to understand Haitian dialects and colloquialisms.

Presumably, fieldwork requires some degree of trust. Regardless of my familiarity with the culture and my local language abilities, I had to earn such trust. I view their participation as evidence that I gained some level of their trust. Although Haitian farmers are very welcoming, some of them expressed their disappointment in participating in research that only leads to more research without tangible actions in their communities. The overall qualitative data analysis utilizes a reflexive interpretative analysis to ascertain the plausibility of each producer's experience and account that triangulate some of the key questions of the survey.

Delimitations and Limitations

A host of issues are relevant to the study of economic value of commodities in the developed and developing world. However, limitations and delimitations are significant to placing the findings in context. This study focuses on the effects of price and producers' characteristics, mainly organizational membership on production, in the context of a small open economy. Key aspects of historical precedence, infrastructure and transaction costs provide supporting arguments to the main thesis under investigation.

Due to the nature of the topic, participation by some agents, such as buyers, exporters, international entities, and government officials, is limited or almost nonexistent. Additional studies would be significant for assessing the effects of land use, production costs, and tradeoffs between growing food crops and tree crops. In particular, the price elasticity of demand for mangoes is beyond the scope of this study.

Chapter 5 – Effects of Price and Characteristics on Production

Introduction

An empirical question in the microeconomic modeling of household decisions centers on how to couple welfare potentials with existing characteristics. The production of tropical tree fruits, notably the mango, enables Haitian smallholders to participate in agro-export by providing use value for their ecological benefits and market value for their trade price. These intrinsic values attract the interests of small producers, exporters, multinational corporations, organizations, and government leaders in search of economic benefits. The multifaceted interactions between producers and markets – in an environment of high unemployment and limited access to land – present opportunities to investigate the household decision-making process, particularly in terms of balancing the trade-offs between producing the export crop versus staple foods.

The factors of production, consumption, and relative value of the most-traded tropical fruits have all increased in the world market during recent decades. World production of the four dominant tropical fruits – mangoes, pineapples, avocados, and papayas – increased over the past decades. Once marginal and neglected among the highly traded tropical fruits, the mango is currently one of the most valued and fastest growing fruits on the world food market. Similar to other categories of tropical tree fruit, the bulk of global mango output comes from smallholders in developing countries, accounting for about 98 percent of total production, while developed countries absorb 80 percent of world import trade (FAO, 2003). The Latin American and Caribbean region is a major contributor to this increase, averaging 63 percent of global avocado output, 38 percent of papaya output, 34 percent of pineapple production, and 14 percent of

mango production, from 2001 to 2010. The renewed emphasis on export-oriented growth and the rising interest in organic fruits both result in a favorable trade balance for many countries of the region, namely for Haiti and its mango production.

Like most countries in Latin America and the Caribbean, the majority of Haiti's population derives its income from agriculture, which makes this study of paramount significance. Multinational corporations open their checkbooks to purchase smallholder-grown mangoes (as in the case of "Whole Food, Whole Trade Haitian Mangoes") and provide technical assistance to enhance production (see the "Haiti Hope Project" of Coca-Cola's Odwalla and USAID). In parallel, local organizations start emerging to marshal smallholders into producing units in order to maximize their potential, in the midst of quasi-inexistent government support. In general, government intervention in support of the fruits and vegetables sector tends to be lower than that of other agricultural sectors, such as rice and corn. Therefore, motivation to produce tends to originate from market demand through export promotion programs and trade policies that facilitate market access. In an effort to take advantage of favorable trade policies, small-scale producers are reverting to agrobiodiversity of tree fruit crops. In particular, the production of the export variety of mango Francis seems to open the door to increase income by participating in agro-exports.

In this chapter, I attempt to answer two questions: (1) Given the widespread ownership of mango trees among producers, what impact do price change and producers' characteristics have on production? (2) Considering land access for the production of tree crops, which characteristic

has a larger influence on household decision-making process when it comes to optimizing production?

This chapter presents the empirical result by exploring the key factors that typically influence household farmer's willingness-to-adopt (WTA) export crops. It highlights the *main effects* of these factors through the use of a Contingent Valuation (CV) approach. I used the CV method due to the fact that the estimates of the main dependent variables (price, land and tree) rely primarily on prospective data, which creates some challenges in assessing subsequent household decisions. I document these challenges in chapter 6, before presenting a more in-depth analysis of the data that utilizes additional variables from this investigation. The chapter contains three sections.

The first section presents an overview of economic theories relevant to the economic assessment that I pursue in the remainder of this dissertation. It provides a conceptual framework of the economic models and reviews the literature on CV, considering the effects of price changeability on welfare. The second section presents a summary of the field survey data with descriptive statistics of the dependent and explanatory variables. It addresses the non-response to explain why a few subjects did not respond or were unreachable. The section also contains the formulation of the economic model that I use to analyze the data. In the final section, I present the results from a subset of data to pave the way for a more in-depth analysis in the following chapter.

Conceptual Framework and Literature Review

The decision to investigate farmers' willingness to produce was inspired by a combination of field experience in Haiti and the technology adoption literature, which covers many facets of adoption. The multi-faceted economic modeling approach addresses environmental issues in the forms of predictive number of trees and social networking in terms of effects of local producer organizations. Beyond the environmental and social issues, there is the question of adoption due to price incentive that is crucial to this conversation.

Willig (1976) and Hicks (1956) made early contributions to the theoretical measurement of changes in welfare due to price and income variations of individuals. These were later adapted for determining the appropriate welfare measure using utility and expenditure functions (Hausman, 1981) and the Contingent Valuation (CV) approach (M. Hanemann et al., 1991). From a policy-making perspective, CV is one of the preferred valuation methods used to determine environmental intervention and natural resources management (Arrow et al., 1993). The approach provides survey participants with relevant information about a future scenario that would likely affect their welfare. From a market valuation standpoint, this method helps determine the necessary price for generating a certain level of supply.

Contingent Valuation Review

Researchers use the CV method to evaluate and place monetary value on nonmarket goods and on market goods and services. This technique involves direct elicitation of appropriate values from respondents through carefully designed survey questions. The format of the questions

could be a combination of open-ended, closed, and/or a series of questions, contingent upon a previous binary "yes" or "no" answer choice. The ultimate goal is to estimate either: (1) the compensating measure, which constitutes the minimum willingness-to-accept (WTA) compensation for goods and services, or (2) the equivalent measure, which is the maximum willingness-to-pay (WTP) to acquire a desired good and/or service (R. Carson, 2011; Flores, 2003). The difference between the two types of estimates could yield different results, which in turn may have significant policy implications (Knetsch, 1990). This study seeks willingness-to-produce, which falls under the category of WTA because it attempts to ascertain producers' minimum acceptable price.

The CV approach started with Davis (1963), who used an auction-like bidding process to place a value on the use of a public recreational park. The initial value was a low bid. If the respondent answered "yes," the bid kept increasing until the respondent answered "no." After a "no" answer, the bid went back down until it isolated the exact amount the respondent was willing to pay. This amount was recorded as the WTP.[25] In this model, isolating the respondent's exact minimum or maximum WTA/WTP was very ambiguous, and determining a suitable starting bid was a point of contention. Therefore, researchers began to focus their efforts on various aspects of the model in order to improve its valuation effectiveness.

To remove some of the contentious ambiguity from the model, Bishop and Heberlein (1979; 1980) used a single-bounded technique, which involved asking if the respondent would be willing to pay some given price for a given product. Hanemann (W. M. Hanemann, 1984)

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[25] Carson (2005; 2011) provides an extended explanation of the iterations of the CV method.

improved on the previous version by linking the Random Utility Model (RUM) with the single-bounded CV responses. The formulation of the individual's utility is: $u(p, g^j, y; z)$; j=0, 1, where p represents a vector of prices, g is the good to consume, y represents income, and z is a vector of other influential and observable attributes (e.g., sex, age, experience, and region). Even when a survey participant makes a clearly rational decision to accept or reject a bid, the researcher may not observe all the variables that enter into the decision-making process. By taking into account the unobservable characteristics of the individual's indirect utility, $v(g_i, y; z)$, the formulation of the stochastic response takes the form of:

$$u(g_i, y; z) = v(g_i, y; z) + \varepsilon_i \ , \quad j = 0, 1, \tag{5-1}$$

where $j = 0$ when g is missing and $j = 1$ when g is available; and where ε_0 and ε_1 represent the identically and independently distributed (i.i.d) unobserved random variables in jth situation, with means zero. A participant would accept an offer for an amount \$A when $v(0, y + A; z) + \varepsilon_i \geq v(1, y; z) + \varepsilon_i$ and reject it otherwise. Hanemann et al. (1991) subsequently note the probability of obtaining a "no" or a "yes" response respectively as

$$\pi^n(A) = G(A; \theta), \tag{5-2}$$

$$\pi^y(A) = 1 - G(A; \theta), \tag{5-3}$$

where $G(.; \theta)$ represents some statistical distribution function with parameter vector θ. In the context of a utility-maximization response, $G(.; \theta)$ represents the cumulative density function (cdf) of WTA, which entails

$$\Pr(response\ to\ A\ is\ No) \leftrightarrow \Pr(A > maximum\ WTA),$$

$$\Pr(response\ to\ A\ is\ Yes) \leftrightarrow \Pr(A \leq maximum\ WTA).$$

Another formulation of this model uses the log-likelihood function for a set of responses.

Consider N number of participants in a single-bounded CV survey, and let P_i^S represent the offer

price to the *i*th participants. A representation of the log-likelihood for the responses, after

substituting (2) and (3) becomes

$$ln\, L^S(\theta) = \sum_{i=1}^{n}\{d_i^y ln\pi^y(P_i^S) + d_i^n ln\pi^n(P_i^S)\}$$

$$= \sum_{i=1}^{n}\{d_i^y\, ln[1 - G(P_i^S;\theta)] + d_i^n ln G(B_i^S;\, \theta)\} \tag{5-4}$$

where d_i^y is 1 if the *i*th response is "yes" and 0 otherwise, while d_i^n is 1 if the *i*th response is "no"

and 0 otherwise.

Opponents of the CV method argue that the direct questioning technique represents an opinion

poll and that it falls short of accurately measuring the intended variables, as an observation

approach would (Diamond & Hausman, 1994). Depending upon the design of the questions, CV

may yield biased estimates of the different variable values. Therefore, these critics conclude,

reliance on CV surveys for determining economic values is misguided. Sometimes skepticism

generates healthy debate among researchers and may push the research envelope to uncover new

and efficient way of solving problems.

The econometric methods to estimate CV data evolve from the single-bounded (referendum) to

the double-bounded dichotomous choice (DBDC). Although the single method is more

straightforward than the double, from the perspective of the researcher, it presents some

statistical inefficiency and its analysis requires a very large number of observations for accurate

measurement. To remedy to this issue, Cameron and Quiggin (1994) introduced an alternative

questioning strategy in the form of follow-up dichotomous questioning, with a value threshold

that elicits a second discrete response. While the stated values of the initial and follow-up

responses are correlated, they are totally different.

The economic model of this study follows the DBDC elicitation format. This work draws

extensively from previous studies that utilize a similar approach, covering different types of

goods and services (R. T. Carson, 2000; M. Hanemann et al., 1991; Jaramillo et al., 2010).

While this method is well established in the environmental economics literature (Adamowicz,

Boxall, Williams, & Louviere, 1998) for determining WTP of nonmarket goods, researchers also

widely employ it in the valuation of market goods, such as the pricing of Bt cotton in Argentina

(Qaim & de Janvry, 2003). Before expanding on the actual economic model of this study, the

following section describes the survey data.

Survey Data

This study draws from a household survey of 780 producers in the South and the Artibonite

regions of Haiti, between 2011 and 2012, as I explained in chapter 4. Every household in the

survey has some access to land. I proportionally distributed a total of 900 surveys across 26

localities in the two regions, to arrive at a response rate of 91 percent or 823 participants. Of the

total responses, I removed 43 from the analysis due to data incompleteness, inconsistency and/or

for being underage. Although I set the minimum age requirement for participation to 18, many

Haitians start practicing farming at a much younger age. Agricultural labor activities are mainly

male-dominated. The participation rate by women of 35 percent in the final unit of analysis is

relatively high, with 37 percent in the North and 34 percent in the South. This rate of participation speaks to the market interests in the fruits sector.

The two regions received identical survey instruments consisting of six sections: (1) personal information and formal organizational membership, (2) family description, (3) on-farm and off-farm activities and income, (4) *konbit* participation, (5) landholding and fruit production, and (6) price, which included the production elicitation questions. The participants represent a subsample of mango producers from the two above-mentioned sites. The use of a producer-based sample is consistent with the broader aim of this research: to determine the effects of price and producers' characteristics, including participation in agricultural organizations, on production.

Because I was investigating one type of good – the export variety of mango, the Francis – I averted potential issues of sequence bias, which may occur in valuation surveys when researchers present an array of goods to select from (Mitchell & Carson, 1993). I also suppressed any such bias in the multiple price offers with the DBDC format of elicitation questions. Additionally, the initial offer price was based on the mean of gross profit, derived from the actual market price per dozen mangoes.

Non-Response Analysis

Of the 77 total non-respondents, 50 of them were not reachable because of daily farming activities far away from home or because of difficulties finding addresses. Finding addresses in rural Haiti, where there are no street names or available maps, requires guidance from

individuals who are familiar with the area. Consequently, the address issue and the potential effects from lack of education (where respondents are unable to complete the form) support the use of the face-to-face survey approach rather than mailing. The only information that I already had for the non-respondents was their region and locality. The remaining 27 potential respondents declined to participate, for one reason or another.

However, the recurring reasons among those who declined to participate (3 percent of the total) was that they were skeptical of researchers collecting free data and that they have become accustomed to participating in surveys that generally do not lead to tangible action in their communities. To avoid non-response bias and measurement error, I dropped these records from the respondent pool. In addition, from a data integrity standpoint, I thought it was better to gather information from those who voluntarily participated in the survey rather than to persuade the unwilling.

Descriptive Statistics

The average age of the survey participants was 47 (N = 780), with an average household size of 5 members. The respondents I interviewed were either the head of household or the decision maker for the farm. To analyze the data from multiple angles, I grouped the respondents by age, starting from 18 years of age. Based on a recent land tenure and agricultural survey, *Récensement Général de L'Agriculture* (RGA) from the Ministry of Agriculture, 73.9 percent of farms are less than 1.29 ha. (MARNDR, 2012c). The 26.1 percent that are greater than or equal to 1.29 ha occupy 53.3 percent of total agricultural land.

The average farm size from respondents in the South is 1.96 ha; while the average farm size of

the South department is 0.84 ha, with 20.6 percent of the farms being greater than 1.29 ha and

accounting for 47.6 percent of the total agriculture land (MARNDR, 2012b). By contrast, the

average farm size for the survey participating mango growers of the upper Artibonite region

stands at 3.25 ha, while the average farm size of the Artibonite department is 0.97 ha, with 24.4

percent of farms being greater than 1.29 ha and occupying 51.9 percent of the total cultivable

land (MARNDR, 2012a). With the mean farm size of 2.44 ha across 3 parcels, the survey data

shows that, generally, Haitian mango producers farm more hectares than the national average of

farmers who cultivate 0.93 ha, spread over 1.8 parcels.

While the results present some differences and correlations between the farm size of these

research sites and the national data, the variations may well be due to the survey sampling

method that limited participation to mango producers. Even after accounting and removal of

outliers, using Hadi's (1994) method, the farm size standard deviation in the sample remains

relatively large, which signals insignificant statistical differences from the national average.

 Table 5-1 presents a statistical summary of the key the variables of the study. As I described

above, the baseline sample for the analysis consists of 780 mango growers from two regions in

Haiti: the South region and the northern region of Artibonite. Of the total participants, 494 are

from the South and 286 are from the North.

Table 5-1: Statistical Summary of Dependent and Explanatory Variables

Variable Name	Description	Obs	Mean	Std. Dev.
Willingness to Produce Mango Trees (WTA), as dependent variable				
WTA_20	Initial Bid: Agree to produce for 20 HTG profit (1 = No; 2 = Yes)	780	1.36	0.48
WTA_12	Lower follow-up Bid: Agree to produce for 12 HTG profit (1 = No; 2 = Yes)	277	1.12	0.32
WTA_28	Higher follow-up Bid: Agree to produce for 28 HTG profit (1 = No; 2 = Yes)	503	1.82	0.39
AgeGroup	Age group (1 = 18-29; 2 = 30-39; 3 = 40-49; 4 = 50-59; 5 = 60-69; 6 = 70+)	780	3.22	1.39
Gender	1 = Female; 2 = Male	780	1.65	0.48
OrgMember	Member of farmers organization (1 = No; 2 = Yes)	780	1.81	0.40
HseholdSize	Nbr of people in the household, including relatives	780	5.39	2.80
NbrChildren	Nbr of children in the family	780	4.35	2.97
NbrFamLabor	Nbr of family members providing farm labor	780	2.19	1.94
FrancisOwn	Nbr of Francis tree, own	780	12.02	18.52
NFranTreeOwn	Nbr of Non-Francis tree own	780	17.14	26.49
FarmIncSr	Income from Farming (1 = No; 2 = Yes)	780	1.93	0.25
JobIncSr	Income from off-Farm job (1 = No; 2 = Yes)	780	1.12	0.32
SmBusIncSr	Income from Small Business (1 = No; 2 = Yes)	780	1.56	0.50
RemitIncSr	Income from Remittances (1 = No; 2 = Yes)	780	1.24	0.43
OtherIncSr	Income from Other Activities (1 = No; 2 = Yes)	780	1.13	0.34
FarmSize	Small = (Size < r(p25)); Medium = (Size >= r(p25) & Size <= r(p75)); Large = (Size > r(p75))	780	2.44	1.90
SellLocal	Sell mangoes to local resellers (1 = No; 2 = Yes)	780	1.67	0.47

I followed a two-step contingent approach to gather additional information from those

respondents who gave a positive answer to both the initial and follow-up questions. I asked a

series of four elicitation questions to obtain the number of trees they would plant, the number of

hectares of owned land they would dedicate to planting more mango trees, the number of

hectares they would buy or rent, and their willingness to reduce staple crops to plant more fruit

trees (refer to Table 5-2).

Table 5-2: Follow-up Elicitation Response Variables

Variable Name	Description	Obs	Mean	Std. Dev.
WTA_20	*Initial Bid: Agree to produce for 20 HTG profit (1 = No; 2 = Yes)*	*780*	*1.36*	*0.48*
qTree_20	Nbr of trees respondent would produce for 20 HTG profit	277	81.31	137.07
qLand_20	Quantity of land owned would dedicate to mangoes, at 20 HTG profit	277	18.27	7.54
qRentBuy_20	Quantity of land would buy/rent to produce mangoes, at 20 HTG profit	277	1.81	2.01
ReduCrop_20	Agree to reduce other crops to produce mangoes, for 20 HTG profit (1 = No; 2 = Yes)	277	1.40	0.49
WTA_12	*Lower follow-up Bid: Agree to produce for 12 HTG profit (1 = No; 2 = Yes)*	*277*	*1.12*	*0.32*
qTree_12	Nbr of trees respondent would produce for 12 HTG profit	31	59.00	101.87
qLand_12	Quantity of land owned would dedicate to mangoes, at 12 HTG profit	31	0.92	1.03
qRentBuy_12	Quantity of land would buy/rent to produce mangoes, at 12 HTG profit	31	1.06	1.25
ReduCrop_12	Agree to reduce other crops to produce mangoes, for 12 HTG profit (1 = No; 2 = Yes)	31	1.00	0.00
WTA_28	*Higher follow-up Bid: Agree to produce for 28 HTG profit (1 = No; 2 = Yes)*	*503*	*1.82*	*0.39*
qTree_28	Nbr of trees respondent would produce for 28 HTG profit	411	378.81	651.11
qLand_28	Quantity of land owned would dedicate to mangoes, at 28 HTG profit	411	1.89	2.68
qRentBuy_28	Quantity of land would buy/rent to produce mangoes, at 28 HTG profit	411	2.76	3.73
ReduCrop_28	Agree to reduce other crops to produce mangoes, for 28 HTG profit (1 = No; 2 = Yes)	411	1.95	0.23

Data Categorization

Haitian farms are generally small, and mango production requires relatively large plots. For the purpose of grouping the farms, I used a quartile approach to categorize the sizes into three groups: Small – the first 25 percent; Medium – from 25 to 75 percent; and Large – greater than 75 percent (Table 5-3). Besides providing services, many of the growers' organizations also purchase the harvest to sell to exporters and local markets. The organizations establish direct relationships with the markets. The grower-organization relationship is an intermediary stage that helps negotiate the complexity of the markets, while also providing services to help overcome biases against small farms.

Table 5-3: Farm Size Summary

Farm Size Categorization			
	Respondent Region		Respondents
Farm Size – Groups	North	South	Total
Small = Size < 25%	14	171	185
Medium = Size ≥ 25% & Size ≤ 75%	205	279	484
Large = Size > 75	67	44	111
Total	286	494	780

We collected farm-level data to examine the impact of off-farm income sources on farmers' decision to produce mango trees (Table 5-4). It is rather surprising to find that the majority of the respondents report some kind of off-farm income. Farmers diversify their income sources, mainly from off-farm self-employment, in order to complement farm income and to avoid borrowing constraints, land constraints, capital market imperfections, and various market failures. In addition to remittances, micro-enterprises also constitute key off-farm income

sources. These include buying and selling goods, skilled mechanical or manual work, carpentry, masonry, tailoring, and teaching.

Table 5-4: Off-Farm Income Sources

	Remittances			Employment			Small Business			Other Income		
	North	South	All	North	South	All	North	South	All	North	South	All
Recipients	41	149	190	12	80	92	198	238	436	23	78	101
	14%	30%	24%	4%	16%	12%	69%	48%	56%	8%	16%	13%
Non Recipients	245	345	590	274	414	688	88	256	101	263	416	679
	86%	70%	76%	96%	84%	88%	31%	52%	44%	92%	84%	87%

One peculiarity lies in the general belief that Haiti is an agricultural country. As such, one would expect farming to be the largest source of household income, but this seems to be contrary to actual situation. However surprising the responses might be, de Janvry and Sadoulet's (2001) empirical findings corroborate that off-farm income activities play a significant role in farmers' household income and that more than half of household income in Mexico's *ejido* sector derives from off-farm activities.

Economic Model Formulation

Review of Factors Influencing Adoption

Several key factors influence the adoption of new agricultural technologies and the decision to continue producing with old technologies or crops under new conditions (new price and insurance). Economic models focus on consumers, individuals, farmers, and farm characteristics – such as farm size, land type, age, education, number of children, and off-farm income – as prominent factors in the decision to adopt (Qaim & de Janvry, 2003). The basic adoption model

seeks to determine the choices that agents make when comparing a new technology to an old one. Most studies propose static models that relate the level of adoption to explanatory factors affecting adoption, such as price and farm size.

The literature presents a range of outcomes that one can evaluate. These outcomes include: (1) the technology diffusion rate, (2) the adoption probability/choice as a function of farmer characteristics, and (3) the benefits that derive from adopting the technology. Foster and Rosenzweig (2010) address the third case in terms of profitability, or the financial and nonfinancial returns from adoption. A key set of issues that researchers consider is the degree to which adoption behavior is affected by information access, credit access, and risk aversion, to name a few. These factors relate to fixed costs (sunk costs for mango production), credit market imperfections, and wealth of the adopter (generally, farm size and capital stock) as influential characteristics. The present study takes into account key explanatory factors that may determine adoption, including price, number of children, and farm size.

Modeling Willingness to Produce

The general assumption is that farmers considering mango production desire to maximize their profit with negligible possibility of destroying their livelihood, if the market fails to efficiently allocate goods and services. The market and Mother Nature can periodically make an unpredictable and heartless pair. Especially for Haitian farmers who have gone through trade shocks due to fruit flies and devastating earthquakes, every additional penny on the dozen could greatly assist their goal of maximizing profit. Producers organize themselves into social groups to better absorb shocks from the market and from nature. To research this phenomenon, I used

the CV approach for the questionnaires to ascertain producers' WTA additional mango trees for a specific dollar amount of gross profit per dozen mangoes. The gross profit is based on a scenario that describes a new policy subsidizing all harvest and postharvest costs related to the supply of mango trees.

I consider farmers' responses to a hypothetical new subsidy policy that would secure a gross profit of 20, 12, or 28 *Haitian Gourdes* (HTG) per dozen mangoes. The gross profit could also be in the forms of postharvest expense subsidies. Taking into account that the amount in the follow-up question is contingent upon the answer to the initial question, let P_i^I denote the initial price offer of 20 HTG. If the participant responds "yes" to the initial price, then the follow-up price (P_i^L) is a lower amount, 12 HTG ($P_i^L > P_i^I$). If the participant responds "no" to the initial price offer, then the follow-up price (P_i^H) is a higher amount, 28 HTG ($P_i^H > P_i^I$). I assume that farmers would decide to produce under the utility-maximizing motivation, meaning that respondents would answer "yes" to the price only if his/her WTA (denote as P^*) is greater than or equal to the initial asking price (P_i^I), as in this equation:

$$P_i^* = WTA_i \geq P_i^I$$

The combination of the initial and follow-up questions generates four possible outcomes: (1) "no" to both questions, (2) "yes" to both questions, (3) "no" to the initial and "yes" to the follow-up, and (4) "yes" to the initial and "no" to the follow-up. In expressing the outcomes d_i, in terms of the real value of P_i^*, the responses represent

$$
d_i = \begin{cases}
1 & no, no & \rightarrow & P_i^I < P_i^H < P_i^* & ==> & P_i^I < P_i^* \\
2 & yes, yes & \rightarrow & P_i^I > P_i^L \geq P_i^* & ==> & P_i^L \geq P_i^* \\
3 & no, yes & \rightarrow & P_i^I < P_i^* \leq P_i^H & ==> & P_i^H \geq P_i^L \\
4 & yes, no & \rightarrow & P_i^I \geq P_i^* > P_i^L & ==> & P_i^I > P_i^L
\end{cases}
$$

The likelihood of the possible outcomes denotes as π^{nn}, π^{yy}, π^{ny}, and π^{yn}. For example, the term π^{ny} represents the likelihood of a farmer's willingness to produce at a price greater than the initial asking price. In the first scenario, the outcome likelihood formulation of $P_i^H > P_i^*$ corresponds to:

$$\pi^{nn}(P_i^I, P_i^H) = \Pr(P_i^I \leq WTA_i \text{ and } P_i^H \leq WTA_i)$$

$$= \Pr(P_i^I \leq WTA_i \mid P_i^H \leq WTA_i) \Pr(P_i^H \leq WTA_i)$$

$$= \Pr(P_i^H \leq WTA_i)$$

$$= 1 - G(P_i^H; \theta). \tag{5-5}$$

Analogous to (5-3), $G(P_i^H; \theta)$ represents the statistical distribution function, with θ as vector of estimable parameters. In the context of a utility-maximization response, $G(A; \theta)$ represents the cumulative density function (cdf) of WTA. Since by outcome $P_i^H > P_i^*$, then

$$\Pr(P_i^I \leq WTA_i \mid P_i^H \leq WTA_i) \equiv 1.$$

Likewise, with $P_i^L < P_i^I$, $\Pr(P_i^L \leq WTA_i \mid P_i^I \leq WTA_i) \equiv 1$. Therefore,

$$\pi^{yy}(P_i^I, P_i^L) = \Pr(P_i^I > WTA_i \text{ and } P_i^L > WTA_i) = G(P_i^L; \theta). \tag{5-6}$$

When a "yes" follows a "no" (no/yes), it results in $P_i^H > P_i$ and

$$\pi^{ny}(P_i^I, P_i^H) = \Pr(P_i^I \leq WTA_i \leq P_i^H) = G(P_i^H; \theta) - G(P_i; \theta); \tag{5-7}$$

and when a "yes" follows a "no" (no/yes), it results in $P_i > P_i^L$ and

$$\pi^{yn}(P_i^I, P_i^L) = \Pr(P_i^I \geq WTA_i > P_i^L) = G(P_i; \theta) - G(P_i^L; \theta). \tag{5-8}$$

For a sample N respondents, P_i^I, P_i^L, and P_i^H represent the prices offered to ith respondent. Following Hanemann et al. (1991), I then express the log likelihood function for the DB model as:

$$lnL(\theta) = \sum_{i=1}^{N} \begin{cases} d_i^{yy} ln\pi^{yy}(P_i^I, P_i^H) \\ +d_i^{nn} ln\pi^{nn}(P_i^I, P_i^L) \\ +d_i^{yn} ln\pi^{yn}(P_i^I, P_i^H) \\ +d_i^{ny} ln\pi^{ny}(P_i^I, P_i^L) \end{cases} \tag{5-9}$$

where $d_i^{yy}, d_i^{nn}, d_i^{yn}, and\ d_i^{ny}$ represent the binary-valued indicator variables, corresponding to the response probabilities of equations (5) to (8). Assuming a normal distribution for v_i, in reference to the equation (1), the log-likelihood for the DB elicitation format is:

$$lnL(\theta) = \sum_{i=1}^{N} \left\{ d_i^{yy} ln \left[1 - \Phi \left(\frac{P_i^H - x_i'\gamma}{\sigma} \right) \right] \right.$$

$$+ d_i^{nn} ln \left[\Phi \left(\frac{P_i^L - x_i'\gamma}{\sigma} \right) \right]$$

$$+ d_i^{yn} ln \left[\Phi \left(\frac{P_i^H - x_i'\gamma}{\sigma} \right) - \left[\Phi \left(\frac{P_i^I - x_i'\gamma}{\sigma} \right) \right] \right]$$

$$\left. + d_i^{ny} ln \left[\Phi \left(\frac{P_i^I - x_i'\gamma}{\sigma} \right) - \Phi \left(\frac{P_i^L - x_i'\gamma}{\sigma} \right) \right] \right\} \tag{5-10}$$

The result of the equation $\frac{\partial \ln L(\hat{\theta})}{\partial \theta} = 0$ constitutes the maximum likelihood (ML) estimator, $\hat{\theta}$, for the DB model, where Φ indicates the standard normal probability density function (cdf), as Figure 5-1 describes. The asymptotic variance-covariance matrix for $\hat{\theta}$, following the Cramer-Rao lower bound theorem is:

$$v(\hat{\theta}) = \left[-E \frac{\partial^2 \ln L(\hat{\theta})}{\partial \theta\, \partial \theta'} \right]^{-1} \equiv I(\hat{\theta})^{-1}. \tag{5-11}$$
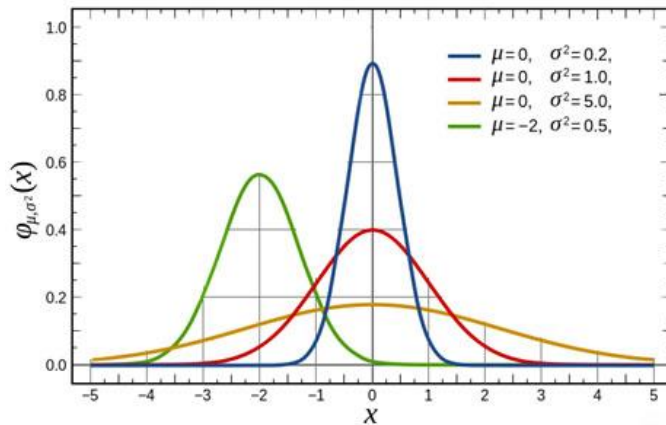
Figure 5-1: Standard normal distribution graph.

To estimate the farmers' WTA, I use ML and censored Tobit estimators side-by-side with robust standard errors option to correct statistical inference and to ensure homoscedasticity. Providing that the dependent variables contain possible zero values at prices lower than the lower bound, both estimators are conducive for analyzing the CV data (Greene, 2003). The Tobit provides the flexibility to censor from below, from above, or both. In addition to its censoring ability, the model provides the value of WTA_i when $(WTA_i < P_i^I)$, which is more efficient than simply obtaining a range (Long, 1997). The set of values render it possible to calculate the variance.

This approach provides ways to estimate the impact of the explanatory variables on non-zero responses, from deciding to grow a certain number of mango trees to the actual share of hectares respondents would convert at the given price. I represent the formulation of the stochastic response in equation (1) as the structural Tobit equation of:

$$y_i^* = x_i\beta + \varepsilon_i, \tag{5-12}$$

where y_i^* represents the latent variable, WTA_i for ith respondent for values greater than the censoring threshold τ, or as the previous notation of P_i^I, and is censored for values less than or

equal to P_i^I; and x_i is a vector of exogenous variables, and β is the vector of parameters (region,

farm size, price, number of children, and others). The parameter ε_i represents the distribution of

errors to capture the unobservable characteristics of the respondent. With mean μ and variance

σ^2, I assume a representation of $\varepsilon_i \sim N(\mu, \sigma^2)$ as an independent and normal distribution (see

Figure 5-1) with zero mean and constant variance, $N(0,1)$ (Greene, 2003). I further equate the

observable y_i as:

$$y_i = \begin{cases} y_i^*, & \text{if } y_i^* > 0 \\ 0, & \text{if } y_i^* \leq 0 \end{cases} \tag{5-13}$$

Under the assumption that the decision to produce and the outcome are separate processes that

produce two latent variables, in keeping with Heckman's (1979) model, I model them separately:

$$y_i^* = x_i\beta + \varepsilon_i, \text{ where } y_i = \begin{cases} y_i^*, & \text{if } y_i^* = 0 \\ 0, & \text{otherwise} \end{cases} \tag{5-14}$$

$$d_i^* = z_i\gamma + v_i, \text{ where } d_i = \begin{cases} 1, & \text{if } d_i^* > 0 \\ 0, & \text{if } d_i^* \leq 0 \end{cases} \tag{5-15}$$

Where z is a vector of explanatory variables, γ is a vector of parameters, and ϱ represents the

correlated coefficient for the error terms. Solving through ML, the likelihood function is

$$L = \Pi_{y=0}\Phi_1(-z_i\gamma)\Pi_{y>0}\left\{\Phi_1\left\{\frac{z_i\gamma + \frac{\varrho}{\sigma_y}(y_i - x_i\beta)}{\sqrt{1-\varrho^2}}\right\}\frac{1}{\sigma_y}\phi\left(\frac{y_i - x_i\beta}{\sigma_y}\right)\right\}, \tag{5-16}$$

Given that 100 percent of the participating producers are current adopters, the main purpose of

the WTA estimate is to determine their willingness to increase or decrease their adoption.

Therefore, I place greater emphasis on land allocation and the number of trees.

Modeling Land and Tree Responses

Upon determining the producers' responses through *Tobit* and ML estimators, I use an ordinary

least squares (OLS) estimator to model the responses to the follow-up questions about the

hectares of land and the number of trees that producers would produce at the specific price

proposals. Any of the models could be sufficient to express the findings. The integration of a

cross-model approach serves to compare and contrast the consistency and robustness of the

results across different models. However, throughout the data analysis, I intend to adopt the ML

results for its superior fit for estimating the WTA.   The OLS models are similar to equation (5-

12) with a single response variable, (y_{land}), representing the land response as in:

$$y_{land} = \beta_0 + x_1\beta_1 + x_2\beta_2 + x_3\beta_3 + x_n\beta_n + \varepsilon_{land} \tag{5-17}$$

where β_0 is the intercept, x_1 to x_n indicate the multiple explanatory variables, and β_1 to β_n

parameters represent the average change in (y_{land}) associated with each unit increase in the

explanatory variables.

For estimating the effects on trees, where it is necessary, I use the feasible and productive

number of trees per hectare, rather than the producers' stated number. When the stated number

of trees is feasible, then I use the stated number. The productive number of trees to land ratio is

100 per 1.26 hectare, a ratio that I obtained from the producers. The model considers this tree to

land ratio in determining the tree response, (y_{tree}), as in the following equation:

$$y_{tree} = \beta_0 + z_1\beta_1 + z_2\beta_2 + z_3\beta_3 + z_n\beta_n + \varepsilon_{tree} \tag{5-16}$$

The analysis uses three different models. First, I ran a series of censored Tobit regressions to

ascertain respondents' willingness to produce under three price scenarios. Second, I used

maximum likelihood estimation (MLE) to fit the response models. Through MLE, I derived log-

likelihood values from linear form (LF) evaluator programs, with questions and responses as input values. The programs estimated the producers' responses when I controlled for region, number of children, number of trees owned, farm size, and off-farm income sources. Third, I used an ordinary least squares (OLS) estimator to determine the *ex ante* share of land already owned that producers would be willing to dedicate to tree planting, the number of hectares of land they would purchase, and the number of trees that they would likely plant. The elicitation driver of the results is the profit (price) that producers would realize under the new policy.

Wherever necessary, in addition to the aggregate results, I highlight the differences between the north and south regions. Throughout this study, I use robust variance-covariance estimates, to be asymptotically unbiased and to avoid the assumption of homoscedasticity of the random error terms. In addition, I consciously omitted certain variables in these models to present a preliminary assessment of the key variables that determine adoption. This multi-layer approach offers the benefits of determining the effects of some variables in absence of others.

Results

Willingness to Produce

I present the regional and aggregate responses to the inquiry about the producers' WTA in Figure 5-2. The results show that 53 percent of the producers would be willing to increase mango tree production for a price of 28 HTG profit; 31 percent would accept the current price of 20 HTG or an amount greater than 12 HTG; 12 percent would produce at a price higher than the ceiling

offer price of 28 HTG (right-censored); and 4 percent of the respondents would produce for 12
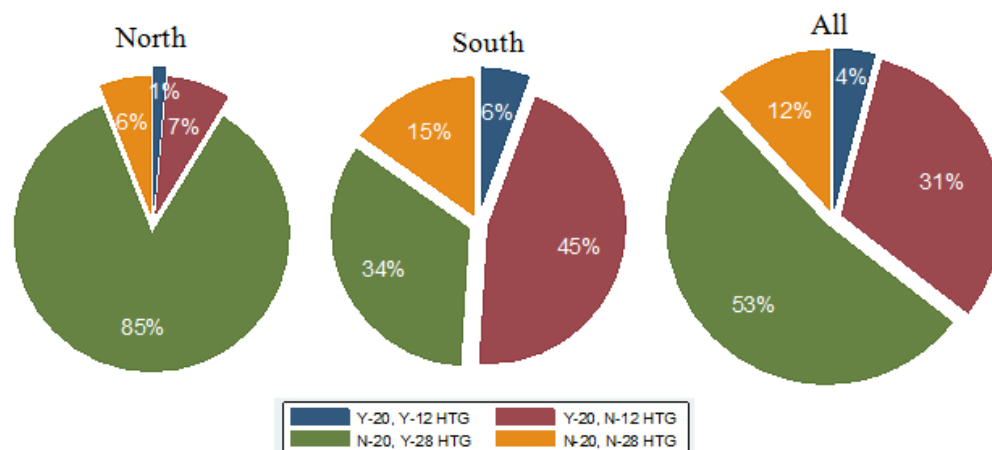
HTG or less (left-censored).

Figure 5-2: WTA - Response to Price

The econometric analysis results in Table 5-5 rely on several key household characteristics of the

producers. These characteristics include region, gender, age, number of children, farm size, off-

farm employment income, and number of export variety trees (Francis) that the respondent

currently owns. In interpreting the results, one must be mindful of the coding of the responses.

The codes of the dependent variable (WTA) correspondents to the four possible outcomes. A

minus sign signal a higher willingness to produce at a lower price. The producer who responds

negatively to an offer price displays a lower willingness to increase production and demands a

higher price. The coefficients of the multinomial regression indicate the probability of the four

possible outcomes to occur based on the associated characteristics. As expected, greater access

to land increases willingness to produce. For instance, for a one-unit increase in farm size, there

is a 0.43-point increase in producers' WTA (as the negative sign indicates), suggesting an

increase in readiness to increase production for a lower price. The influence of the farm size on

the producers' decision is significant at the 99 percent confidence level, with similar signs across

the three models.

Table 5-5: Tobit regression results of the WTA – Robust Standard Error

WTA Responses[a]	Models Comparison		
	ML Logit	ML Normal	Tobit
Region	-4.057***	-3.731***	-0.479***
	(0.4416)	(0.4496)	(0.0576)
Gender	0.421	0.478	0.078
	(0.4256)	(0.4225)	(0.0637)
Age	-0.001	-0.001	-0.000
	(0.0164)	(0.0165)	(0.0023)
Number of Children	0.150*	0.151*	0.022*
	(0.0782)	(0.0784)	(0.0112)
Farm Size	-0.426***	-0.454***	-0.066***
	(0.1116)	(0.1129)	(0.0155)
Job Income	1.429**	1.392**	0.206**
	(0.6464)	(0.6263)	(0.1013)
Remittance Income	-1.240***	-1.094**	-0.154**
	(0.4732)	(0.4686)	(0.0725)
Francis Tree Own	-0.042***	-0.050***	-0.008***
	(0.0121)	(0.0105)	(0.0024)
Constant	28.511***	28.082***	3.546***
	(1.3158)	(1.3420)	(0.1735)
Overall Model Fit			
Observations	780	780	780
F-test			
P-value	0.000	0.000	0.000
Pseudo-R^2			
Log likelihood	-790.67	-793.098	-790.67
Wald chi^2	117.12	115.96	117.12

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
a: Dependent variables of the four outcome indicators, 0 to 1, where 1 is a lower price

In reference to equations (5-4) to (5-8), the overall P-value of the regression is 0.000, which is

significant at the 99.9 percent confidence level. The results show that six factors among eight

were significant predictors of the outcomes. The predicted value of WTA is 4.06 points lower in the South than the North, which means that for a one-unit increase in region (a movement from North=1 to South=2), I observe a willingness to produce for a lower price, as the negative sign suggests. The regional differences are noticeable in the form of larger farms and higher mango production in the North than the South. The variations are more remarkable between regions that possess different endowments – land, children, and off-farm income – rather than within-region.

Surprisingly, 75 percent of the respondents reported some type of off-farm income in the form of miscellaneous employment, small business activities, self-employment, and/or remittances. In general, the off-farm sources of income play a significant role in household livelihood as compared to agricultural output from small parcels of land less than 2 hectares. The agricultural income is generally insufficient to achieve satisfactory living conditions. Hence the importance of income diversification in the decision to produce additional fruit trees. In addition to these explanatory variables, in chapter 6 I will focus on the producers' ties to local organizations in the subsequent data analysis chapter to further explain the regional differences.

Off-farm employment and remittance income sources are significant explanatory factors within the 95 percent confidence level. These two prevailing factors affect the overall result in inverse proportion. For a one-unit increase in off-farm employment, I find a 1.43 points increase in price or a decrease in producers' willingness to produce for a lower price. The positive sign indicates a request for a higher price to produce the next dozen. The overall results show 1.24 points decrease in price for a one-unit increase in remittance income. Such a decrease in price suggests that remittance have an effect of production. The estimates on land and trees will provide

additional insights into this result. Remittance income is more pronounced in the South than the North, resulting in respondents agreeing to produce at a lower price. Neither off-farm employment nor remittances are significant income sources in the North.

Income from small businesses plays a less meaningful role in the decision to produce, at the 90 percent confidence level. Yet 56 percent of the respondents report gaining some miscellaneous small business income. This phenomenon is partly due to the micro and almost inconsequential level of these small businesses in the lives of producers. For instance, some individuals start a small business with $5.00 U.S. dollars to buy and resell roasted peanuts. A six-pack of soft drinks is enough to start a business.

The number of children in the family seems to have opposite effects in each of the two regions. After accounting for outliers, the data shows an average of 4.47 children per family in the North and 4.21 in the South. These numbers are relatively close, yet I observe an inverse influence in WTA. In the North, an increase in the number of children increases the likelihood for accepting a lower price. The opposite is true in the South. The inclusion of interaction terms between the core variables may provide additional insights on these results. The regional results are available upon request.

Predictive Allocation of Owned Land and Trees

Land availability remains the key determinant for fruit tree planting. In this section, I present the results from the share of land that producers would dedicate to producing additional mango trees.

I also introduce the price explanatory variable that holds the three acceptable prices I offered, in reference to (P_i^*), the four possible answers to the DBDC of 20-HTG, 12-HTG and 28-HTG. This new variable represents the amount that producers would receive after accounting for all postharvest expenses. Most of the coefficients resulting from the models show the signs and the trend that I expected. The sign of the price variable may appear counter-intuitive but the results are intuitive. Producers who are more willing to increase produce tend to accept a lower price.

The post-estimation tests of the linear hypotheses indicate that the models are well fitted, at the 99 percent confidence level, and they do not violate proportional odds assumption. Table 5-6 presents the estimation of two model-pair: (1) land allocation from current holdings, (2) and number of trees. Considering the Tobit model, price, farm size and remittances exert significant influence of willingness to increase production. Farm size is particularly constraining for Haitian farmers.

Unsurprisingly, as economic theory led us to expect, the estimates show that the price the producers receive for their fruits is highly significant in their decision to allocate more land for mango production. An increase in price positively affects land allocation, chipping away from current landholding stock and from new land acquisition. Equally significant at the 99.9 percent confidence level, and yet more impactful than price in terms of hectare allocation responses, are farm size and remittances income. An additional hectare of farm size increases allocation from current landholding to 0.35 point. That percentage significantly increases when the model accounts for new land acquisition. One potential explanation is that larger landowners can afford to dedicate part of their holdings – either for reasons of low yield, lack of irrigation, or by having

access to capital – to the long-term process of tree fruit production. Another reason points to the empirical linkage between adoption of new crops and farm size (B. Barham et al., 1995).

However, among the off-farm sources of income, remittances produce surprising results. Its coefficient sign changes from a 0.14-points to a negative 0.10 when considering current holding and new land acquistion, signaling that recipients are likely to give up some of their current landholding to plant trees rather than investing new capital to acquire land for fruit tree production. Remittances constitute a significant and reliable source of private capital inflows to the Haitian economy. The total remittance inflow to Haiti accounted for 21 percent of GDP in 2011, representing an absolute amount of US $1.6 billion, an increase of 64 percent from 2005 (Figure 5-3). Since recipients are less likely to invest in land acquisition for agricultural activities, the divergent results of the regressions establish a contrast between, on the one hand, enthusiasm for shifting existing land and, on the other hand, reluctance to purchase new land.

Figure 5-3: Remittances & FDI Inflows to Haiti (US$ million)
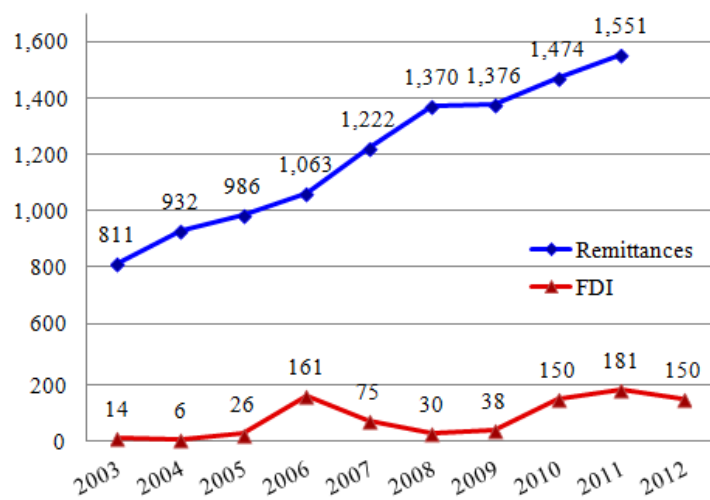
Source: Author's computation with World Bank data

Table 5-6: Estimates of Owned Land and Number of Tree

Land/Trees	Owned Land		Tree on Owned Land	
	Tobit	OLS	Tobit	OLS
Price	0.049***	0.042***	4.217***	3.557***
	(0.0051)	(0.0046)	(0.4589)	(0.4015)
Region	-0.034	-0.035	-9.853**	-9.904**
	(0.0454)	(0.0445)	(4.1762)	(4.1021)
Gender	0.009	-0.006	6.099*	4.701
	(0.0330)	(0.0310)	(3.1598)	(3.0119)
Age	0.003**	0.002*	0.085	0.040
	(0.0014)	(0.0013)	(0.1277)	(0.1239)
Number Children	0.001	0.000	1.088*	0.963
	(0.0073)	(0.0071)	(0.6439)	(0.6274)
Farm Size	0.355***	0.342***	20.345***	19.371***
	(0.0140)	(0.0134)	(1.4196)	(1.3908)
Job Income	-0.054	-0.041	-6.356	-4.881
	(0.0599)	(0.0547)	(5.1707)	(4.6797)
Remittance Income	0.144***	0.143***	5.936	5.971
	(0.0494)	(0.0461)	(4.4024)	(4.1047)
Francis Tree Owned	-0.003**	-0.002	-0.089	0.027
	(0.0011)	(0.0010)	(0.1084)	(0.1013)
Constant	-1.434***	-1.185***	-104.868***	-82.251***
	(0.2160)	(0.1963)	(19.4293)	(17.5154)
Overall Model Fit				
Observations	687	687	682	682
F-test	109.0	116.27	54.05	57.23
P-value	0.000	0.000	0.000	0.000
R^2		0.7558	0.0902	0.605
Log Pseudo.	-403.668		-3243.62	
Pseudo-R^2	0.541		0.090	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from Table 5-7 address the impacts of price and producer characteristics on the

number of trees that farmers are willing to produce on land they already own plus new land. The

expectation is that an increase in the number of mango trees could possibly spread income to

smallholders and thereby improve livelihood. As I described above, the tree estimates are based

on the feasible and productive number of trees per hectare, rather on the stated value. The models indicate significant overall fit, with R^2 of 0.66.

Price, region and farm size remain significant at the 99 percent confidence level and remittances drop out of significance all together for the tree estimates. This suggests that remittance recipients lack interest in investing in the tree fruit sector. Remarkably, none of the off-farm income sources are significant throughout all three models. Without these important sources of private capital investment, and in the absence of a positive spike in price and/or enactment of sector-specific policy, the prospect of growth seems to hang in the balance.

Farm size and price seem to exert great influence on the number of trees. For every additional hectare, the average farmer in the sample is willing to grow 20 trees on already owned land. The number slightly decreases to 17 for the predictive trees on land that farmers would buy or rent. However, when I combined owned land a new land acquisition, the results show an increase of 38 trees. The price that farmers receive for their mangoes applies pressure to grow more trees.

Table 5-7: Estimates of the Combined Owed and New Land and Number of Tree

Land/Trees	Owned, Buy/Rent Land		Tree on Owned, Buy/Rent Land	
	Tobit	OLS	Tobit	OLS
Price	0.095***	0.116***	4.871***	6.910***
	(0.0164)	(0.0142)	(1.1339)	(0.9743)
Region	-1.122***	-0.986***	-97.814***	-84.675***
	(0.1507)	(0.1343)	(11.6839)	(10.4337)
Gender	0.162	0.165*	16.721*	16.784**
	(0.1118)	(0.0989)	(8.6877)	(7.6555)
Age	0.008*	0.006*	0.343	0.229
	(0.0041)	(0.0037)	(0.3238)	(0.2898)
Number Children	0.006	0.010	1.505	1.658
	(0.0207)	(0.0182)	(1.6369)	(1.4557)
Farm Size	0.741***	0.714***	38.178***	35.767***
	(0.0366)	(0.0340)	(3.1981)	(2.9554)
Job Income	0.039	0.084	1.551	5.763
	(0.1547)	(0.1290)	(12.4727)	(10.4135)
Remittance Income	-0.014	0.013	-6.262	-2.480
	(0.1363)	(0.1228)	(11.2209)	(10.0694)
Francis Tree Owned	0.001	0.001	0.405	0.416
	(0.0033)	(0.0030)	(0.2970)	(0.2836)
Constant	-0.835	-1.447**	8.074	-54.489
	(0.6930)	(0.6173)	(49.9999)	(44.2216)
Overall Model Fit				
Observations	749	749	749	749
F-test	154.61	166.15	54.45	56.84
P-value	0.000	0.000	0.000	0.000
R^2		0.665		0.520
Log Pseudolikeli.	-1241.186		-4078.028	
Pseudo-R^2	0.223		0.0571	

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The number of trees on owned land is indicative of overall profits and income distribution, as

one might expect under an imperfect and thinly rationed land market. The significantly large

coefficients on price and on farm size suggest that landed producers have a lower shadow price

for adding more trees. As Figure 5-4 depicts, the larger the farm size, the more trees that

producers are willing to grow and the more likely they are willing to accept a lower price. In reference to Foltz's (2004) findings in Tunisia, one would expect any level of relaxation in the constraints of land and credit access to result in some degree of activation of the rural land markets, by enabling producers to rent in or buy the most favorable amount of land.

Figure 5-4: Logarithmic Prediction of Number of Trees - Interaction of Price and Farm Size
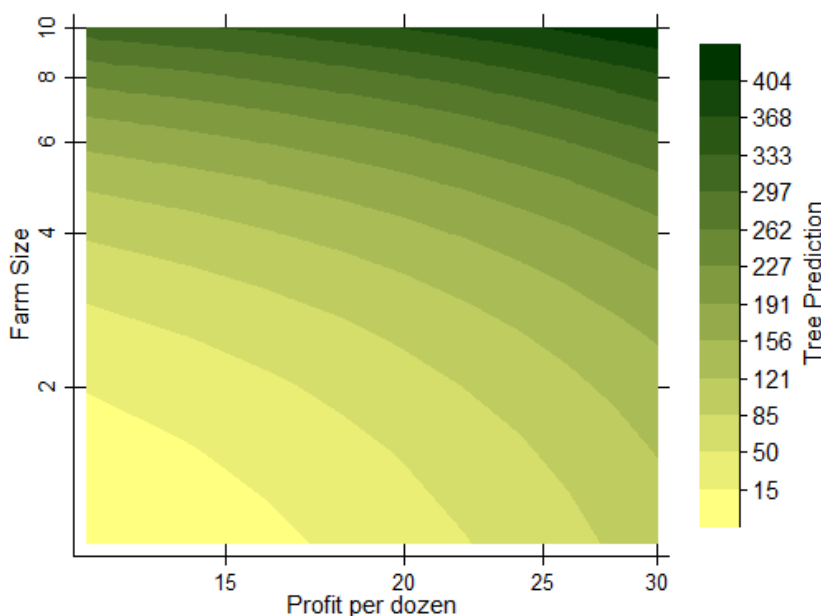
In sum, the results of this analysis suggest that factor of price, land and price have a relatively high impact on farmer's WTA. Noticeably, the majority of those who are willing to produce at the higher price claim that they would reduce the production of staple crops to make room for additional mango trees. In other terms, they tend to fall in the category of smaller landholders. This raises the question of the possible impact of shifting land from staple food production to growing the export crop. If that occurred, welfare economics suggests that the rational producer would likely take the direction that would maximize income.

Mango production does not require rigorous labor, as does the production of vegetables and other staple crops. Therefore, key factors of land, credit access and sale price tend to determine the rates of adoption. Achieving some degree of profit through price increase alone remains a tall order, partly due to information asymmetry and limited sale channels that stock against mango suppliers. Other factors, such as producer's organizational ties or bottom-up stimuli, are less apparent enablers that warrant investigation. Although economic theory would lead us to predict price and farm size as dominating factors in the decision-making process, the extent of their influence in association with social factors is not so obvious. In the following chapter, I intend to expand the models to include additional variables that explore farmer's social ties and various interaction terms in order to obtain additional insights.

Chapter 6 – Influential Effects of Organizational Ties

Introduction

Most Haitian farmers are well aware of the benefits of networking with others and of being members of producers' organizations. These producers face barriers to entry and many constraints before they actually participate in the agro-export industry. Specifically, their participation is subject to constraints that include, but are not limited to, the following categories: household (agrarian assets, capital stocks, and transaction costs), market (price volatility and stabilization, access to credit, insurance, information, power relations, and global competition), and society (change in labor exchange practice, the value of waged labor and organization membership).

Indeed, most producers understand that when it comes to producing for the export market, the degree of economies of scale is likely to have an impact on their capacity to participate and their ability to meet export requirements. They acknowledge that the low output level of individual producers could be cost-prohibitive for export participation, as compared to the collective output of a group of producers. In general, they concur that farming with rudimentary tools would be more strenuous without the joint effort of family labor, farmers' networks, and ties to organizations. Each of these constraints may carry enough weight that small producers may not participate. The combined effect of many of these constraints can impede the general adoption process.

In particular, the evident downward changes in Haiti's economic conditions in recent decades, as well as the lack of agricultural services, help create ripe conditions for gravitation toward

networking and organizing. What is less evident, however, is how farmers, particularly those producing mangoes, use local mechanisms and organizational ties to cope with these shifts and to acquire some economic value. What is also unclear is how organizational ties actually impact production, land allocation for certain crops, and the prices that producers receive for particular crops.

In this chapter, I introduce organizational ties from a historical prospective to account for the contribution of *konbit, gwoupman* and collective actions across communities to bring about social and economic improvement. These movements and institutions are relevant to this debate because the capacity of Haitian producers to increase their incomes highly depends on lessons learned from these experiences coupled with their ability to collectively mitigate risks and compete in the global market. The competitive advantages of tasty mangoes, plentiful family labor, and the growing market demand are not sufficient to avoid the squeezing out of small producer's profits, due to scale and access to a range of resources and services (Poulton, Dorward, & Kydd, 2010). While these social movements are not explicitly and singularly listed in the econometric models, they are inherent part of organizational ties, which the models account for as key explanatory variable that captures the depth of social ties that farmers have. Therefore, the questions I would ask are: Do organizational ties exert an influence on producers' willingness to produce? To what extent are such ties key factors in production, like land share and number of trees?

I argue that the social effects of organizational ties among producers exert significant influence on the decision to produce additional mango trees and on land allocation. More specifically,

these ties ease the constraints of market access and transaction costs. Organizations that provide value-added services do influence producers' choice to a great extent. I also expect farm size and price to remain influential, in reference to the results from chapter 5. However, their effects will lessen in the presence of organizational ties. These organizations support producers in acquiring economic value and help override certain market failures. By the same token and by conjecture, organizational ties can be too strong to be productive and may serve as a hindrance to price appreciation. In general terms, these organizations lack the mechanisms to affect sale prices in ways that could be profitable for their members. In terms of adoption, export pricing below a competitive price level – the initial offer price in the models – will likely increase supplier's surplus and result in relative lower adoption rates.

This chapter attempts to directly answer the above questions using the experimental results of carefully gathered household surveys of mango producers, some of whom I also interviewed. The analysis set forth in this chapter is an expansion of chapter 5 in terms of utilization of a series of parallel *Tobit*, maximum likelihood estimates (MLE), and linear regression (OLS) estimates. One strength of the parallel estimation approach resides in the complementarities in evaluating binary responses with continuous data points. It allows inference of how explanatory variables influence the target outcomes through the lens of various models. It deepens the findings that I discussed in the previous chapter about the producers' willingness to produce additional mango trees.

The organization of this chapter is as follows: First, I review the literature on social networks, adoption, and price variability. This review considers the economic aspects of network ties and

builds onto the discussion of social factors from chapter 3. Second, I present a summary of the empirical data before formulating the econometric models. The third section contains the experimental results of the survey. In the final section, I discuss the findings and emphasize the influence of producers' organizations on the decision to allocate land and to increase tree production.

Contextual Framework

Local Organizations

The use of organizational ties among Haitian farmers has its historical roots in the revolt ceremony at Bois Caïman, with Boukman Dutty, Toussaint Louverture, and many other visionaries in the 1790s (S. W. Mintz & Trouillot, 1995), in the form of secret political societies. Subsequently, during the 1800s, the term *konbit* expanded to primarily social networks, connecting citizens for communal work and linking farmers for agricultural labor exchange purposes.

Due to its multi-faceted uses, one could describe *konbit* in many ways. In its most practical form, however, *konbit* refers to a group effort to perform a specific task without the exchange of money. Exchange and reciprocity are the cornerstones of this practice. Networking through a *konbit* team often generates some value for participants, be that in the form of labor sharing, food sharing, tool usage, knowledge diffusion, or acquisition of tricks of the trade. Particularly in the farming community, farmers operationalize this helping-hand principle to access tools and labor. Scholars who are familiar with the Haitian culture know the socioeconomic value of these

associations. They incorporate the concept and its meaning in their writing, in one form or another (Bell, 2001; J. M. Smith, 2001). As Smith explains, these types of farmer-led organizations are the building block for many types of community organizations and development projects in rural Haiti. Farming with others, in the context of developing countries, provides the necessary 'on the job training' to acquire the experience, the skills and tricks for growing healthy food.

However, a few decades ago, *konbit* labor exchange was more prevalent among farmers. Some farmers have opted out, citing the time commitment involved in rotating from farm to farm. Others point to the increasing dominance of waged-labor in the agricultural sector as the reason for this decline. Currently, many farmers in the south and the north of Haiti have transformed themselves into squad labor to collect wages for their work. Whether this structural shift leads to meaningful economic value or renders producers more vulnerable remains open for discussion.

During the 1960s, the emergence of *gwoupman* in rural Haiti represented the community development arm of *konbit*, involving not only farmers but also the community at large. Coupeau (2008, p. 120) refers to *gwoupman* in terms of "consensus-building" and "social awareness," where social actors engage in collective action to solve common problems. During the 1980s the *gwoupman* expanded to various spheres including politics (e.g., assistance in electing community leaders), justice (e.g., arresting and imprisoning law-breakers and forcing some men to marry women they impregnated), policy formulation (e.g., setting up a fee one must pay for regaining a cow that crossed into a neighbor's farm), and cooperative economic ventures (e.g., making arrangements for peasants to obtain credit, seeds, and technical assistance).

A communal section or county may have multiple *gwoupman* under a broader umbrella called

local council, or *Conseil d'Action Communautaire* (CAC). An executive board composed of a

president, treasurer, secretary, and multiple advisors, manages the various communal *gwoupman*.

For example, during the 1980's, my father, Bona Polynice, was the president of the *Conseil*

d'Action Communautaire de Fond-Parision, which encompassed six *gwoupman*, representing

various parts of the village. Every two years they elected the board members, who served as an

advocating body in search of development assistance. The community expects the board to act

responsibly in the best interests of those they represent. The board members pay regular dues,

approve operating budgets, establish goals and objectives, and carry out the duties of the

organization. The members have to be in good standing and well known in the community,

interested in development matters, capable of being a team player, and able to articulate the goals

of the organization.

While the state could still overpower the authority of the CAC, the board was the legal guardian

of natural resources and various communal amenities that could be sources of revenue for self-

development (Flora, Green, Gale, Schmidt, & Flora, 1992; Green, 2001). The ministry of

agriculture, for example, used to channel various projects – irrigation, seeds distribution, and

training – through this governing body. This was a way for civil society to interact with the

state, either alone or in collaboration with other organizations. Many cooperative associations

emerged from within the CACs to further producers' causes, mainly in terms of credit access and

seeds acquisition. However, unlike the CAC, which was a local community-led effort,

cooperatives emerged in Haiti during the late 1930s with government support. Particularly

during the Estimé presidency, many rural cooperatives received government support for carrying

out projects. The government provided micro-loans and financed some community projects.

Many international organizations, government agencies, and migrants channeled funds through

the cooperatives to finance a range of projects across a range of sectors.

Today, many formal and informal producers' organizations strive to fill the void left by market

failures and by a lack of policy instruments conducive to economic growth. Consequently,

producers often join organizations in order to obtain production support and tools, to acquire

knowledge, and to access postharvest services. In the mango industry, however, organizational

ties tend to be more formal than in general farming practice. "Formal" means that the

organization is registered with the appropriate state regulatory agency and has bylaws. The

services that members receive vary from assistance with the planning phase, to growing a few

trees or an orchard, to market access for the final product.

For instance, one of the organizations that I worked with during this research provided grafting

and pruning training to 40 producers around the country. They provided training in nursery

techniques, orchard development, harvesting, post-harvesting, and general production

management. They developed over 120,000 avocado and mango seedlings to distribute to

communities (including members and non-members). With producer-donated land and funding

from international agencies, they built two postharvest centers to sort, wash and store mangoes

prior to sending to packinghouses for export. As a result, they employ more than 25 seasonal

workers who provide these postharvest services. They also purchased one ATV with pulling

trailers to negotiate travel over rough terrain and hills. Several organizations plan to follow these

efforts and duplicate these accomplishments in other regions of the country. The general consensus is that members of the organizations express interest in domestic processing of a range of fresh fruits, not just mangoes for export. They see potential value in the availability of agro-processing and refrigerated warehouses that can prolong the marketable life of fresh fruits.

Considering the broader framework of agricultural export, the recent efforts to promote export of Haitian mangoes rests mainly on the influence of producers' organizations and on the highly inclusionary aspect of mango tree ownership across small farm households. If agro-experience in Latin America and the Caribbean provides any clue, it may be that agro-export's benefits tend to be exclusionary rather than widespread. Whether this push for mango export in Haiti can be different from previous ones, in terms of participation and benefits, is a reasonable question.

Literature Review

Value of Organizational Ties

Consistent with the premise that producers have the propensity to join organizations in order to obtain access to services, Bebbington (1999) found that in the high Andes, social ties were vital to wellbeing and served as precursor for accessing necessary resources and linking to other agents. Social ties can constitute an effective community support system for resource-scarce individuals to absorb economic shocks and to facilitate value acquisition (Carter & Maluccio, 2003). Since small producers lack formal technical skills and access to formal training, being part of support networks can support learning about new technologies and acquiring tricks of the trade. Empirical evidence shows that farmers learn how to cultivate new crops from others cultivating the same crop (Besley & Case, 1993; Conley & Udry, 2010; Foster & Rosenzweig,

1995; Munshi, 2004). Social networks represent significant vehicles for transfering knowledge among participants, as shown in the case of pineapple growing in Ghana (Conley & Udry, 2010) and BT cotton in India (Maertens, 2010).

Besides facilitating access to physical capital and tricks of the trade, teaming up with others can also be an effective strategy for smallholders to overcome transaction cost constraints. Although a transaction cost analysis is beyond the scope of this study, cost is an inherent and influential factor in producers' decision-making process. When producers share the costs of accessing markets – such as those related to information acquisition, sales, distribution, and marketing – they are better able to defuse the tension between possible gains from specialization and corresponding increases in transaction costs (Omamo, 1998). Apart from organizing themselves into units of production to spread risk, farmers also diversify their crops as an optimal response and a rational strategy to counter high trading costs and to adjust production according to comparative advantage. For the most part, the costs for producing fruit trees are sunk and non-transferable. They include multi-year land allocation, nursing expenses, training, transportation, and goodwill with potential buyers. Upon entering the agro-export market, however, smallholders face an additional array of multifaceted constraints and risks that are complex to mitigate. Therefore, spreading costs and risks makes it more plausible for producers to diversify their crops and grow additional fruit trees.

Price Variability and Transmission

A key feature of this analysis is its focus on the price variability and the transfer of global price to small scale producers. The literature on agricultural export extensively covers the factors that

influence price variability. Jacks, O'Rourke, and Williamson (2011) provide a longitudinal perspective on historical commodity prices from 1700 to 2008, for both primary and manufactured products. They find that primary products are more volatile than manufactured goods and that commodity price volatility has not increased over time. In turn, developing countries are more volatile than developed countries, and this volatility impedes growth performance. They also conclude that world market integration could result in less volatility for individual commodity prices. When a small domestic economy trades with a large world economy, local shocks to supply and demand stabilize. Deaton and Miller (1995) construct a country-specific index of commodity prices for each sub-Saharan African country in order to analyze the relationship between commodity prices and growth in Africa. They claim that there is a direct correlation between commodity prices and economic growth in Africa.

Price transmission and information asymmetry remain persistent issues in primary products export. A few studies address the impact of asymmetric price transmission on small producers, comparing the pre-reform and post-reform periods of market liberalization, in conjunction with economic agents such as middlemen, exporters, and organizations (Fafchamps & Hill, 2008; Subervie, 2011; Wilcox & Abbott, 2004). Fafchamps and Marcel (2008) find that world price increases are not necessarily reflected in producers' prices, due to information asymmetry. Agents take advantage of small producers' lack of knowledge about world market prices in order to delay and in some cases prevent possible increases in producers' prices.

Negative price changes transmit much faster than positive ones, mainly due to weak contracts enforcement, new marketing schemes in some cases, and the unfavorable influence of rent-

seeking agents along the commodity chain (Subervie, 2011; Worako, van Schalkwyk, Alemu, & Ayele, 2008). Particularly in tree fruits production, which requires irreversible-like investment and long-term commitment, trade shocks and price shocks amplify the impacts on small producers. Although supply and demand are the principal drivers of prices, Lewis (1955) declares that the price mechanism does not resolve all social conflicts and constraints, such as inequality, *mounpanism*, and autarchic groups.[26] Therefore, price remains an imperfect mechanism, like other social institutions. At a glance, the literature raises a dualistic flag of caution on commodity price variability and transmission: Small scale producers receive negative prices transmission much faster than positive prices. In absence of a subsidy that could lower these imperfections, the discussion on increasing small producers' income through mango production reveals reasons for concern.

The following section presents a summary of the survey data and introduces a contingent price scheme for determining producers' willingness to produce, to allocate land, and to grow more trees. Then, I formulate econometric models to analyze the data, within the framework of producers' WTA based on organizational ties, price, and producers' characteristics.

Data Summary

I use the CV approach to gather producers' responses on WTA additional mango trees for a specific dollar amount of gross profit per dozen mangoes. The scenario describes a new policy

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[26] In the Haitian literature, *mounpanism* refers to fovoritism, being part of a family and circle of friends or social network.

to subsidize all harvest and postharvest costs related to the production of mango trees, under three price scenarios. This section presents a summary of the household survey conducted with 800 producers in the South and Artibonite regions of Haiti, between 2011 and 2012 (Table 6-1). The CV survey used the DBDC elicitation method, as I described in chapter 5, to directly request producers' willingness to produce based on discrete choices of price per dozen mangoes (Cameron & Quiggin, 1994; M. Hanemann et al., 1991).

Descriptive Statistics of Dependent and Explanatory Variables

The data contains information on farmers' characteristics, demographics, farm characteristics, and farmers' participation in producers' organizations. Table 6-1 displays the statistical summary of the dependent and explanatory variables; Table 6-2 presents the regional responses to the WTA questions. The analysis contains five dependent variables: (1) willingness to accept, which is a binary choice, (2) allocation of owned land, (3) allocation of owned land and newly purchased land together, (4) number of trees on owned land, and (5) number of trees on owned land and newly purchased land together. Each variable contains the outcomes for a specific model.

Table 6-1: Statistical Summary of Dependent and Explanatory Variables

Variable Name	Description	Obs.	Mean	Std Dev.
Dependent Variables				
WTA	Willingness responses based on three possible answer choices (1 = No; 2 = Yes)	780	24.83	4.54
Owned Land	Continuous variable to estimate allocation of owned land	687	0.88	0.83
Owned+Purch. Land	Continuous variable to estimate allocation of owned land and new purchase together	749	2.36	2.14
Trees on Owned Land	Continuous variable to estimate number of trees on owned land	780	24.83	4.54
Trees Own + Purch. Land	To estimate number of trees on owned land and new purchase together	657	85.17	97.92
Explanatory Variables				
Price	The accepted price to produce, minimum 12 and maximum 28 *Gourdes*	780	24.83	4.54
Region	North = 1 and South = 2	780	1.63	0.48
Gender	Female = 1 and Male = 2	780	1.65	0.48
Age Group	Minimum age is 18, there are 6 groups	780	3.22	1.39
Nbr Children	Number of children in the family	780	4.35	2.97
Farm Size	Continuous variable of land already owned	780	2.45	1.92
Job Income	Income from off-farm job (1 = No; 2 = Yes)	780	1.12	0.32
Remittances	Income from remittances (1 = No; 2 = Yes)	780	1.24	0.43
Francis Tree Owned	Number of Francis trees currently owned	780	13.55	18.95
Org. Ties	Producer's ties to organization	780	3.33	1.02
Supply Only	Supply relation with organization, no membership	780	0.09	0.28
Member Only	Member of organization, no supply	780	0.17	0.38
Member Supplier	Member and supplier of organization	780	0.64	0.48

Table 6-2: Regional Willingness to Produce

Region	WTA Responses (N=780)				
	1.YesYes	2.YesNo	3.NoYes	4.NoNo	Total
North	4	21	244	17	286
	12.50%	8.57%	59.37%	18.48%	36.67%
South	28	224	167	75	494
	87.50%	91.43%	40.63%	81.52%	63.33%
Total	32	245	411	92	780

In light of the adoption literature, the models include explanatory variables that typically influence producers' decisions. The rationale for including these factors is based on the adoption literature. In addition to focusing on organizational ties, core factors such as farm size and gender are of particular interest in this inquiry. Farm size is considered as a quasi-fixed input, despite its influential attributes in such a land-constraining production context. Realistically, a large number of small producers in developing economies face binding constraints of land availability, credit access, basic services, and enabling factors of participation. The producers' rational behavior in negotiating these barriers seems to be their effort to maximize the cash crops to a practical level.

Gender is particularly relevant in the fruit production sector. Traditionally, women used to take charge of managing the harvest and selling the products at markets. The men were the ones climbing the trees to harvest the fruit. The women took care of all subsequent tasks, including catching, selecting, loading the backs of donkeys and mules for transport to market, and spending countless hours at the farmers' markets to sell the mangoes. With the difference in market value between the export type and the non-export types, it would be important to know how gender influences the decision to produce. The gender dynamics at play in the field provide an econometrically justifiable basis for including gender in the list of explanatory factors.

Omitted Variables

In addition to the core factors in Table 6-1, several omitted variables could merit inclusion as explanatory factors in the adoption assessment. These factors include education, age of the

children, family labor, the quality and location of the land, credit availability, and non-farm income sources amounts. These variables are omitted for the following reasons.

Firstly, there is not much variation in the level of education, which, according to census data, is a very low level, among these producers. Additionally, mango production is widespread and very inclusive. Therefore, including education would add only very modest value to this analysis. The age of the children could be an important factor in terms of determining their readiness to attend school and their capacity to help as family labor on the farm. Although children's characteristics could support the assessment of a family's expenses and labor gains, their delineation could be blurry. A child's typical day generally consists of a blend of farm work and schoolwork. Moreover, children often start farm work at an early age and may continue to help their parents beyond the age of maturity and after having their own families.

Secondly, the factors of credit access, location, and quality of land are certainly important explanatory variables for mango production. In fact, I collected this data, but I chose to omit it because of the widespread credit constraints among producers. This study took place in mango-producing regions, which means that the producers are well aware of the type of land that can produce mangoes. As such, this information is embedded in the farm size and the number of trees that the producers are willing to produce. In the Haitian context, the farm size variable captures a lot of information. As the survey result indicates, the typical mango grower tends to have more land than the national average of all farmers. Therefore, capturing the farm size serves as a good proxy for the family's commitment to agriculture. It also serves as an indicator

of labor requirement, ability to allocate land, and capacity to grow additional mango trees. Overall, these omissions prevent collinearity in the estimates.

Another omitted variable is the number of non-export mango trees the producers own. Although I collected the data, I did not include it in this analysis due to the fact that the producers generally can only provide a vague number of their non-export holdings, and they often disregard the non-export types altogether. Moreover, there is more fluctuation in the price of the non-export varieties, which would require some selection and valuation process for the data to be meaningful. A striking revelation is that the producers tend to overlook the number of non-export varieties that they have. Though, the non-export mangoes account for approximately 85 percent of Haiti's total production. A general and questionable practice is grafting, which consists of replacing the non-export variety with the export species.

The binary question of whether or not someone receives remittance income may produce more accurate results than the actual amount they receive, which may be irregular and of different transfer amounts. A producer may have received remittances last year but not this year. However, last year's amount could be enough to start a small business that may continue to grow for years to come. In this case, reporting the amount can be ambiguous. Therefore, the collection of binary data on some of the core variables results in a more accurate representation of the phenomenon, as opposed to continuous data that could be less accurate or unavailable. Especially in the context of rural Haiti, reporting a regular and accurate income from a small business can lead to inaccurate data. For instance, a small business may be losing money without the farmer being aware of it. Also, the practice of inter-cropping cash crops and staple

foods dominates the subsistence agricultural system of Haiti. The production and consumption costs cannot be separated (Omamo, 1998), since they often blend together like a tropical fruit shake. As such, it is econometrically defensible to omit these factors for the reasons explained above.

Descriptive Statistics of Organizational Ties

To determine the level of producers' organizational ties, I created four dummy variables from a combination of the Membership variable and the Supplier variable. The latter refers to whether or not the producer sells his or her mangoes to an organization as opposed to selling to other buyers. However, the producers' organizations do not have exclusive rights of purchase from their members. The use of these categorical predictors serves to convey the significance of organizational ties for the producers. Table 6-3 describes four variables of organizational ties. The "no relation" variable refers to producers who are not members of any organization. They receive no direct services from organizations, and they harvest their products using family labor and friends and sell to available buyers. The "supply-only" variable refers to producers who sell some of their products to organizations but who have no membership affiliation. One could describe this relationship as a weak one. The "member-only" producers receive services from organizations but do not sell their products to organizations. The "member-supplier" variable defines the producers who receive services *and* sell the export variety of mango to organizations. One may describe these ties as strong. From an operation standpoint, each of these categories is different from the others.

Table 6-3: Levels of Organizational Ties by Region

| Organizational Ties | Description | Respondent Region | | Respondents |
		South	North	Total
No_Relation (_IOrgTie_1)	Not a member and no supplying	27	57	84
		9.44%	11.54%	10.77%
Supply_Only (_IOrgTie_2)	Sell products to the organization	18	50	68
		6.29%	10.12%	8.72%
Member_Only (_IOrgTie_3)	Receive org. services; no supplying	94	38	132
		32.87%	7.69%	16.92%
Member_Supplier (_IOrgTie_4)	Receive services and supply org.	147	349	496
		51.40%	70.65%	63.59%
Total		286	494	780

The overall response shows that 81 percent of the survey participants (mean = 1.81 and standard deviation = 0.39) have some organizational ties. The North reports 84 percent membership affiliation and the South stands at 78 percent. The standard deviations of the two regions (North = 0.36 and South = 0.41) from the overall mean shows a well-balanced dataset, in terms of organizational ties. Figure 6-1 provides a parallel view of the WTA responses as related to organizational ties.

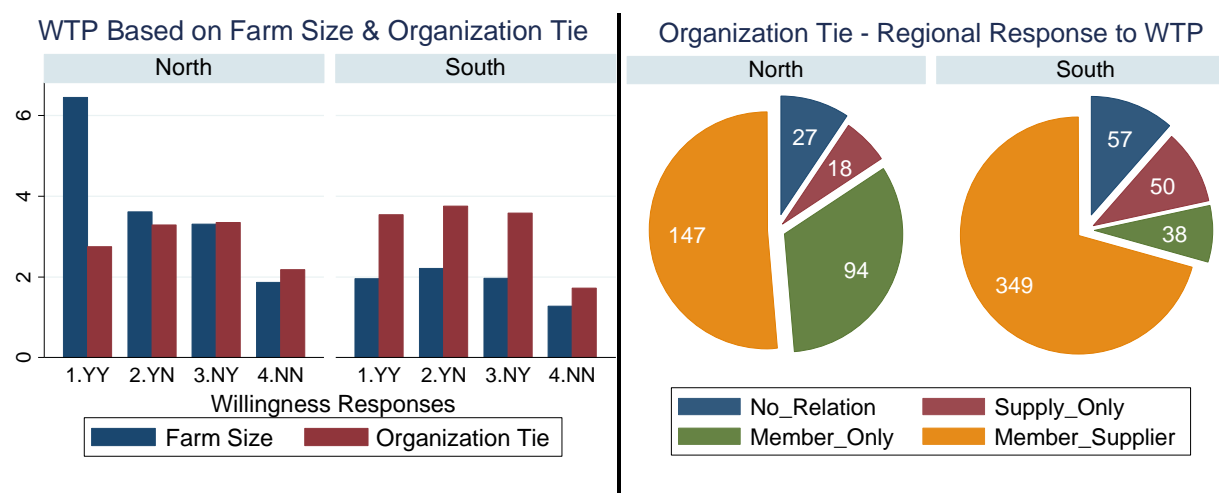Figure 6-1: WTA Responses Based on Organizational Ties

Table 6-4 displays the tabulation of the participants' responses to the initial and follow-up

questions, based on their organizational ties. The table shows the outcome responses in the

WTA column and the organizational ties by category, and the total column presents the overall

adoption. In general, the survey instrument provides explanatory data on farm and farmer

characteristics, including total hectares, off-farm income (including employment, small business,

and remittances), gender, age group, and number of children.

Table 6-4: WTA Responses by Level of Organizational Ties

WTA Outcomes	Organizational Ties (N=780)				
	No_Relation	Supply_Only	Member_Only	Member_Supplier	Total
1.YY	1	7	1	23	32
	1.19%	10.29%	0.76%	4.64%	4.1%
2.YN	1	22	23	199	245
	1.19%	32.35%	17.42%	40.12%	31.41%
3.NY	30	21	98	262	411
	35.71%	30.88%	74.24%	52.82%	52.69%
4.NN	52	18	10	12	92
	61.9%	26.47%	7.58%	2.42%	11.79%
Total	84	68	132	496	780

Interaction Terms Basis

Although there are operational differences between the categories, there are relatively

insignificant statistical differences between the "no relation" and "supplier-only" categories and

between the "member-only" and "member-supplier" categories (Table 6-5). Therefore, I collapse

these two group-pairs into two statistically different categories: (1) the "Member" category,

which includes the producers who have a formal membership in an organization and also sell

their products to the organization and (2) the "Non-Member" category, which includes all other

producers in the sample. These two categories serve as the basis for the interaction terms

between organizational ties and farm size and between organizational ties and region.

Table 6-5: Organizational Ties Indicator Variables – Regional Responses

| Tie Indicators | Description | Respondent Region | | Respondents |
		South	North	Total
Non-Member	Producer who is not both a member and supplier to the organization	139	145	284
		48.60%	29.35%	36.41%
Member	Producer who is both a member and supplier to the organization	147	349	496
		51.40%	70.65%	63.59%
Total		286	494	780

In modeling the household decision to produce, given the inherent distinctions in the levels of

ties, one can infer that producer's utility varies with organizational membership, farm size, and

region. From the perspective of the analyst, the factors that influence decision-making are both

observed and unobserved. The explanatory variables, such as farm size and region, capture the

observed factors. The random error terms capture the factors that the analyst is not likely to

observe. For instance, organizational membership provides some degree of prestige in the

village as well as emotional support for celebrating the good times and enduring the dire

moments. The models account for the difference between the observed and the unobserved

factors by expanding the interrelation between the categorical variables of organizational ties and

supply relation into the two indicator (dummy) variables. Table 6-6 displays the tabulation of

the two indicator variables for organizational ties in the first column, the responses to the initial

and follow-up offers in columns 2 to 5, and the overall adoption in the "Total" column.

Table 6-6: Organizational Ties Indicator Variables - WTA Responses

Ties Indicators	WTA Responses (N=780)				
	1.YesYes	2.YesNo	3.NoYes	4.NoNo	Total
Non-Member	9	46	149	80	284
	28.13%	18.78%	36.25%	86.96%	36.41%
Member	23	299	263	12	496
	71.88%	81.22%	63.75%	13.04%	63.59%
Total	32	245	411	92	780

Advantages and Challenges in Estimating CV Responses

A number of studies have found a few drawbacks in the DBDC data gathering format of CV, in terms of possible anomalies that may result from the responses to the initial and follow-up questions (Alberini et al., 1997; Cameron & Quiggin, 1994; DeShazo, 2002; Herriges & Shogren, 1996). Most of these studies, however, analyze anomalies in WTP studies, where the respondents play the role of payer, as opposed to WTA studies, where the respondents play the role of immediate payee. In any case, the anomalies in the double-bounded approach are the following:

Anchoring Effects (Starting Point Bias): Anchoring occurs when the respondents cling to the initial offer (the starting point) as the main reference point or anchor for subsequent offers. Herriges and Shogren (1996) conducted an experiment to address the issue of starting point bias and to examine the extent to which anchoring to the starting offer diminishes the efficiency gains from follow-up questioning. They concluded that individuals do anchor their decisions to the starting offer in a sequence of offers, leading to bias in the responses. Even when the analyst optimally designs the questions and corrects for the anchoring effect, starting point bias may likely diminish the efficiency gains from follow-up questioning.

Shifting Effects: Shifting occurs when the respondent perceives the follow-up question as an unfair request to pay more (in case of WTP study) or an advantageous offer to receive more incentive (in case of WTA study). As such, the iterative questioning may lead to a systematic shift in willingness between the two responses, resulting in inconsistency (Alberini et al., 1997). Shifting is similar to *Cost Expectations* in the sense that the respondent may answer the follow-up question under the assumption that the initial question conveys information about the actual value of the good in question, leading to a decrease in willingness to pay a higher price (DeShazo, 2002; Watson & Ryan, 2007). Conversely, the respondent may provide a follow-up answer under the assumption that the initial offer is an unfair value for the good in question, which may result in an upward bias in WTA or an increase in the respondent's initial willingness to accept.

Yea-Saying Effects: This may be one of the most common sources of anomalous responses to follow-up questions in the DBDC method. Yea-saying bias occurs when the respondent tends to accept any offer without considering the value of the good in question. In such a case, respondents overstate or undercut their true willingness in order to appease the interviewer, and this is often associated with ascending offers (DeShazo, 2002; Watson & Ryan, 2007). Yea-saying bias may occur in a descending bid sequence, in a WTA investigation, if the respondent has the propensity to agree with a lower bid.

Framing Effects: Framing presents similar characteristics to anchoring in terms the use of the initial bid as a reference point. In modeling *framing effects*, DeShazo (2002) refers to prospect

theory and decomposes the iterative question format into ascending and descending sequences in order to determine the pattern of inconsistencies.[27] The empirical results from the rearrangement of the questions show that these anomalies are path-dependent and symptomatic of preference reversal, and they primarily occur in sequences of WTP questions that ascend in value (Alberini et al., 1997; DeShazo, 2002).

Strategic Behavior Effects: This is another variation from anchoring and shifting, in that the respondent infers that the first offer indicates the true value of the good. In this case, the respondent considers the ascending follow-up offer as an attempt to acquire funds beyond the true value of the good (Alberini et al., 1997; DeShazo, 2002; Flachaire & Hollard, 2006; Watson & Ryan, 2007). Accordingly, the respondent is more likely to reject the follow-up offer than he or she would otherwise.

Solutions to Anomalies: A number of researchers propose econometric models to solve these anomalies and increase the efficiency of the iterative question format. DeShazo's findings (2002, p. 379) lend support to this study's use of the discrete approach, in the sense that "the empirical effect of framing on follow-up questions is much greater for open-ended questions than for discrete questions." Two sets of equivalent questions may yield statistically different answers by asking them in a different order. Therefore, to eliminate framing bias, DeShazo proposes a

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[27] DeShazo (2002) states the framing effects in terms of prospect theory, which predicts that a respondent who accepts the initial offer may view the ascending follow-up offer as a potential loss and therefore may become relatively more exposed to risks (Kahneman & Tversky, 1979).

design format that monotonically iterates the questions downward. In such a case, the follow-up

question is no longer contingent upon the first one.

Bounding Effects: In the WTA approach, the respondent faces an initial offer (e.g. $40), which

he or she may accept or reject. If the respondent accepts the initial offer, the follow-up will be a

lesser amount (e.g. $30); otherwise, the follow-up offer will be a greater amount (e.g. $60). The

dilemma lies in obtaining estimation for the entire sample, where some answers may fall outside

of the data range or above the threshold of $60. Such cases make it difficult to distinguish

between the would-be adopters at a price above the threshold, and those who would not adopt at

any price. A potential solution is to consider the subsample of likely adopters, which is the

approach of this study.

Model Formulation

Categorical Predictor

To convey the significance of organizational ties, I created two categorical predictor variables

(Non-Member and Member) to interact with farm size and region. The purpose of the interaction

terms is to expand the linear models and remove ambiguities in interpreting the results. For

example, the *additive* model assumes that the effect of region on land dedication is the same (in

number of hectares) for each farm size level or the same for each level of organizational tie. Let

us consider the case where there is one continuous variable, x_1 (farm size), and one categorical

binary variable, x_2 (gender), resulting in this linear equation:

$$y_{land} = \beta_0 + x_{1land}\beta_1 + x_{2land}\beta_2 + \varepsilon_{land}$$

$$= \begin{cases} \beta_0 + x_{1land}\beta_1 + \varepsilon_{land}, & if \ x_{2land} = 0 \\ \beta_0 + x_{1land}\beta_1 + \beta_2 + \varepsilon_{land}, & if \ x_{2land} = 1 \end{cases} \qquad (6\text{-}1)$$

β_2 represents the change in the intercept when comparing $x_{2land} = 1$ and $x_{2land} = 0$. However, this assumption could be misleading or even untrue, when comparing a categorical variable with two or more levels. The interaction terms, which are the products of variables in a model, provide the necessary mechanisms for more accurate inferences. For instance, it may be that one's ties to organizations depend on the region in which one lives or on farm size, and that a change in tie level (say from non-member to member) may affect one's willingness to produce.

Now, let's consider the continuous variable price X_{tree} to represent the accepted price and the interaction terms between two binary categorical variables, R_{tree} (representing region: North = 1 and South = 2), and Z_{tree} (representing organizational ties' category "member"), with yes/no levels, resulting in $R_{tree}Z_{tree}$. The formulation of the interaction terms for modeling the response to number of trees is as follows:

$$y_{tree} = \beta_0 + X_{tree}\beta_1 + \alpha_1 R_{tree} + \alpha_2 Z_{tree} + \gamma R_{tree}Z_{tree} + \varepsilon_{tree} \qquad (6\text{-}2)$$

where parameter γ represents how much the intercept changes from the *additive* model for two variables.

To model the amount of land allocation, I apply the same principle and substitute land for trees, including the interaction of organizational ties and land ($R_{land}Z_{land}$). The additional parameters from the product of the interacting variables generate changes in the slopes of the regression lines. They also provide intercepts that deviate from the *main effects* of the additive models. Although in many cases the additive structure fits the data very well, the inclusion of interaction

terms – such as member by farm size and member by region – increases the number of explanatory factors and reduces the error degrees of freedom. Therefore, the results become more generalizable and adaptable.

In order to triangulate the results, the econometric approach first considers modeling of the *main effects* through a series of *Tobit,* ML, and OLS. I then compare these models with a second set of models that include the interaction terms that result from multiplying organizational ties by farm size and then by the producer's region, to ascertain the impacts of these terms on other factors. The aim is to deepen the previous estimates and to illustrate the influence of these relationships coupled with the price variability factor on farmers' decision-making process. The broad assumption is that when producers network with others, it is not simply for altruistic reasons, but mainly for maximizing their values while minimizing the possibility of becoming worse-off. Moreover, it is not only the strength of ties that matters; one's farm size and location, in relation to networking possibilities, could also offer advantages or induce constraints (Isaac, 2012; Spielman, Davis, Negash, & Ayele, 2011).

My hypothesis is that the effects of organizational ties on the decision to produce differ according to farm size and to the regional strength of these ties. Ties may exert greater influence than price on producers' decision to allocate land and to plant additional trees. By virtue of having loyal producing members, organizations may serve as a price-oppressor and, consequently, may not constitute the driver of price appreciation for such a "soft" commodity as

the mango.[28] In the absence of buyer-supplier contracts, where there are no price stabilization

schemes and no commodity futures trading (Morgan, Rayner, & Ennew, 1994), the ultimate

price appreciation and income booster may be investment in local capacities to absorb the

harvest, which in turn creates competing buying agents.[29]

Estimation Models

In the attempt to link adoption and land accumulation decisions, this model follows Barham et al.

(1995) and looks to determine three production-related decision points: (1) the binary choice of

whether or not to produce (adopt), (2) the amount of land to allocate for the production, (3) the

binary choice of *whether or not* the producer would purchase land for production, and (4) the

number of trees to produce. When it comes to the adoption of export crops among small farm

households, the core factors of interest are the price per dozen that the producers receive (after

postharvest expenses), the producers' ties to organizations, and farm size. The Barham et al.

study relied on retrospective (*ex post*) survey data of actual adoption and subsequent land

accumulation. This research, by contrast, relies on prospective (*ex ante*) data, which creates

certain challenges in terms of using contingent valuation data as intentional data to assess

subsequent decisions about land accumulation and fruit tree production.

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[28] "Soft commodity" generally refers to commodities that are grown, rather than mined. Their

marketable value is relatively short, and they include fruits, vegetables, sugar, cotton, cocoa and

coffee.

[29] This is in reference to price variability in commodities, using the fundamental analysis that

increasing demand leads to higher prices.

This study considers producers' responses to a new policy that would provide incentives to produce additional mango trees by increasing income. The stipulation consists of securing a price of 20, 12, or 28 *Haitian Gourdes* (HTG) per dozen mangoes, after all postharvest expenses. In determining whether or not the conditions are acceptable, following Hanemann, Loomis and Kanninen's (1991) DBDC approach but consistent with WTA inquiry, I asked an initial question with a starting offer and then a follow-up offer. Providing that the follow-up offer is contingent upon the answer to the initial offer, let P_i^I indicate the initial offer price of 20 HTG. If the participant responds "yes" to the initial offer, the follow-up price (P_i^L) is a lower amount of 12 HTG ($P_i^L > P_i^I$). If the participant responds "no" to the initial offer, the follow-up price (P_i^H) is a higher amount of 28 HTG ($P_i^H > P_i^I$). I assume that farmers would decide to produce under the utility-maximizing motivation, meaning that respondents would answer "yes" to a price only if her/his WTA (denotes as P^*) is greater than or equal to the initial asking price (P_i^I), resulting in the following equation:

$$P_i^* = WTA_i \geq P_i^I$$

As I presented in the previous chapter, the combination of the initial and follow-up questions generates four possible outcomes: (1) "no" to both question, (2) "yes" to both questions, (3) "no" to the initial and "yes" to the follow-up, and (4) "yes" to the initial and "no" to the follow-up. In expressing the outcomes d_i, in terms of the real value of P_i^*, we can write the responses as:

$$d_i = \begin{cases} 1 & no, no & \rightarrow P_i^I < P_i^H < P_i^* \implies P_i^I < P_i^* \\ 2 & yes, yes & \rightarrow P_i^I > P_i^L \geq P_i^* \implies P_i^L \geq P_i^* \\ 3 & no, yes & \rightarrow P_i^I < P_i^* \leq P_i^H \implies P_i^H \geq P_i^L \\ 4 & yes, no & \rightarrow P_i^I \geq P_i^* > P_i^L \implies P_i^I > P_i^L \end{cases}$$

The likely outcomes are denoted as π^{nn}, π^{yy}, π^{ny}, and π^{yn}. For instance, the term π^{ny} represents the likelihood of a farmer's willingness to produce at some price greater than the initial asking price. In the first scenario, the outcome likelihood formulation of $P_i^H < P_i^*$ corresponds to:

$$\pi^{nn}(P_i^I, P_i^H) = \Pr(P_i^I \leq WTA_i \text{ and } P_i^H \leq WTA_i)$$

$$= \Pr(P_i^I \leq WTA_i \mid P_i^H \leq WTA_i) \Pr(P_i^H \leq WTA_i)$$

$$= \Pr(P_i^H \leq WTA_i)$$

$$= 1 - G(P_i^H; \theta).$$

Analogous to (5-3), $G(P_i^H; \theta)$ represents the statistical distribution function, with θ as the vector of estimable parameters. In the context of a utility-maximization response, $G(P_i^H; \theta)$ represents the cumulative density function (cdf) of WTA. Since outcome $P_i^H > P_i^*$, then

$$\Pr(P_i^I \leq WTA_i \mid P_i^H \leq WTA_i) \equiv 1.$$

Assuming a normal distribution of the parameters, the above expression becomes

$$\pi^{nn} = 1 - G(P_i^H; \theta) = \Phi\left(\frac{P_i^H - E[WTA_i]}{\sigma[WTA_i]}\right)$$

Let $E[WTA_i|x] = \beta'x$, representing a constant variance and conditional mean of WTA_i, leading to the simplified equation of

$$\pi^{nn} = \Phi\left(\frac{P_i^H - E[WTA_i]}{\sigma[WTA_i]}\right) = 1 - \Phi\left(\frac{P_i^H - \beta'x}{\sigma}\right) \tag{6-3}$$

Likewise, with $P_i^L < P_i^I$, $\Pr(P_i^L \leq WTA_i \mid P_i^I \leq WTA_i) \equiv 1$. Therefore, given a normal distribution

$$\pi^{yy}(P_i^I, P_i^L) = \Pr(P_i^I > WTA_i \text{ and } P_i^L \geq WTA_i) = G(P_i^L; \theta) = \Phi\left(\frac{P_i^L - \beta'x}{\sigma}\right) \tag{6-4}$$

When a "yes" follows a "no" (no/yes), resulting in $P_i^H > P_i$ and

$$\pi^{ny}(P_i^I, P_i^H) = \Pr(P_i^I \leq WTA_i \leq P_i^H) = G(P_i^H; \theta) - G(P_i; \theta)$$

$$= \Phi\left(\frac{P_i^H - \beta'x}{\sigma}\right) - \Phi\left(\frac{P_i - \beta'x}{\sigma}\right) \tag{6-5}$$

and when a "yes" follows a "no" (no/yes), it results in $P_i > P_i^L$ and

$$\pi^{yn}(P_i^I, P_i^L) = \Pr(P_i^I \geq WTA_i > P_i^L) = G(P_i; \theta) - G(P_i^L; \theta)$$

$$= \Phi\left(\frac{P_i - \beta'x}{\sigma}\right) - \Phi\left(\frac{P_i^L - \beta'x}{\sigma}\right) \tag{6-6}$$

For a sample N respondents, where $P_i^I, P_i^L,$ and P_i^H represent the prices offer to ith respondent,

the corresponding log-likelihood function for WTP_i is

$$lnL(\theta) = \sum_{i=1}^{N} \begin{cases} d_i^{yy} ln\pi^{yy}(P_i^I, P_i^H) \\ +d_i^{nn} ln\pi^{nn}(P_i^I, P_i^L) \\ +d_i^{yn} ln\pi^{yn}(P_i^I, P_i^H) \\ +d_i^{ny} ln\pi^{ny}(P_i^I, P_i^L) \end{cases} \tag{6-7}$$

where $d_i^{yy}, d_i^{nn}, d_i^{yn},$ and d_i^{ny} represent the binary-valued indicator variables, corresponding to

the response probabilities of equations (6-3) to (6-6). Assuming a normal distribution, the

corresponding log-likelihood for the DB elicitation format is

$$lnL(\theta) = \sum_{i=1}^{N} \left\{ d_i^{yy} ln\left[\Phi\left(\frac{P_i^L - \beta'x}{\sigma}\right)\right] + d_i^{nn} ln\left[1 - \Phi\left(\frac{P_i^H - \beta'x}{\sigma}\right)\right] \right.$$

$$+ d_i^{yn} ln\left[\Phi\left(\frac{P_i - \beta'x}{\sigma}\right) - \Phi\left(\frac{P_i^L - \beta'x}{\sigma}\right)\right]$$

$$\left. + d_i^{ny} ln\left[\Phi\left(\frac{P_i^H - \beta'x}{\sigma}\right) - \Phi\left(\frac{P_i - \beta'x}{\sigma}\right)\right] \right\} \tag{6-8}$$

Results Interpretation

In reference to Quaim and de Janvry (2003), the coefficient β represents the marginal effects of

x variables on WTA_i in currency terms. Therefore, the results provide the predictive number of

producers who are likely to grow mango trees at different price levels. Given that the results

contain both price and quantity of land and trees, I can construct a supply curve to provide a

graphical representation of the supply. However, in order to construct a demand curve to

estimate consumers' behavior, I would need additional data procurement. Some of the demand

data is available, but I did not collect it for this study.

To better understand the results, it is essential to keep in mind that the models include interaction

terms, created by multiplying organizational ties by farm size (Org. Tie X Farm Size) and

organizational ties by region (Org. Tie X Region), and that this results in additional parameters

in the models. As I stated in the previous chapter, the codes of the dependent variable (WTA)

and the price factor correspondents to the four possible outcomes. A minus sign signal a higher

willingness to produce at a lower price. The producer who responds negatively to an offer price

displays a lower willingness to increase production and demands a higher price.

Tobit Model of the Adoption Decision

Let y_i^* be the censored latent variable (WTA_i) for the inclination of ith respondent to adopt and

to possibly allocate land to produce mango trees. Assuming a linear relationship, the Tobit

formulation is as follows:

$$y_i^* = x_i\beta + \varepsilon_i, \tag{6-9}$$

where x_i presents a vector of exogenous variables and β is the vector of explanatory variables

(refer to Table 6-1). The random variable, ε_i, represents the distribution of errors, capturing the

unobservable characteristics of the respondent. The estimates of the parameters contain the

robust option for the variance-covariance matrix. With mean μ and variance σ^2, I assume a

representation of $\varepsilon_i \sim N(\mu, \sigma^2)$ as an independent and normal distribution with zero mean and

constant variance, $N(0,1)$ (Greene, 2003). I further equate the land allocation for mango

production to the observable y_i as in:

$$y_i = \begin{cases} y_i^*, & \text{if } y_i^* > 0 \\ 0, & \text{if } y_i^* \leq 0 \end{cases} \tag{6-10}$$

Under the assumption that the decision to produce and the outcome are separate processes that

produce two latent variables, and in reference to Heckman's (1979) model, I generate separate

models as follows:

$$y_i^* = x_i\beta + \varepsilon_i, \text{ where } y_i = \begin{cases} y_i^*, & \text{if } y_i^* = 0 \\ 0, & \text{otherwise} \end{cases} \tag{6-11}$$

$$d_i^* = z_i\gamma + v_i, \text{ where } d_i = \begin{cases} 1, & \text{if } d_i^* > 0 \\ 0, & \text{if } d_i^* \leq 0 \end{cases} \tag{6-12}$$

where z is a vector of explanatory variables, γ is a vector of parameters, and ϱ represents the

correlated coefficient for the error terms.

ML Estimation

Estimating the ML ratio through the logit model for comparison purposes, let the dependent

variable Y represent an indicator variable with value 1 for success and 0 otherwise (Gould,

Pitblado, & Poi, 2010). The probability mass function from the Bernoulli distribution is

$$f(y_j; \pi_j) = \begin{cases} \pi_j, & \text{if } y_j = 1 \\ 1 - \pi_j, & \text{if } y_j = 0 \end{cases}$$

where π_j is the probability of successful response, with $0 \leq \pi_j \leq 1$. The logit model uses the

log of the odds ratio to illustrate the association between the independent variables x_j and π_j in

the following equation:

$$h^{-1}(\pi_j) = \ln\frac{\pi_j}{1 - \pi_j} = x_j\beta$$

Solving for π_j, the new form of the expression becomes

$$\pi_j = (x_j\beta) = \frac{e^{x_j\beta}}{1 + x_j\beta} = \frac{1}{1 + e^{-x_j\beta}}$$

where $h()$ represents the *link function,* referring to the *logistic function* or *inverse logit function.*

The log-likelihood function for the *j*th observation (to meet the linear-form restrictions) is

$$\ln l_j = \begin{cases} \ln h(x_j\beta), & if \ y_j = 1 \\ \ln h(-x_j\beta), & if \ y_j = 0 \end{cases} \tag{6-13}$$

In addition, note that

$$\frac{\partial h(x_j\beta)}{\partial x_j\beta} = h(x_j\beta)h(-x_j\beta)$$

providing the derivatives of log-likelihood function as

$$g_j = \frac{\partial \ln l_j}{\partial x_j\beta} = \begin{cases} h(-x_j\beta), & if \ y_j = 1 \\ -h(x_j\beta), & if \ y_j = 0 \end{cases}$$

$$H_j = \frac{\partial^2 \ln l_j}{\partial^2 x_j\beta} = -h(x_j\beta)h(-x_j\beta)$$

OLS Models

In comparison to the Tobit model, I also use ordinary least square (OLS) models to estimate the

hectares of land and the number of trees that producers would produce at the specific prices. The

models are similar to equation 6-1 and 6-2 with a single response variable, (y_{land}), representing

the land response as in:

$$y_{land} = \beta_0 + x_1\beta_1 + x_2\beta_2 + x_3\beta_3 + x_n\beta_n + \varepsilon_{land} \tag{6-14}$$

where β_0 is the intercept, x_1 to x_n indicate the multiple explanatory variables, and β_1 to β_n

parameters represent the average change in (y_{land}) associated with each unit increase in the

explanatory variables.

For estimating the effects on trees, I use the feasible and productive number of trees per hectare,

rather than the number that the producers stated during the survey. I only use the stated number

of trees when it is feasible for the number of hectares of available land. To represent the model,

let the productive ratio of number of trees to land be 100 trees per 1.26 hectares. I obtained this

ratio from the producers. The model uses this ratio in determining the tree response, (y_{tree}) as in

$$y_{tree} = \beta_0 + z_1\beta_1 + z_2\beta_2 + z_3\beta_3 + z_n\beta_n + \varepsilon_{tree} \tag{6-15}$$

Models Summary

The data analysis uses three types of models. First, I use censored Tobit regressions to obtain

respondents' willingness to produce under three price scenarios and to estimate land and tree

allocation. Second, I use the maximum likelihood estimator (MLE) programs to fit the response

models and to derive log-likelihood values from linear form (LF) evaluator programs, with

questions and responses as input values. Although I use both the *normal linear* and the *logit*

evaluators, I adopt the linear form because it is a better fit. Third, in addition to the Tobit model,

I use an OLS estimator to obtain the amount of owned land that producers would be willing to

dedicate to tree planting, the number of hectares of land they would purchase, and the number of

trees that they would likely grow.

Results

Overall the models are well-fitted, and they show significant positive effects on producers'

willingness to produce and on their propensity to allocate land and plant more trees. Factors

such as number of Francis trees owned, organizational ties and the interaction terms that were

not included in the chapter 5 estimates, have a strong influence on farmers' decision to produce.

Table 6-7 shows the comparative results of a set of three models (ML-Logit, Tobit, and Extended

Tobit that includes additional interaction) including interaction terms between organizational ties

and farm size. I mainly refer to the ML results for interpreting the results. Note that the

coefficient signs remain consistent across the models, suggesting similar consistency that I

observed in chapter 5. Moreover, in interpreting the WTA results, the signs of the coefficients

are relative to the coding of the four possible outcomes.

Table 6-7: ML & Tobit Estimates of WTA Responses

WTA Responses[a]	Comparative Models		Extended Tobit [c]
	ML-Logit[b]	Tobit	
Constant	31.376***	3.942***	3.357***
	(1.2627)	(0.1791)	(0.2452)
Francis Trees Owned	-0.044***	-0.008***	-0.008***
	(0.0112)	(0.0022)	(0.0022)
Farm Size	-1.092***	-0.151***	-0.115***
	(0.1617)	(0.0271)	(0.0295)
Region	-3.228***	-0.378***	-0.052
	(0.4236)	(0.0600)	(0.1255)
Org. Tie	-6.693***	-0.981***	-0.058
	(0.6159)	(0.1056)	(0.2293)
Org. Tie X Farm Size	1.175***	0.165***	0.117***
	(0.1939)	(0.0291)	(0.0320)
Job Income	1.323**	0.195**	0.191**
	(0.5864)	(0.0949)	(0.0951)
Remittances Income	-1.138***	-0.143**	-0.138**
	(0.4353)	(0.0655)	(0.0653)
Gender	0.327	0.067	0.075
	(0.3901)	(0.0587)	(0.0580)
Age	0.005	0.001	0.001
	(0.0151)	(0.0021)	(0.0021)
Number of Children	0.117*	0.017*	0.016
	(0.0711)	(0.0099)	(0.0098)
Org. Tie X Region			-0.512***
			(0.1337)
Overall Model Fit			
Observations	780	780	780
F-test		20.85	21.85
P-value	0.000	0.000	0.000
Pseudo-R^2		0.119	0.127
Log likelihood	-731.9		
Wald chi^2	266.3		

Robust standard errors in parentheses

*** Significant at 1%; ** Significant at 5%; * Significant at 10%

a: Dependent variables, coefficient value of 1 to 4, with 1 indicating higher WTA for lower price

b: Logistic Distribution's coefficients are in currency

I display the graphical representation of the WTA responses in the form of a hanging rootogram (Tukey, 1977; Wainer, 1974), comparing the empirical distribution to the best fitting normal distribution by showing the square root of the frequencies as deviations from the horizontal line instead of deviations from a normal curve (see Figure 6-2). This makes deviations from normality in the tails more visible.
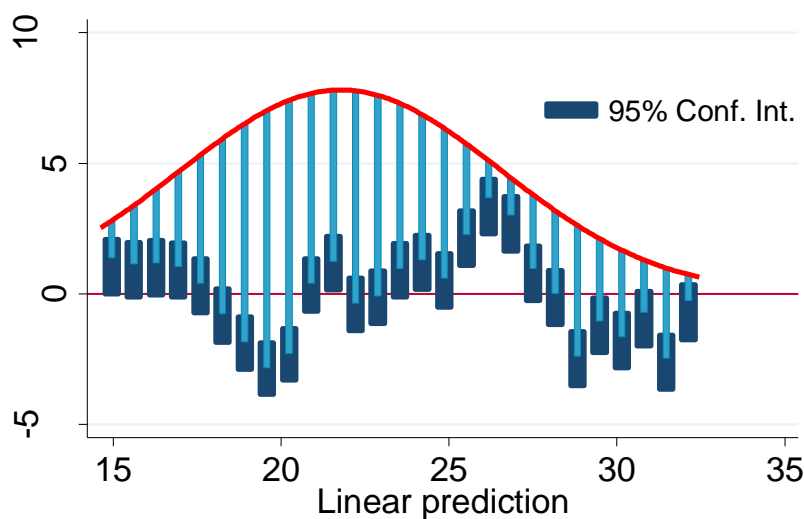

Figure 6-2: PDF of Adoption (ML Logit)

Willingness to Produce Mango Trees: ML and Tobit Results

Most of the coefficients in the models show the expected signs. Producers who are already producing the export variety (the current adopters) are willing to increase their production at a significant margin within the 99 percent confidence level. Ownership of the export variety strongly correlates with landholding, which is not surprising. On average, for every additional tree that they own, producers are willing to accept 0.04 HTG less per dozen of mangoes. This makes perfect sense, since investment in tree fruit production is sunk. Without competing buyers to absorb the harvest, current adopters have no alternatives for supplying their products.

The coefficient on farm size is statistically significant across all the models, as the literature supports. For each additional hectare, the average producer from the sample is willing to accept 1.09 HTG less to produce each additional dozen. As I hypothesize, the larger the landholding, the more the producer is willing to produce and to accept a lesser price. The difference in regional land endowments reflects in the choices that producers make about whether or not to produce additional mangoes. The North has larger farms and a higher volume of production than the South, which reflects in the farm size coefficient differences. Region, the categorical variable that identifies the farms and producers of the North (value = 1) and South (value = 2), is highly significant. A move from North to South affects WTA a lower price by 3.22 HTG per dozen. The negative sign indicates WTA at a lower price.

More meaningful to this study are the coefficients that relate willingness to produce tree crops to organizational ties and their related interactions. An organizational tie is statistically significant at the 99 percent confidence level across the models, indicating a significant influence on the decision to produce. On average, the producers who is a member of an organization (Org. Tie variable), is willing to accept 6.69 HTG less to produce each additional dozen, representing a 33 percent discount from the initial offer price. This finding lends support to the thesis of this chapter, in terms of influence of organization on producer's decision. In absence of such ties, as the results of chapter 5 showed, the influence of farm size, number of Francis tree owned, and region is less pronounced. Although the results of the simplified models remain robust after the expansion, an organizational tie seems to positively affect adoption.

The interaction terms add new dimensions to understanding the influence of organizational ties on WTA. For instance, by interacting organizational ties with farm size, the result shows a WTA of 1.17 HTG more than the initial price for the non-members. From a cross-region standpoint, members are likely to accept 0.51 HTG less to produce the next dozen, which translate into a higher propensity to produce for less. Conversely, in the absence of organizational tie, producers tend to demand a higher price to produce the next dozen. As Figure 6-3 depicts, for instance, at the 80 percent probability point, the WTA of an average member is at price A, whereas the non-member is at price B. The distance from point A to point C indicates the probability difference between the two groups. This suggests that social ties matters and may serve as a price oppressor, by virtue of having loyal members. The reserve scenario could be true, where organizations can bargain to achieve price stability or appreciation through collective action. However, such is not the case in the sample of this study, because of the nature of the commodity and the market conditions, reasons that I established in chapters 2, 3 and 5.
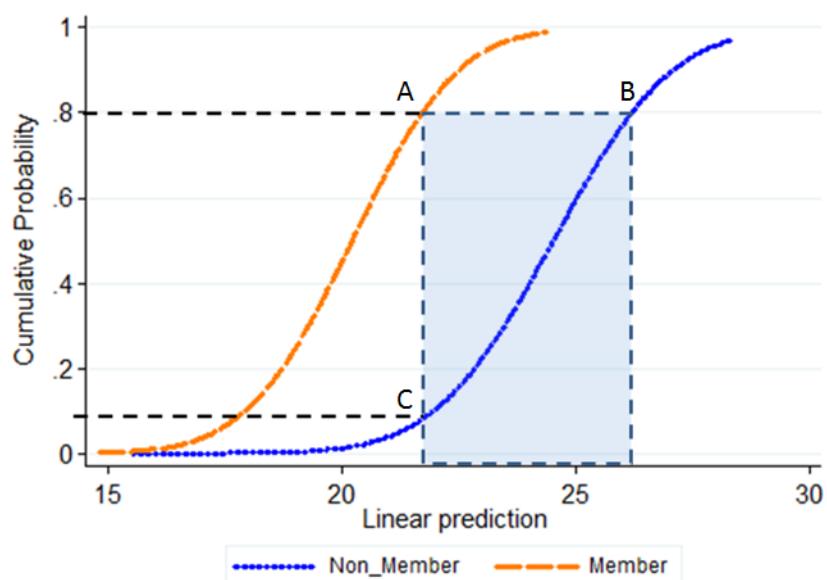

Figure 6-3: CDF Difference betwen Organization Members and Non-members

Off-farm income sources in the form of miscellaneous employment and remittances significantly influence producers' decisions. Not surprisingly, many small farms are unable to generate sufficient income to keep families afloat. As a result, household members try to generate some type of income outside of the farm in order to help support production decisions and general livelihood. Interestingly enough, off-farm employment and remittances each have opposite effects on producers' WTA. Whereas producers who earn some off-farm employment income bid the WTA price up by 1.32 HTG per dozen, those who receive remittances bid the price down by 1.14 HTG, within the 95 percent level of confidence.

Neither the producers' age nor the number of children was significant factors in the decision to increase production at various price levels. Understandably, mango production does not require intensive labor that age would inhibit and constant family labor could facilitate. Also, across all the models, the data does not support the importance of gender in deciding whether or not to increase production at a specific price. Even after including interaction terms in the models, the coefficient on gender remains insignificant.

However, the positive sign on the gender coefficient indicates that men request a slightly higher price (0.33 HTG) than women to produce an additional unit. This difference is mainly due to changing gender roles in the mango sector. In general terms, mangoes used to be mainly considered as livestock feed, and men paid very little attention to their market value. Very seldom would one see men selling mangoes on the streets. They left the mango-harvesting and selling tasks to women. This is no longer the case, particularly when it comes to the export variety. With the export market that provides cash on arrival, gender roles are shifting as more

men want to sell directly to the exporters. They start to take the forefront in the harvesting, negotiating and selling of mangoes. During the data gathering process, I talked with several women who are not particularly pleased with this latent displacement and being in charge mainly of the non-export varieties, which typically bring less of one-time cash value to the households. Yet, the local varieties require spending long days at the farmers' market or standing by a roadside fruit stand in order to sell. The WTA response differences between genders do not necessarily explain the role-shifting. It could be that men demand a higher price because they tend to sell to exporters rather than the local market.

Marginal Effects on Owned land and Trees

Table 6-8 presents the *ex ante* estimates on allocation of owned land for the production of mango trees. The first two models (Tobit and OLS) are for comparative purposes. The third model (Extended) is the extension of the OLS model to include a series of operations on the number of children variable, including log, square, and cube. The last two models present the estimates of the number of trees that the producers would decide to grow on land that they already own. The interpretation of the results focuses on the ML models, with occasional reference to the Tobit models. Another way to present the adoption results is in the form of a graphical representation of the probability distribution function (PDF) depicted in Figure 6-4.
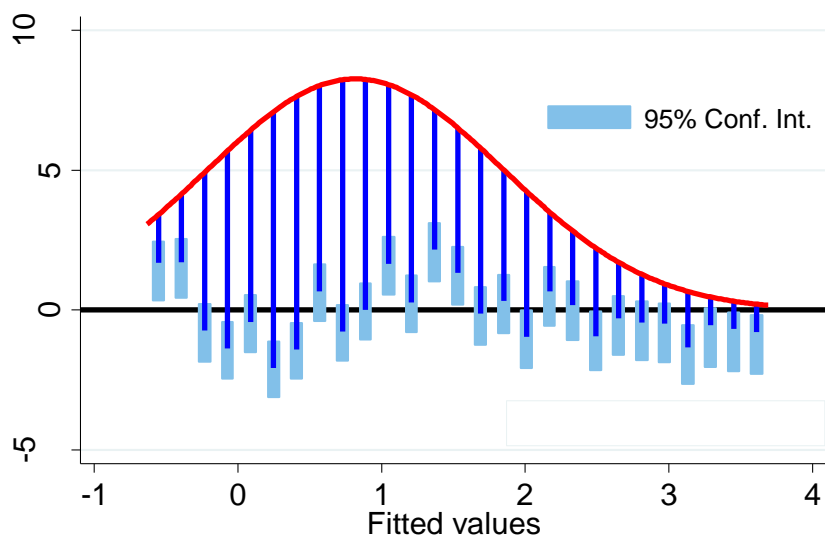
Figure 6-4: Predictive PDF Allocation of Owned Land

The overall result shows that the explanatory factors are well-fitted to explain producers'

allocation of land from some of their current holdings. One of the core factors influencing

adoption is the price per dozen that the producers would receive for their fruits. For a one-unit

increase in price, (P_i^*), producers are likely to allocate 0.04 hectares of their current landholding.

At the same time, they are willing to grow an additional 4 mango trees on the additional hectare.

Both estimates are significant within the 99 percent confidence level. These considerable effects

of price are not surprising, since price is inherently a supply-motivating factor, as I explained in

chapter 5. In relative terms, several other factors exert greater influence on land allocation and

number of trees, although this may be an indication of the actual amount rather than price *per se*.

A higher price may change this argument.

Table 6-8: Allocation of Owned Land & Number of Trees

Variables	Owned Land Allocation			Trees on Owned Land	
	Tobit	OLS	Extended	Tobit	OLS
Constant	-1.447***	-1.216***	-1.282***	-117.721***	-96.540***
	(0.2174)	(0.1989)	(0.2389)	(19.4112)	(17.4837)
Price	0.049***	0.042***	0.044***	4.274***	3.598***
	(0.0048)	(0.0043)	(0.0046)	(0.4346)	(0.3807)
Francis Trees Owned	-0.002*	-0.001	-0.001	-0.047	0.065
	(0.0010)	(0.0009)	(0.0010)	(0.1047)	(0.0968)
Org Tie	0.221	0.236	0.286*	27.448*	29.535**
	(0.1529)	(0.1516)	(0.1504)	(14.0542)	(13.9325)
Farm Size	0.315***	0.299***	0.309***	19.823***	18.554***
	(0.0269)	(0.0261)	(0.0267)	(2.6790)	(2.6693)
Org Tie X Farm Size	0.056*	0.063**	0.051*	0.671	1.195
	(0.0308)	(0.0297)	(0.0302)	(3.0561)	(3.0333)
Region	-0.083	-0.062	-0.058	-7.952	-5.741
	(0.0621)	(0.0598)	(0.0604)	(5.0046)	(4.7456)
Org Tie X Region	-0.050	-0.081	-0.081	-8.866	-11.977*
	(0.0761)	(0.0737)	(0.0739)	(6.6511)	(6.3837)
Job Income	-0.046	-0.030	-0.048	-6.338	-4.557
	(0.0555)	(0.0508)	(0.0519)	(5.0720)	(4.6000)
Remittance Income	0.167***	0.166***	0.168***	6.924	7.047*
	(0.0453)	(0.0423)	(0.0445)	(4.3055)	(4.0242)
Gender	0.010	-0.004	0.001	6.252**	4.845
	(0.0314)	(0.0295)	(0.0301)	(3.1025)	(2.9518)
Age	0.002	0.001	0.002	0.036	-0.012
	(0.0013)	(0.0012)	(0.0013)	(0.1229)	(0.1199)
Number Children	0.002	0.001	-0.091	1.115*	0.992
	(0.0070)	(0.0067)	(0.1656)	(0.6319)	(0.6152)
Children_log			0.125		
			(0.2464)		
Children_squared			0.009		
			(0.0147)		
Children_cubed			-0.000		
			(0.0005)		
Overall Model Fit					
Observations	687	687	629	682	682
R-squared		0.7838	0.7961		0.6196
F-test	108.5	116.0	93.56	44.09	46.65
P-value	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
*** Significant at 1%; ** Significant at 5%; * Significant at 10%

As a key determining factor in production, farm size has a considerable effect on land allocation, at the 99 percent confidence level, just as it did in the simplified model of chapter 5. The coefficient indicates that an additional hectare increases the owned land share by 0.31 hectares and the number of trees by 19. Providing that the number of trees is a function of farm size, the significantly large coefficients on farm size imply that landed-producers have a relatively low shadow price for growing more trees, compared to the land-constrained producers. As one would expect, constraint-reducing policies and local market absorption opportunities could lead to some level of activation of rural land markets (Foltz, 2004). Such prospective incentives, coupled with remittance investment, could promote land purchase and or leasing, which could result in possible economic growth.

A change in organizational tie from non-member to member results in producers' willingness to dedicate an additional 0.22 hectares and grow an additional 27 trees. But only the organization's coefficient for the tree model is significant. The positive sign of the interaction between organizational ties and farm size signals that organization members are more willing to allocate land as their farm size grows.

Remittances are one of the largest sources of private capital funding in Haiti. Interestingly enough, the remittances variable is significant within the 99 percent confidence level. For a one unit increase in remittance income – in reference to an affirmative answer – there is a 0.17 hectare increase in the predicted value of land share, corresponding to 7 more trees on owned land. Job income has the opposite effect on land and tree shares, without the significance level.

Marginal Effect on Total Land and Trees

The results in this section consist of: the addition of owned land plus purchased land (total land), and the predictive number of trees on the combined land (see Table 6-9). The models address the effects of price and producers' characteristics on the number of trees that producers would grow. As I noted in the model formulation section, the tree estimates are based on the number of trees per hectare, as opposed to the producers' stated number.

For a one-unit increase in price (P_i^*), there is a 0.12 hectares in total land allocation and an additional 6 mango trees. Both the land and tree coefficients are significant within the 99 percent confidence level. The number of trees grows by 25 percent when I include new land acquisition to already owned land, which could be the result of possible rural land market activation, under the assumption that the market offers more mango-related income to smallholders. As I stated earlier, these significant effects on price are expected, since price is considered a motivating factor for supply.

Table 6-9: Share of Total Land & Number of Tree Allocation

Variables	Total Land Allocation			Tree on Total Land	
	Tobit	OLS	Extended	Tobit	OLS
Constant	-0.959	-1.461**	-1.626**	-15.943	-72.316
	(0.7065)	(0.6326)	(0.7752)	(53.3595)	(46.9505)
Price	0.120***	0.133***	0.136***	6.383***	7.760***
	(0.0140)	(0.0125)	(0.0131)	(1.0711)	(0.9447)
Export Var. Owned	0.005	0.004	0.004	0.563*	0.538**
	(0.0033)	(0.0030)	(0.0031)	(0.2894)	(0.2718)
Org Tie	0.583***	0.537***	0.564***	34.694***	30.454***
	(0.0692)	(0.0631)	(0.0657)	(6.1343)	(5.4617)
Farm Size	0.194**	0.238***	0.206***	2.600	6.595
	(0.0761)	(0.0705)	(0.0730)	(6.9314)	(6.3311)
Org TieXFarm Size	-0.056	0.000	0.298	14.061	22.016
	(0.5107)	(0.4661)	(0.4793)	(41.7351)	(37.7481)
Region	-1.677***	-1.364***	-1.249***	-127.487***	-95.681***
	(0.2317)	(0.1935)	(0.2028)	(16.0562)	(12.6841)
Org Tie X Region	0.524**	0.274	0.150	30.074	4.450
	(0.2581)	(0.2276)	(0.2361)	(20.6641)	(18.1335)
Job Income	0.042	0.093	0.028	0.388	5.926
	(0.1451)	(0.1217)	(0.1284)	(12.4115)	(10.3717)
Remittance Income	0.057	0.083	0.132	-3.558	0.387
	(0.1184)	(0.1064)	(0.1141)	(10.7558)	(9.6324)
Gender	0.151	0.154*	0.158*	16.368*	16.513**
	(0.0996)	(0.0880)	(0.0924)	(8.4083)	(7.4274)
Age	0.003	0.002	0.002	0.150	0.062
	(0.0038)	(0.0034)	(0.0034)	(0.3148)	(0.2818)
Number Children	0.013	0.015	-0.271	1.900	1.909
	(0.0189)	(0.0168)	(0.4739)	(1.6042)	(1.4321)
Children_log			0.529		
			(0.7122)		
Children_squared			0.014		
			(0.0408)		
Children_cubed			0.000		
			(0.0013)		
Overall Model Fit					
Observations	749	749	685	749	749
R-squared		0.7206	0.7319		0.5421
F-test	152.2	160.9	129.4	44.17	47.25
P-value	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
*** Significant at 1%; ** Significant at 5%; * Significant at 10%

The coefficient on organizational ties is significant at the 99 percent confidence level for both the land and tree models. The results show a 0.58 ha increase and 35 additional mango trees on total land, when the organizational tie changes from non-member to member. This also supports the hypothesis that I set forth earlier, in terms of the positive influence of organizations on producer's decision to produce. Farm size is significant for the total land estimate but not for the number of trees. A one-unit increase in farm size is associated with a 0.19 ha increase in the predicted value of total land and 3 additional mango trees. When I consider the interaction of organizational ties and farm size, there is a decrease in hectares to a negative value, suggesting that organizational membership does not necessarily influence the acquisition of land, even though it does influence allocation of owned land.

Relocating from North to South negatively affects total land allocation and number of trees that producers are willing to grow. The coefficient on region is significant at the 99 percent confidence level. But when I consider the interaction between organizational ties and region, there is a gain in total land allocation by 0.52 ha and a gain in number of trees by 30. This implies that the South has strong ties to organizations that propel them to overcome their farm size deficiency. Post-estimation tests reveal that there is a remarkable difference between being a non-member and a member of an organization.

Remarkably though, remittance recipients are more willing to plant fruit trees on land that they own rather than investing in acquiring new land. The number of trees on owned land increases by 7 for remittance recipients. However, when it comes to purchasing land to grow tree crops, the remittance variable becomes insignificant and its sign changes to negative, suggesting a lack

of interest in investing in the tree fruits sector or in the agricultural sector altogether. This could be because immigrants generally invest in education and other business sectors rather than agriculture.

Discussions

Measuring the economic impact of the various ways that network ties may change producers' lives is a monumental task because many of the variables have no price and are unobservable. This is an old issue in economics. GDP measures monetary transactions for all the finished goods and services produced within a country's borders in a specific time period, but not welfare. In the context of this study, however, it is more practical to quantify the degree to which avid versus halfhearted organizational membership impacts the willingness to produce, which is what I presented in this chapter.

Overall, these results suggest that higher prices coupled with strong social ties have meaningful effects on producers' willingness to produce additional mango trees and to allocate land for that purpose. To a significant degree, social ties matter and have a greater impact on producers' decision than price. Many farmers use their networks to override certain market failures, by disseminating information, negotiating price, and sharing transaction costs, in order to acquire some economic values. To a great extent, organizations that provide value-added services tend to influence producers' choice about whether or not to produce. By the same token, organizational ties can be too strong or too weak to be productive and may hinder price appreciation by virtue of organizations having loyal members who are willing to produce at the

organizations' suggested price. The balance between the two extremes could lead to the necessary optimization, rather than maximization, of one's networks.

Although organizations significantly help to enhance production, they may lack the mechanisms to influence price increases and to bring about growth, in a market of limited buyers and virtually unlimited sellers. Without competing buyers from various sectors, such as local beverage manufacturers and exporters, income appreciation may be unstable. Even in the midst of high demand, price may remain stagnant due to this lack of competing buyers. Investment in tangible manufacturing capacities for fruit transformation could help prolong the life of the fragile fruits, creating employment and achieving long-term production gain.

Because of Haiti's land scarcity or the relatively high volume of unused land due to lack of irrigation, securing land for mango production is not a simple affair. However, in the right policy environment that includes incentives to produce, the rational choice of many producers would be to increase the production of their tree crops in order to increase their income. By repurposing land they already own, these farmers show their interest in taking advantage of profits seemingly available in the mango industry. Within the current market demand for Haitian mangoes, some producers opt to reduce staple crops to grow the export variety. Others choose to replace the non-export varieties entirely, through grafting method. Whether or not the producers make an economically advantageous choice to grow additional fruit trees is not the aim of this study. Although the consensus tends to point to a win-win-win proposition for simultaneously providing additional income to producers, benefiting intermediary agents, while improving soil degradation and the environment. However, further studies that include cost-benefit analysis

could determine whether or not small producers end up winning or losing in deciding to produce the export tree fruit crop.

This study does not account for neither the impact of grafting on production nor the possible extinction of many varieties of mango trees in Haiti. It would be worthwhile to determine whether the practice of grafting exposes producers to additional risks, including unsuccessful grafting, the loss of mature trees, and possible extinction of some species. This topic could be the subject of further research.

Chapter 7 – Conclusion

This study emphasizes theoretical and applied analyses pertaining to production decisions at the farm level. The additive contribution of this dissertation comprises the integration of qualitative and quantitative data on the impact of price variability and producer's characteristics on willingness to produce in a developing market context. Further, the dissertation combines of postharvest subsidy offerings, with organizational ties to determine whether or not producers are willing to allocate land to grow fruit trees and the quantity of that allocation. The net result is that a reduction in market price variability, through policy-induced price changes, coupled with social ties, results in an increase in willingness to produce and to allocate land.

Haiti has great potential to increase the value and volume of its mango production and to expand its' portfolio of economic opportunities. This dissertation presents the results of a policy to subsidize producers' postharvest expenses in order to promote additional production. This incentive is paired with organizational ties and household characteristics to determine producers' propensity to allocate land for growing fruit trees. The main goal is to minimize producers' risk through the price that producers receive. With respect to the price factor, two main groups bear the risk of mango price variability in the Haitian mango trade: growers and exporters. These two groups drive production, marketing, sales, and distribution. The study presented the subsidies to small producers because they tend to be more vulnerable to negative price change and their investments in mango trees are irreversible. Comparatively, exporters have the latitude to decide how fast to transfer world prices to producers.

Haiti stands out as the quintessential small farm country of the Latin America and Caribbean region, mainly due to its historical land reforms and inherited parcels that keeps splitting from one generation to the next. Farms sizes starting from less than 1.0 hectare are participating in growing the export variety, which is approximately 15 percent of total production of the country. The econometric investigation suggests that there is significant interest in growing more trees. The analysis focuses on key enabling factors, rather than the constraints that are already well documented for developing countries. The distinction between enabler and constraint is critical to place this study in the optimistic context of activating available resources to project growth in the sector.

The investigation asks four primary questions that are at the center of livelihoods: (1) What are the effects of a perceived price change and characteristics on mango producers' willingness to produce additional mango trees? (2) To what extend do price and household characteristics influence the predictive land share and the number of trees that the producer would produce? (3) To what extent do organizations exert influence on producer's willingness to produce? (4) Can organizational tie be too strong to the point of being a hindrance to price appreciation? I recognize that I consider a narrow aspect of a broad topic, and this dissertation does not aspire to provide a comprehensive sketch of Haiti's mango industry and of the interrated effects of subsidies. However, the contents and omissions of this dissertation could serve as a starting point for further social and economic studies.

Before answering the main questions, the dissertation presents the contextual framework of the topic, both from domestic and global market aspects. In Haiti, multiple events of recent decades

have applied downward pressure on per capita income of small-scale producers, increased use of marginal land, and diminished infrastructure and social welfare. Continued reliance on foreign assistance and inability to attract foreign investment has delayed economic progress. In recent years, however, efforts to improve infrastructure and available services appear to have changed the path of the country toward a direction that may lead to economic growth. For instance, Haiti's lucrative telecom market attracts foreign direct investment to spread the benefits of the latest technologies to remote corners of the country. The country's relatively abundant low-priced labor and seemingly favorable trade policies draw interest in the manufacturing sector. The provision of social services is an encouraging signs that may add value to the total sum of physical and human capital stocks. In addition, the persistent interest in mango production and exports, in the context of economic growth, makes this study relevant.

The overall comparative results from the ML and censored Tobit estimates show that price is a significant explanatory factor that leads to an increase in willingness to produce and to allocate land. It is worth emphasizing that the differences in regional land assets and the degree of social ties echo the choices that producers make about whether or not to allocate land to grow more trees. Mango tree ownership strongly correlates with land ownership. Current adopters of the Madame Francis variety are willing to increase their production at a significant margin. This result seems fitting due to the sunk cost effect of tree crops that requires relatively long gestation period and where producers are less likely to abandon their prior investment. The coefficients on farm size, organizational ties, and off-farm income are all statistically significant explanatory variables that influence the producer's willingness to produce the export crop. On average, each additional hectare of land increases the producers' desire to produce more mango trees. It is not

surprising that landed producers have a relatively low shadow price and that the larger the farm the more the producer is willing to produce and to accept a lesser price.

Although farm size, off-farm income and the prospect for higher income through price remain key determining factors of adoption (as I described in Chapter 5), organizational ties exert significant influence on the decision to produce. In general, organization members are more willing to produce than non-members (Chapter 6). Organizations provide access to resources and services that producers would otherwise lack. The producer's region matters a great deal. The differences and similarities between North and South present meaningful dimensions to this study and lend support to a more representative result. For instance, while the North has relatively larger farms and a long history of producing high volume of mangoes. However, the South has stronger social network ties. The organizational ties, the location and farm size present more specific results when I included the interaction terms.

The interaction of organizational ties with region indicates that southern producers who are members of an organization are more willing to accept a lower price for producing additional mango trees. The interaction between organizational ties and farm size shows that the large landholders who are also members of an organization make the optimal scenario of production increase at a relatively low price. In absence of any organizational tie, producers have the propensity to request a higher price to produce additional units. The interaction terms between these key variables provide additional evidence that organizations may oppress price, simply by virtue of having loyal core members. This result supports the argument that organizations that

serve as intermediary agents may not be the best vehicle for price appreciation, in spite of the value-added services that they provide to producers.

The results indicate that off-farm income sources in the form of miscellaneous employment and remittances significantly influence producers' decisions to produce. In general terms, small farms are unable to generate sufficient income to support household expenditures. In cases where there are many mouths to feed and not enough land to produce staples, it is very common for household members to generate some types of off-farm income.

An interestingly finding is that off-farm employment and remittances each have opposite effects on producers' willingness to produce. Whereas producers who earn some off-farm employment income tend to request a higher price, those who receive remittances request a lower price. A plausible explanation for the different responses is that remittance income tends to be more substantial than employment income, in the Haitian context. The off-farm employment could be temporary or unreliable enough to forgo possible gain from the export crop.

In reference to the second key question, the analysis of prospective data reveals a unit increase in price per dozen applies upward pressure on willingness to produce additional trees, to allocate owned land and to accumulate new parcels of land. The price effect is expected because price is inherently a supply-motivator. At the same time, price variability and transmission often play against the small-scale producers of primary product exports. Negative price changes transmit much faster than positive ones, mainly due to information asymmetry, unfavorable influence of agents and very high export fees. In absence of a diversified and high market demand, the

irreversible-like investment and long-term commitment place producers at a bargaining
disadvantage. Therefore, a subsidy that could lower the market imperfections – as it is often the
case for producers of developed countries – would support the increase of small-scale producers'
income. The popular characterization of mango production as a win-win-win proposition could
come closer to reality through efforts linking this potential three-fold outcome to effective
policies.

The effect of price is more meaningful when the analysis controls for farm and household
characteristics. The coefficient on farm size has a positive influence on predictive share of land,
both owned and purchased. However, farm size is not significant when it comes to the predictive
number of trees, suggesting that land allocation may not necessarily translate into the equivalent
number of trees. Surprisingly, remittance recipients are more enthusiastic about dedicating
owned land for growing mango trees rather than investing in new land acquisition. A plausible
explanation is that immigrants are more likely to invest in sectors other than agriculture. Such a
reliable and increasing source of private capital is not flowing to the tree fruits sector for new
land acquisition. Once again, generating income through increased production calls for some
effective interventions, which could be credit access, expense subsidies, and building local
markets through investment.

With respect to the third question, social ties play a major role in the producers' decision-making
process to allocate owned land for growing mango trees. However, the interactions of
organizational ties and farm size indicate that organization members are unlikely to purchase
new land to plant trees, which is consistent with remittance recipients' approach to new land

acquisition. Although the North has more land, the south displays stronger ties to organizations. Producers join networks to negotiate markets, override endemic market imperfections and acquire assets. The widespread ownership of mango trees among producers represents an opportunity to spread income, but the low level of output of individual producers makes yield-consolidation relatively costly. Consequently, producers join forces to achieve some economies of scale and to share transaction costs. In addition, organizations' influence markets because they contribute to render producers better suited to defuse the tension between risks and possible gains from trade.

With respect to the fourth question, I conclude that organizational ties can be too strong and too numerous to be effective and may hinder price appreciation. This is partly because organizations that play the role of intermediary buying-agent may be complacent in passing extra income to producers. Balancing the two extremes is a challenge that could lead to the crucial optimization, rather than maximization of ties. Although the findings indicate that organizations have the ability to positively enhance production and land allocation, they may lack the mechanisms to influence price increases. Because the market has many sellers and very few buyers, both organizations and individuals have limited bargaining power. The lack of competing buyers may be a signal that the real volume of production may not be high enough or the profit margin may be insufficient to attract investors in the space. Another reason might be because, traditionally, very few individuals have access to capital to lower the high barrier to entry into the exports or agro-processing market. I suspect the latter case is more likely, since the participation of Latin America and the Caribbean region in agro-export tends to be exclusionary rather than widespread.

Historically a privileged minority tends to reap the bulk of the benefits from agro-export. Haiti's market conditions contribute to the loss of small producers' profits. Case in point, some observers believe that the relatively high costs of key market enablers such as transportation, packaging, export fees, shipping, storage, and distribution substantially reduce the price that producers receive for their mangoes. Postharvest shipping and handling within Haiti are more costly than ocean freight; because, during domestic transportation, more than 50 percent of the yield is damaged and lost. Constraint-reducing policies could support small-scale producers in generating economic values.

Policy Implications

Focus on the Value Chain

Fresh mango is one of Haiti's main export crops and there is a great deal of demand domestically as well. Yet, the mango-related initiatives are broad and diffused. Lack of a concerted plan for the sector leads many groups and sub-groups to try to implement multiple programs without allocating sufficient resources that could bear lasting results. I propose a value chain approach that would consider all economic activities related to the crop, from production inputs to credit to point-of-sale. A key feature of the value chain is to focus on building local processing capacities to cater to the high demand for fruit juice and other mango-derivative products.

The benefits of such investments would be widespread and would generate spillover across many types of fruit processing. A close partnership between the government and private sector would be vital to reach growth in the tree fruits industry that consistent waste has plagued year-to-year.

Most significantly, this approach would minimize waste, generate employment and create economic opportunities along the chain.

Subsidizing Price

One of the mandates of governments is the ability to harness resources to implement programs that could contribute to the country's overall standing. The use of sound subsidies can be an effective tool to promote production and to break away from economic growth stagnation. The premise of the survey was to determine how a prospective policy to subsidize mango producers' postharvest expenses could influence production decisions. I propose a sector-specific program to subsidize producer's postharvest expenses to raise rural incomes, create business opportunities and boost GDP growth.

Although subsidies are very common in developed countries, the developing world typically has very limited national programs to support their basic economic sectors. Leaders of developing countries often cite lack of available funds hampers the enactment of sector-specific policies because these programs are generally expensive to implement. At the same time, many public officials of these countries drive around in expensive SUVs and enjoy daily per diems larger than most producers yearly incomes. Furthermore, subsidies are not new to Haiti. The government runs a fuel subsidy program to help absorb the impacts of high food and fuel prices on the economy at large. However, the high cost of similar subsidies tend to disproportionately benefit vehicle owners and the wealthy (Coady *et al.*, 2006). Therefore, the issue may not be one of funding, per se. Rather, it amounts to effective prioritization and management of available resources.

Efficient reallocation of a few cents per gallon via fuel subsidies and tree fruits production can bring about broad economic and environmental benefits. The policy can help producers overcome their weak bargaining position in requesting a fair price. By the same token, demanding a higher price may not be sufficient to achieve lasting impacts and may not withstand market pressure when global demand decreases. A mix of local demand and export markets may be one of the effective remedies to price and income appreciation.

Diversification

Many producers attest to the benefits of having access to external markets. In particular, the U.S. market has been, almost singlehandedly, the backbone of Haiti's mango export. Apart from favorable trade relations between Haiti and the U.S. that facilitate exchanges, there is enthusiasm on both sides to increase mango exports. For example, during the "National Mango Forum" held on April of 2010 in Port-au-Prince, Haiti, sponsored by the USAID, participating producers, local and international organizations "agreed to support the common goal of increase export by 100 percent, from 2.52 to 5 million cases of USDA-certified mangoes by 2015 (USAID, 2010a, p. 6). In order to increase production, they proposed a single variety specialization model that include planting new trees, reducing postharvest waste, and most importantly, a "massive pruning and grafting program of 200,000 existing mango trees per year from 2011-2015" (p. 21). Agricultural subsidies, similar to the one that I proposed in this study, tend to promote specialization by encouraging producers to grow the subsidized crop (Chibwana et al., 2012). Under the right policy environment, selecting a series of high-value crops for specialization

could bear high dividend for the Haitian economy. Exporting these crops could narrow the trade deficit and reduce the balance of payment. However, there are reasons for concerns.

The mango export market hangs on a thin thread that a single fruit fly can chew and break. From Haiti to India, from Brazil to Côte d'Ivoire, fruit flies are destructive pests that have caused trade embargo on an entire industry. If shipping inspectors detect fruit flies, they can prevent a mango-producing country from exporting non-mango produce and call for the closure of major ports and borders. The efforts to prevent, detect and destroy these flies within the Haitian borders have been productive in averting damage to the agricultural system of the importing-countries and, thereby, avoiding exporting embargo. In addition, the lack of refrigeration, inadequate infrastructure, the absence of industrial absorption mechanism, and market failures amplify the risks of crippling mango exports. Therefore, the heavy dependence on export exposes mango producers to risks that are often difficult to mitigate.

In small farm systems, crops diversification is one of the key strategies that farmers use to mitigate risks, although such strategies often create non-separability effects (Omamo, 1998). Similarly, Haitian farmers intercrop cash-crops (for example mango trees) and staple food (for example, rice and beans) to attain some level of diversification that could alleviate market shocks. In the mango sector, producers grow a range of species of mangoes – more than 150 – to manage domestic market expectations, where consumers tend to sample more than one type of mango. The push for grafting of the export variety over the other species is changing the diversified-production pattern toward a single spicy specialization. On one hand, such an approach carries undue ecological threats to an already fragile environment and brings additional

market risks that can be avoided through valuing some of the non-export varieties. On the other hand, in terms of species diversification, total risk-aversion may hinder the opportunity to increase producer's income through exports participation.

Investment in Downstream Industries

Under the broader umbrella of economic growth in Haiti, mango production and exports have their place because a great number of farmers benefit from selling their fruits to the export market. Growing mangoes is considerably less labor intensive than many other fruits and vegetables, such as strawberries, tomatoes, or asparagus. Therefore, achieving some level of employment growth in the sector requires investments in the subsequent related-industries. For instance, infusion of capital investment in the fruit-processing sector could provide the possibilities for using the non-export varieties, reducing spoilage, and opening the domestic market. In addition to exporting fresh mangoes, these capacities could produce frozen pulps, purees and dried mangoes for the exports.

A public and private partnership could promote investment in the sector by providing credit access to finance group projects, which would contribute to strengthening the market. Credit access is one of the major growth-enablers that have implications in all sectors of the economy. Leaders could activate the credit market and direct investments to the agro-processing sector to absorb the non-export varieties and other fruits. Apart from private investors, producers could take collective action through their organizations to request financing to build processing facilities to cater to the domestic and export markets.

Parallel human resource development is a key process that could lead to broad-based growth. Haiti's abundant human resources can play a significant role in boosting economic growth, by promoting labor-intensive light industries as its principal export growth engine. As more developed countries seek to attract labor-intensive industries to keep their unemployment low, Haiti has more pressing reasons to pursue these opportunities and educate its workforce to be able to compete. In most countries, government plays a major role in creating mechanisms to enhance human capital. From education policies to public-private investment to corporate technical training, government helps foster conducive environment for developing human capital, which in turn contribute to economic growth and development (Polynice, 2012). Therefore, it is imperative for Haiti to abandon fruitless policies and develop pragmatic instruments to become an emerging economy.

Women in Focus

Considering that 73 percent of the women from the sample report some types of non-farm, small business income compared to 46% of men, women are the engines of the Haitian economy. Even though their business activities tend to be small, they are consistent sources of income that support households when the sporadic and seasonal farm income is unavailable. As a policy issue, policymakers and organizations should implement mechanisms to promote the role of women in the mango value chain. Particularly, many of the women that I interviewed expressed interests in processing all types of mangoes to minimize postharvest waste, create employment and generate income.

Future Studies

In a noncompetitive market, solely increasing production cannot ensure the complementary services and necessary investments upon which widespread benefits are mutually dependent. The results of this study show that producers are holding their end of the bargain by organizing themselves in units of production and in formal organizations to achieve some degree of economies of scale, obtain certain services, reduce transaction costs, and acquire some economic values. Strong willingness to produce, in rather precarious market conditions, indicates that varying the price of mango by a few cents per dozen, through a subsidy program, can make a remarkable difference in land allocation and in mango tree production.

It remains unclear if the government and the private sector are willing and able to hold their end of the bargain by enacting forward-looking policies and investing in the sector. The Haitian government could take tangible action to assure private investors that the interdependence of a public and private partnership would lead to broad-based results. For instance, the government could promote a series of sector-specific plans, provide tax incentives, redirect capital toward long-term loans for orchards development, facilitate the advancement of crop insurance, and subsidize producers to minimize market imperfections and risks. Whether it be in the manufacturing sector of South Korea, where public finance contributed to propel the economy forward (Chu, 2010) or in the agricultural sector of Malawi, where Shively (1998) found positive correlations between participation in agricultural input subsidy program and the amount of land allocation, the evidence of a public and private partnership points to positive results that could serve the Haitian tree fruits sector.

Although this study shows that a prospective policy to subsidize price or postharvest expenses could positively influence farmer's decision, further research is necessary to determine actual economic viability and social benefits of such a program. For instance, the analysis does not account for the potential effects of such a tree fruits-specific program on the production of staple food. I expect complementarities among various crops and spillover effects outside the agricultural sector. However, future studies would be the suitable course to determine these assumptions.

The attempts to generate additional income by increasing production of the export-variety of mangoes will most likely not compensate for the negative effects from many years of clear-cutting deforestation for lumber export, charcoal production, and agricultural production. However, these efforts could produce enough income to generate enthusiasm in growing more mango trees, which is more beneficial than the alternative. Whether these efforts would amount to a zero-sum game or a net benefit for producers is a question that requires further studies. In any event, the purposeful inclusion of women remains a critical success factor. As such, the gender dynamics and role-shifting are significant issues that warrant further investigation. In addition, the increasing push for grafting is a phenomenon that merits further study to determine its effects on producers' livelihood and on the ecological system.

Although planting a few trees here and there could produce positive externalities, tree planting alone may not suffice to generate environmental repair. Other initiatives are necessary to meet the needs of an increasing population on a finite piece of land. For instance, the production of alternative energy – solar, wind, and hydro power – coupled with electrical stove production

could dramatically reduce, if not eliminate, the need for charcoal in a relatively short period.

These efforts may require taking a few steps away from the robotic and linear thinking of

development strategies for Haiti, in order to mimic what will actually work for communities,

using local resources to extract critical economic growth.

Appendices

Appendix A: Context of Production

According to the 2009 from the MARNDR (2012c), the following is a summary of Haiti's agricultural sector. The census covered 1,018,951 farms, totalling 736,241.50 carreaux (cx). Cultivable Agricultural Area average per farm: 0.72 cx, with an average of 0.58 cx for women and 0.77 for men.

26.1% of the farms have a cultivable area of 1 cx and farmers farm 46% of the total cultivable land.
73.9% of farms have less than 1 cx cultivable and operate 53.3% of total cultivable land.

Farm size & land distribution
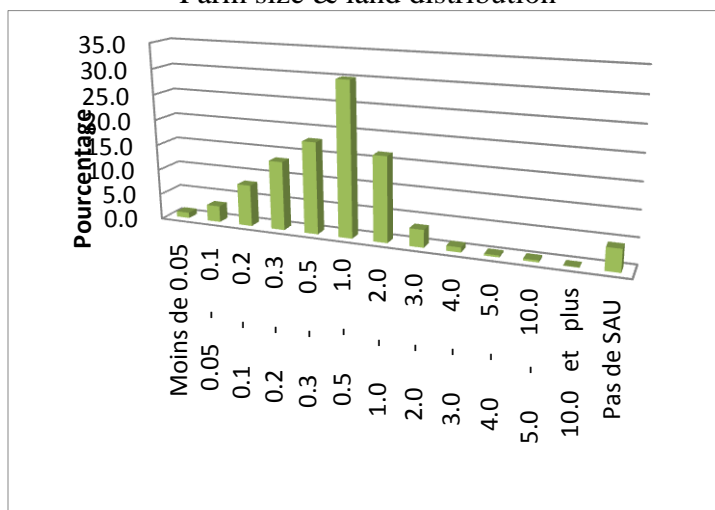
Farm Ownership by Gender
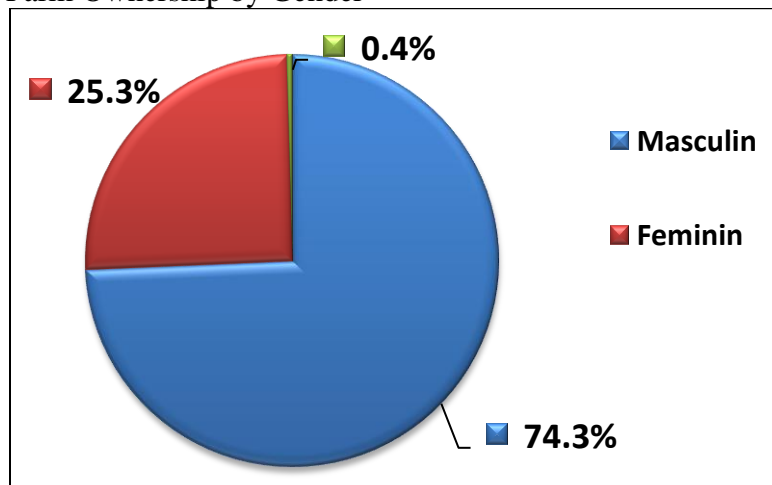
Land Tenure in the Farming Sector:

Legal status of the plots (80% in private ownership)

Title / Purchase: 962,459 parcels or 52.8% of the total

Title / Inheritance: 482,996 plots, represent 26.5% of the total

Sharing: 221,472 parcels or 12.1% of the total

Collective: 56,370 plots, corresponding to 3.1% of the total

State land: 2.1% of the plots
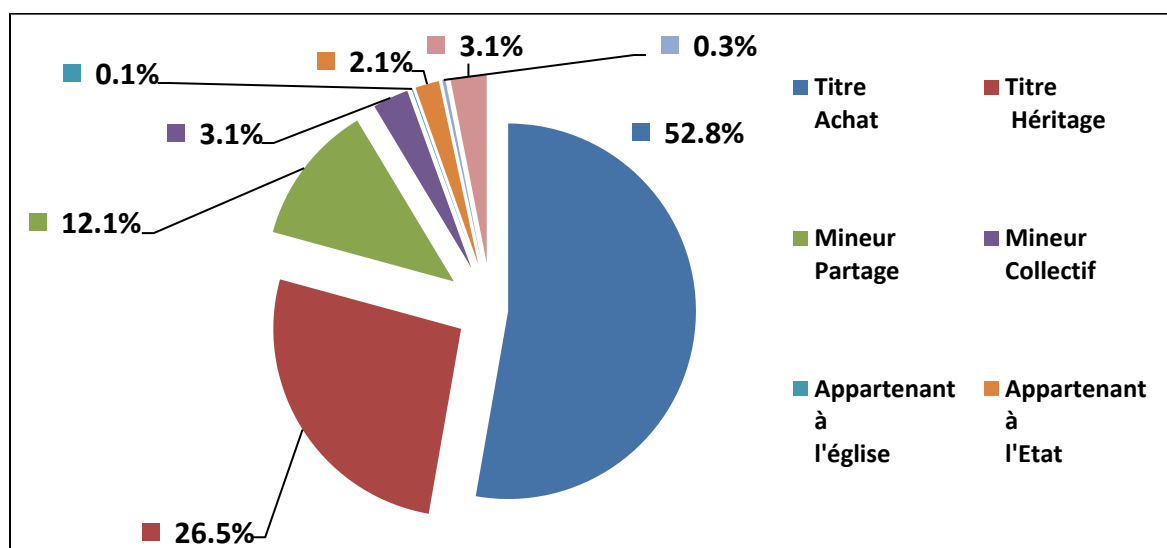
Source: Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural
MARNDR (2012c).

Appendix B: Methodology and Data Collection

Producer's Survey

Date:			Code:	
Please take a moment to complete this form. The information will help us in our research that may result in better interventions and policy changes to improve livelihood in the community. **Your participation is completely voluntary.**				

Section A: Personal Information

First Name		Address	
Last Name		County	
Surname		Section	
Date of Birth		Village	
Sexe	☐ Male ☐ Female	Telephone	
Are you a member of an organization?	☐ No	☐ Yes. What's the name?	
If yes, is it an agricultural organization?	☐ Yes	☐ No	

Section B: Family Description

1) How many people in your family?			
2) How many people living in your house?			
3) Do you own or rent?	☐ Rent	☐ Own	☐ Family/Friend
4) How many children do you have?			
5) Do you farm?	☐ Yes	☐ No	
6) How many people help you in the farm, including your children and others?	____Children	_____ Other people	
7) Do you pay those who are not your children?	☐ Yes	☐ No, because I help them in return	
8) Do you have family in foreign country?	☐ Yes	☐ No	
9) If yes, do you receive monetary support from them?	☐ Yes	☐ No	

Section C: Farm and Non-Farm Activities and Income

1) What types of fruits do you produce?	2) Which fruits are more profitable?	3) What other food crops do you grow?
☐ Mangoes ☐ Avocados ☐ Pineapple ☐ Cashew ☐ Orange, Lime, Grapefruit ☐ Other _____	☐ Mangoes ☐ Avocados ☐ Pineapple ☐ Cashew ☐ Orange, Lime, Grapefruit ☐ Other _____	☐ Banana ☐ Maize, Sorghum ☐ Sorghum ☐ Beans, Vegetables & others ☐ Others_____
4) Which food crops that is more profitable?	5) What are your primary sources of income?	6) Which one do you give priority for next year?
☐ Banana ☐ Maize ☐ Sorghum ☐ Beans, Vegetables and others ☐ Others_____	☐ Farming (fruits and food crops) ☐ Job (work for other people) ☐ Small Business ☐ Remittance ☐ Others_____	☐ Farming (fruits and food crops) ☐ Job (work for other people) ☐ Small Business ☐ Remittance ☐ Others_____

Section D: Konbit Work

1) Do you participate in Konbit?	☐ Yes	☐ No (Go to question #5)
2) If yes, for what activities do you use Konbit?	a)	b)
3) How many people are in your Konbit team?	a)	b)
4) Do you use Konbit for harvesting mangoes or other fruits?	☐ Yes	☐ No
5) If you are not in a Konbit, why not? ☐ I don't have land	☐ Other reasons _____	
6) Can a Konbit team help in harvesting mangoes? ☐ Yes	☐ No	

Section E: Land Holding, Mango Production, and Other Fruits

1) How many mango trees do you own?			2) How long have you been cultivating mangos?	☐ Yes ☐ No			
3) How many you planted in the past two year?			4) How many mango trees will you plant in the next two years?				
5) How many mango trees do you want to have in total?			6) How much land is under the exclusive mango production?				
7) Is mango production more profitable than other food crops?	☐ Yes ☐ No		8) Do you have enough land to plant more mangoes?		☐ Yes ☐ No		
9) How many parcels of land do you have?			10) How many Carreaux in the mountain?				
11) How many Carreaux in the plain?			12) Do you rent land from people?		☐ Yes ☐ No		
13) Do you rent land to people?			14) How many dozen mangoes you sold last year?				
15) What are the harvest months?							
16) What other fruits do you produce?	a)		b)		c)		d)
17) How many trees of these do you have?	a)		b)		c)		d)
18) How many of them do you sell?	a)____ (dozen)		b) ____(dozen)		c)____(dozen)		d)___ (dozen)
19) How much is the dozen?	a)_____ (HTG)		b) ____(HTG)		c) ____(HTG)		d)___ (HTG)
20) Besides exports, what else would you like to do with mangoes?		☐ Juice		☐ Jam		☐ Other………….	
21) What's the advantage of local processing of mangoes?		☐ No waste		☐ Would plant more		☐ No advantage	
22) Exporting or processing, which one is more advantageous?		☐ Exports		☐ Processing		☐ Both are good	

23) To whom do you sell your mangoes?
- ☐ Local market
- ☐ Exporters
- ☐ Organization
- ☐ Middleman of exporters
- ☐ We eat them

24) What's the biggest hurdle of mango production?
- ☐ Not enough laborer to help
- ☐ No credit access
- ☐ Not enough land
- ☐ No problem at all
- ☐ Others _____

Section F: Price and Production of Mango

To ensure widespread benefits of mango production in Haiti, a new policy aims at subsidizing producers' harvest and postharvest transaction costs for supplying mangoes, given a specific **gross profit** (excluding production costs) to producers.

1) If your gross profit was **20 Gourdes** a dozen, would you produce more mango trees? (Check one)

Yes ☐   No ☐

If yes, answer these questions & complete the statements:
a) How many mango trees would you plant? ____
b) In land you already owned, how many hectares would you use to plant mangoes? ____
c) I would buy or rent ____ (ha) to plant more mangoes.
d) Would you reduce your other crops to plant more mangoes? (check one) ☐ Yes ☐ No

2) What if your gross profit decreased to **12 Gourdes** per dozen, would you produce more mango trees?

a) How many mango trees would you plant? ____
b) In land you already owned, how many hectares would you use to plant mangoes? ____
c) I would buy or rent ____ (ha) to plant more mangoes.
d) Would you reduce your other crops to plant more mangoes? (check one) ☐ Yes ☐ No

3) What if your gross profit increased to **28 Gourdes** a dozen, would you produce more mango trees? (Check one)

Yes ☐   No ☐ → Go to question #4

If yes, answer these questions & complete the statements:
a) How many mango trees would you plant? ____
b) In land you already owned, how many hectares would you use to plant mangoes? ____
c) I would buy or rent ____ (ha) to plant more mangoes.
d) Would you reduce your other crops to plant more mangoes? (check one) ☐ Yes ☐ No

4) Provide additional comments? ....
....

Table B-1: Interview sample

Interview Participants Sampling			
Farm size - selection criteria	% of Survey Respondents	Number of Respondent Interviewed	
	Total	South	Artibonite
Small (≤ 1 ha)	31%	6	4
Medium (>1 ha) & (<4 ha)	40%	7	5
Large (> 4 ha)	29%	3	5

Table B-2: Summary of the offers and responses

Willingness to Produce Mango Trees (N = 780)					
20-HTG	28-HTG	12-HTG	Probability	Price Range	% Respondent
Yes		Yes	$P_i^I > P_i^L \geq P_i^*$	From 12 to - ∞	4%
Yes		No	$P_i^I \geq P_i^* > P_i^L$	Between > 12 & 20	31%
No	Yes		$P_i^I < P_i^* \leq P_i^H$	Between >20 & 28	53%
No	No		$P_i^I < P_i^H < P_i^*$	From > 28 to +∞	12%

Appendix C: Two-Stage Estimates

A consistent estimation of an equation requires that the explanators to be exogenous. This is a

two-stage estimate, using Org Tie as the dependent variable in the first stage and then as an

explanatory variable in the second stage.

Org. Tie, Tree and Land

VARIABLES	(1) Est. Org Tie	(2) Est. Land	(3) Est. Trees
OrgTie		-0.280***	-14.816***
		(0.0360)	(3.2902)
price		0.043***	3.638***
		(0.0045)	(0.3955)
Region	-0.223***	-0.103**	-13.535***
	(0.0377)	(0.0423)	(3.9927)
FarmSize	-0.029***	0.340***	19.228***
	(0.0093)	(0.0129)	(1.3709)
Age	-0.003**	0.002	-0.003
	(0.0014)	(0.0013)	(0.1203)
franTreeOwn	0.002*	-0.001	0.066
	(0.0009)	(0.0010)	(0.0974)
Gender	0.010	-0.003	4.821
	(0.0364)	(0.0300)	(2.9592)
NumberChildren	0.007	0.001	0.985
	(0.0066)	(0.0068)	(0.6149)
Job_Income	0.030	-0.037	-4.893
	(0.0532)	(0.0516)	(4.5882)
Remittance_Income	0.030	0.153***	6.525
	(0.0391)	(0.0433)	(3.9946)
Constant	1.818***	-0.739***	-58.310***
	(0.1127)	(0.1880)	(16.4833)
Observations	780	687	682
R-squared	0.0605	0.7775	0.6167
F-test	.	.	.
P-value	1.73e-09	0	0

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

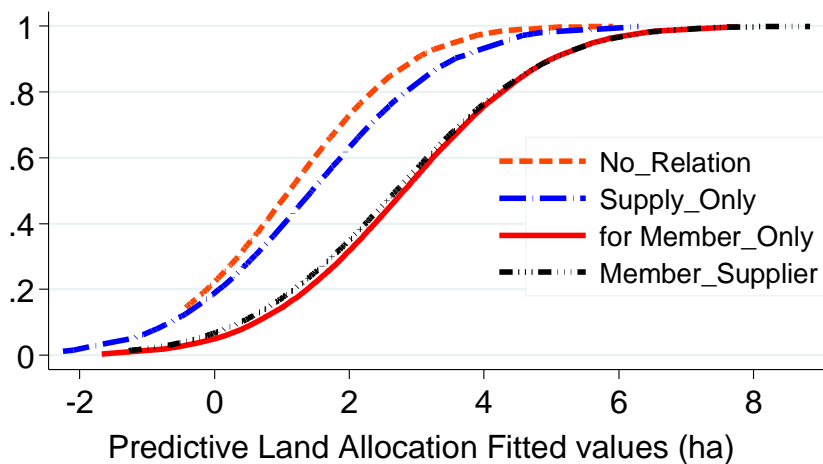Appendix D: Influential Effects of Organizational Ties

Figure D-1: CDF of Owned Land & New Acquisition by Organizational Tie Categories
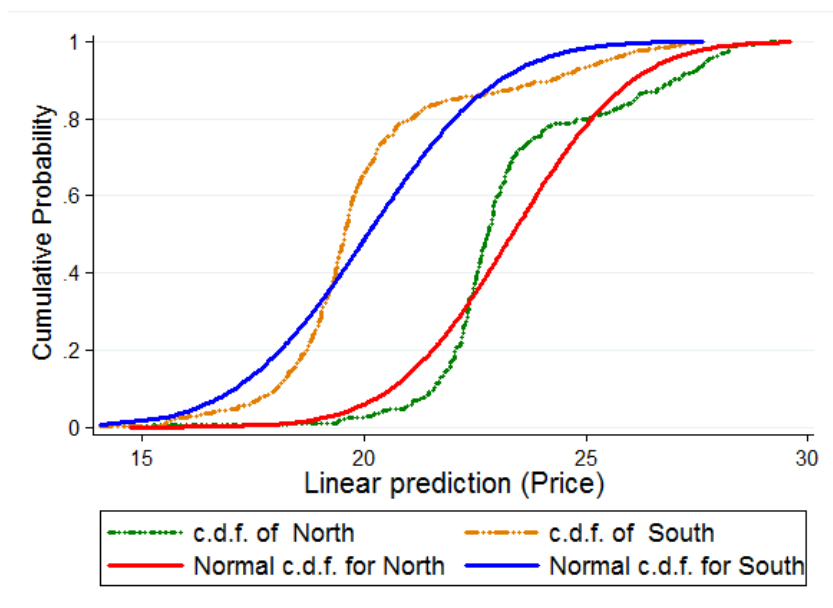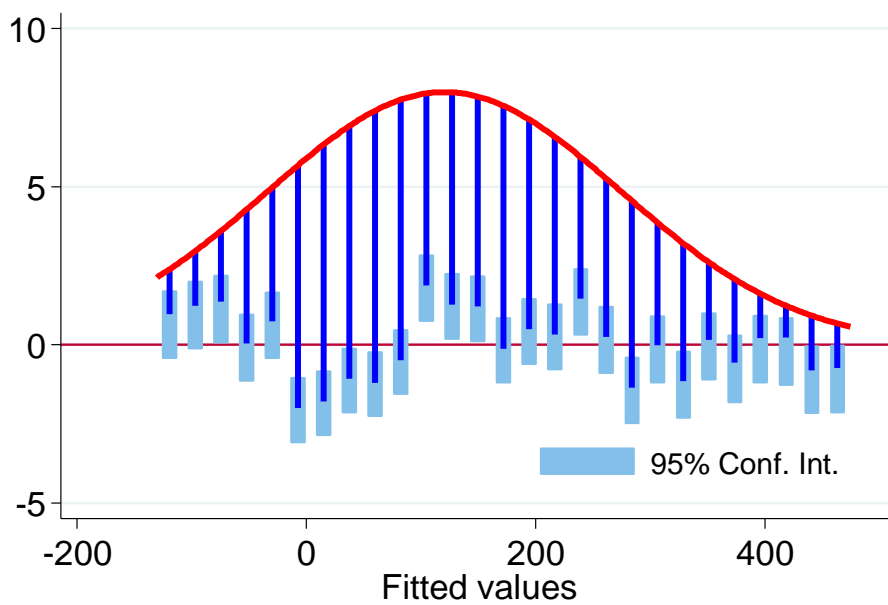

Figure D-2: CDF of Adoption (ML Logit)

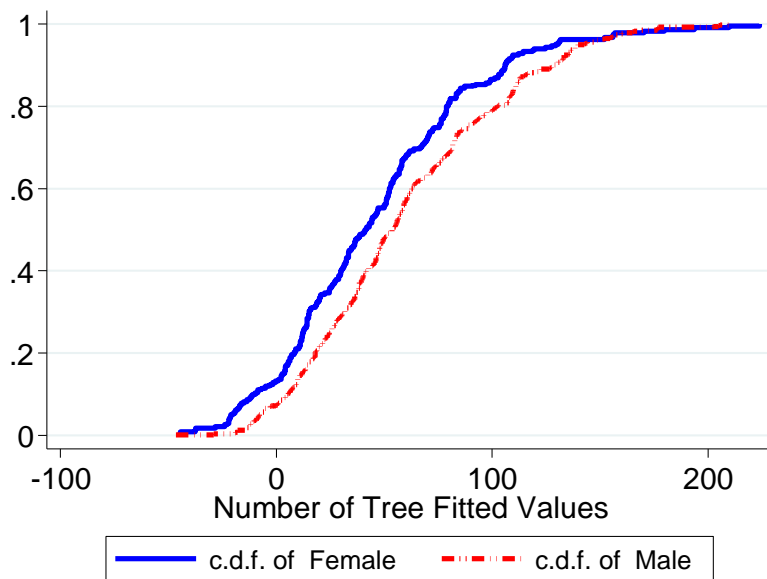Figure D-3: Predictive PDF of Tree on Owned Land & New Land

Figure D-4: CDF Gender-based Responses
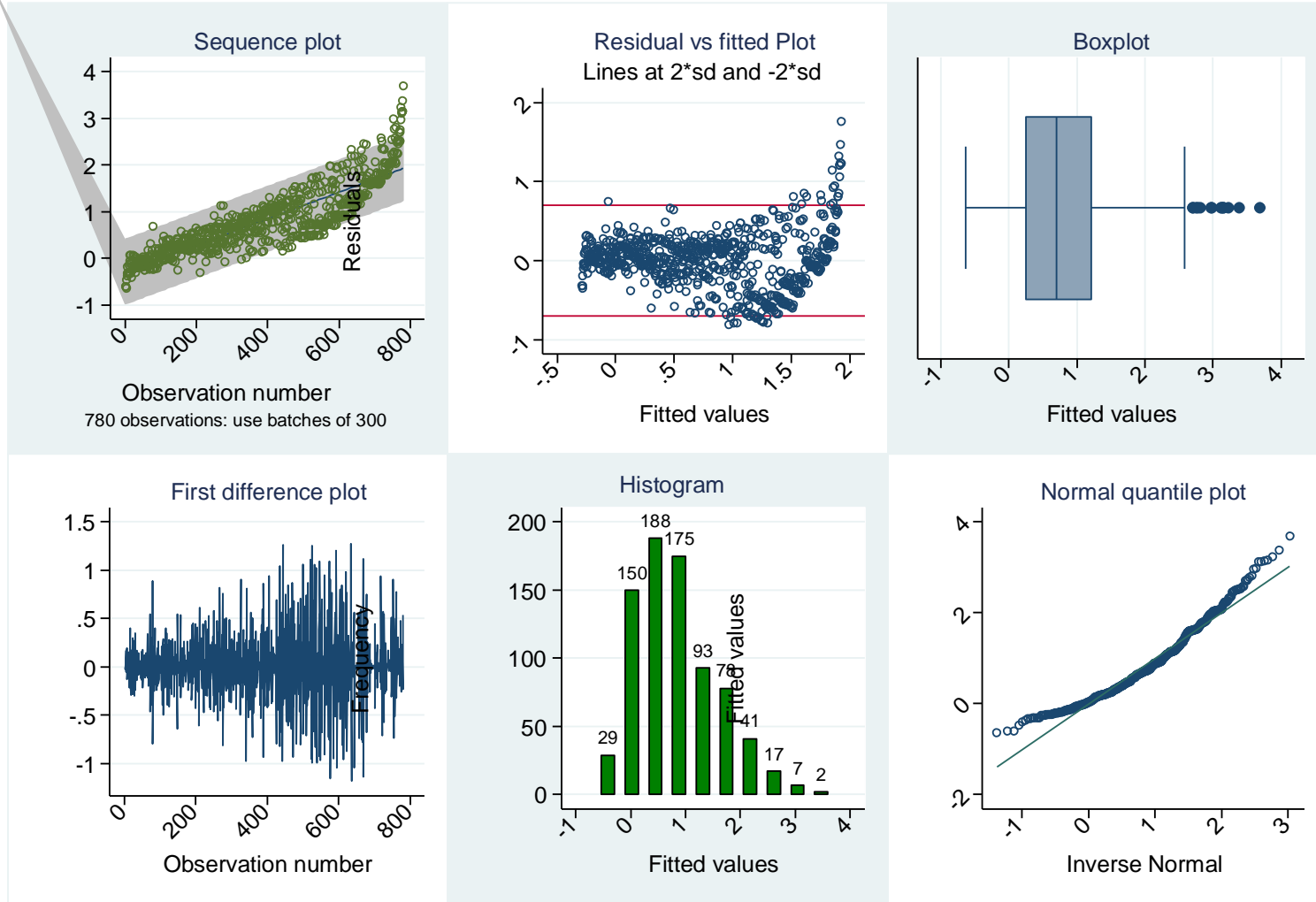
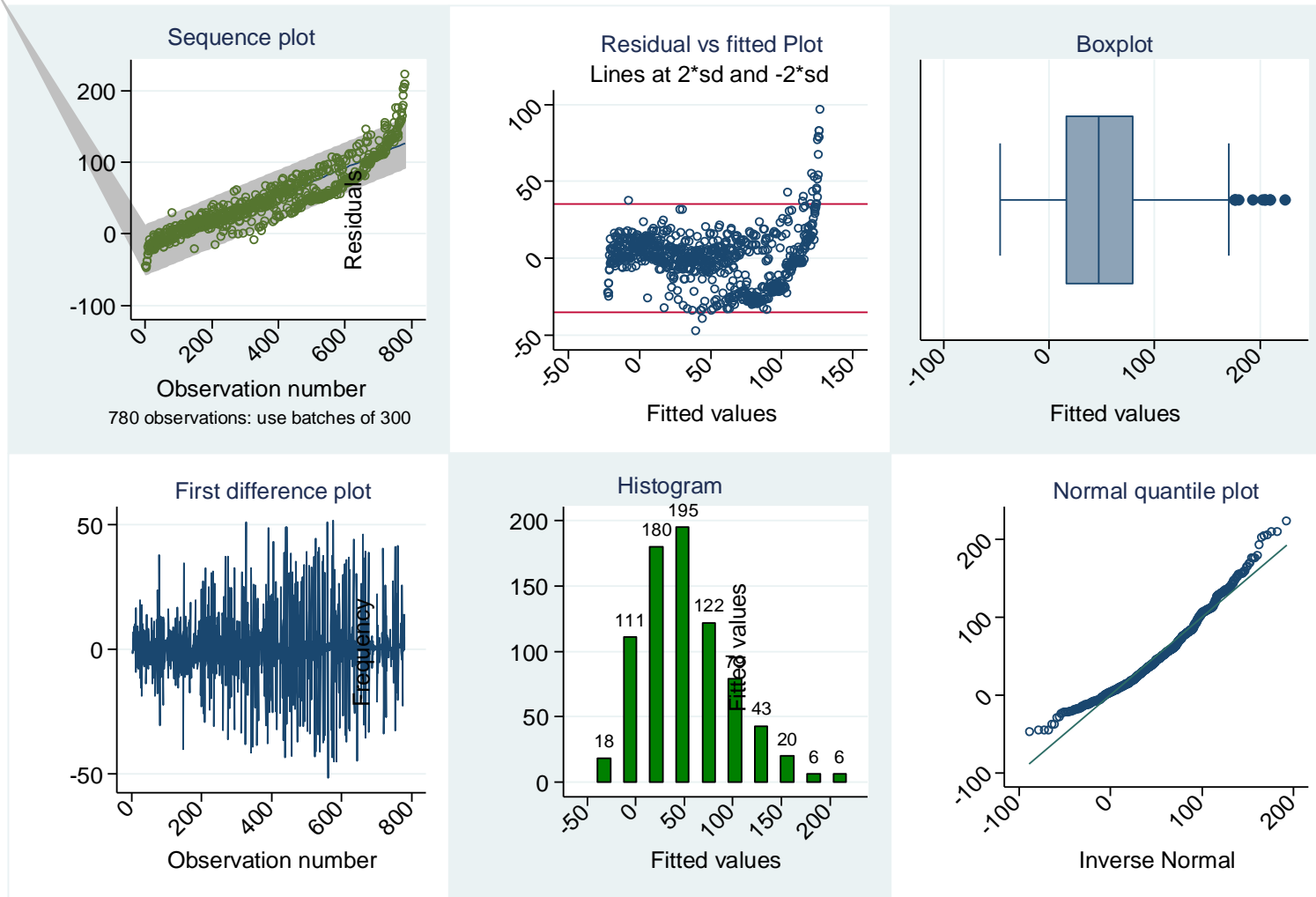Figure D-5: Six Plots Predictive of Owned Land Allocation

Figure D-6: Six Plots Predicting Trees on Owned Land

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