Food Security and Land Disputes in Vanuatu's Peri-Urban Neighbourhoods – An Exploration of Linkages

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Abstract

Food insecurity in Vanuatu mainly stems from the country's growing dependency on imported food staples and a concurrent shift away from traditional staples and forms of small-holder agriculture. The change in dietary patterns and agricultural production is especially pronounced within the peri-urban areas surrounding the country's capital, Port Vila, and has become a major public policy issue for the country. While populations have become more food insecure, the occurrence of land disputes stemming from custom land ownership and expatriate investment have become more frequent. Often, local Ni-Vanuatu cite land disputes as disincentives or barriers to investing in or expanding traditional small-holder agricultural production. After reviewing some of the literature on food security and land tenure in Vanuatu, this paper uses survey data collected from Vanuatu peri-urban and rural areas in June, 2012 to test the relationship between perceived land disputes and food security.

Photo 1 – Principal Researcher in Eratap Village, Shefa, Vanuatu

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1. Introduction

This paper concentrates on the increasingly food insecure peri-urban areas of South Pacific island nations whose populations are becoming more dependent on micronutrient-deficient imported food products while are simultaneously losing interest in or being pushed away from small-scale agriculture as a traditional form of self-sustenance and economic opportunity. Many view the root cause of this shift away from traditional small-holder agriculture as a natural consequence of economic growth – as the wealth of a city or country grows, the peoples' preferences change and lifestyles shift from being reliant on farming to focussing on the urban cash economy. While the effect of economic growth is acknowledged, this paper sets out to explore the possible linkages that land disputes, themselves probable effects of the country's system of land tenure, have with the recent trends of food insecurity in peri-urban areas.

Vanuatu's system of customary land tenure has garnered relatively significant attention (considering the country size) in regional academic journals, NGOs, and from multinational donor organizations like the World Bank. Often it has been praised as providing an important form of social safety net as the unemployed or disenfranchised are able to resort to traditional forms of agriculture on custom land. At other times it has been criticized for involving intrinsically complicated ownership rights which may increase the occurrence of land disputes and potentially hamper investment in agriculture and infrastructure, among other parts of the economy. Without neglecting the positive effects of customary land ownership on the welfare of Ni-Vanuatu, we explore specifically the possibility that customary land tenure increases the

occurrence of land disputes, and thus is having any relationship with the uptake of smallholder agriculture, consumption of imported food products, and inherent levels of food security.

The paper's main hypothesis is that land disputes will lead to families being less likely to achieve the full potential of small-holder agriculture, which can offer a higher capacity to feed as well as generate cash surpluses for a household's socio-economic betterment. As additional facets of research, the paper explores relationships between small-holder production, food security, and a number of different household characteristics. Once variables influencing a household's agricultural production and levels of food security are identified, we will be able to explore interesting avenues of research and possible intervention by local government in order to help mitigate or prevent these pressures on peri-urban populations and food security in general.

The project is empirical in nature and, as such, requires first hand data collection. Data were collected from several rural neighbourhoods and four distinct peri-urban village zones on the main island of Efate in Shefa Province, Vanuatu in June, 2012. Data collection was achieved using a household survey designed specifically for this study which was distributed among select peri-urban and rural populations surrounding the Vanuatu's capital, Port Vila. Certain factors affecting the sample selection within each targeted village which are discussed in Section 4.6 Sampling Issues. The survey questionnaire contains five sections with questions relating to: a) basic household characteristics; b) family expenditures on food, c) agricultural production; and d) 'other'. 'Other' includes subsections on: perceptions of the country's recent

World Trade Organization (WTO) accession, sales of agricultural produce, market activity, and availability of credit. In total, 78 respondent households participated in the survey.

Our analysis suggests that the dummy variable comparing Erakor village to rural villages is the only significant factor in determining the amount of imported food staples consumption per household member at a 5% level of significance. This result was arrived at by an Ordinary Least Squares estimation of an indicator for household food security on a set of potentially significant explanatory variables. Unfortunately, as with the majority of independent variables, the one describing perceived effects of land disputes on agricultural production turned out to be insignificant and thus there lacks any evidence to suggest a relationship exists with household food security. As a result of the study however, we are able to draw a very detailed picture of household characteristics regarding consumption, expenditures, agricultural production, land plots, and market activity.

The paper begins with an introduction on the subjects of food security and land tenure in South Pacific small-holder agriculture, and a review of the relevant literature. It then describes the study's questionnaire and the survey process that was undertaken on the ground in Vanuatu before describing the variables and data set, descriptive statistics, and outlining the results obtained from regression analysis. After several types of sampling issues are discussed, the paper provides a summary of avenues for potential future research with implications for local institutions, including the Department of Agriculture and the Agriculture Development Bank.

2. Context

Vanuatu, formerly the New Hebrides, is considered one of the poorest of the Pacific Island Countries and has been classified a Least Developed Country, with per capita GDP of US$1,276 (Vanuatu Statistics Office, 2013). It ranks 13th out of 15 Pacific Island Countries in terms of the Human Poverty Index (HPI) and 140th globally on the Human Development Index (CIA World Fact Book). It is an archipelago consisting of a chain of 13 principal and many smaller islands in the South-West Pacific Ocean (see Figure 1 - Port Vila, Vanuatu). Island geography consists of rugged mountains, high plateaus, coastal terraces, and offshore coastal reefs (Vanuatu National Statistics Office 2007).

The isolated location, small land area separated by vast oceans, and the associated challenges and costs of providing basic services make Vanuatu, like most Pacific Island Countries, particularly vulnerable to the adverse impacts of climate change (World Bank 2011). Sea level rise, the likely increase in the frequency and severity of extreme weather events, and increased variability in rainfall with an alternation of very dry and very wet periods, are among expected effects of climate change (World Bank 2011). A narrow economic base combined with roughly three quarters of Vanuatu's population engaged in subsistence agriculture compound vulnerability (World Bank 2011).

While most of the population is engaged in subsistence agriculture, which is not part of the cash economy, commercial agriculture exports compose almost the entirety of the country's exports. Data from the past 10 years show that the contribution of commercial agriculture to Vanuatu's Gross domestic Product (GDP) is roughly 20% however stagnating (Sisifa 2012).

Compared to many of the South Pacific Island nations, Vanuatu enjoys considerable land-based resources, fertile soils, and extensive (although declining) forests, which should give it a comparative advantage in regional agriculture (World Bank 2011).

2.1 Vanuatu's Peri-Urban Areas

Vanuatu can be considered as split into a dual economy where the urban areas are engaged in a cash economy, trading goods and services for the country's official currency, while rural areas are mostly engaged in traditional activities including subsistence agriculture, fishing, and using 'Kastom' forms of currency.[1] The peri-urban areas of Vanuatu seem to be at the epi-centre of where the two forms of economy collide. These areas are often highly dependent on a subsistence lifestyle while will also have a considerable share of the population which may work for cash within the main urban areas (through sales of agricultural produce, for example) or through micro-business enterprises. Informal micro-businesses tend to congregate in a few sectors – small retail outlets, buses and taxis, kava bars, and catering businesses. These sectors however are overcrowded, provide small profit opportunities, and have little scope for further expansion (Rawlings 2009).

According to 2009 census figures, the urban population of Vanuatu is 57,027, which represents roughly 24% of the total 234,023 population. Of these urban populations, 67% reside in Port Vila, Shefa Province and 33% in Luganville, Sanma Province. The urban population is currently increasing at a rate of 4.2% per annum, more than double the national average (Vanuatu National Statistics Office, 2009). At this rate, urban populations are expected to double in 18 years. However, official figures on urban areas only include demographics within the formal

[1] Kastom in Vanuatu refers to the traditional custom cultural activities, goods, and beliefs. In this case, Kastom forms of currency, widely used throughout rural areas, include pigs, tusks, and woven mats.

municipal boundaries. If we consider populations within Port-Vila's surrounding peri-urban villages (including Pango, Ifira, Erakor, Mele, and Mele-Maat), then the stated urban population and growth rate would be much higher.

Rapid population growth met with insufficient growth in formal sector employment has led to a noticeable increase in urban and peri-urban poverty over the past decade. For example, the formal economy provides 1,500 jobs available annually compared to 4,000 youths discharged from the education system each year (Sisifa 2012). The increase in poverty is evident not only through declining cash incomes and increasing youth unemployment, but also through declining health and nutrition levels; overcrowded housing; growing tension over land; increased school drop-out rates; and increased stress upon the physical and social environments of low-income families, particularly women and children (Bryant-Tokalau 1995). These are changes taking place in a society traditionally able to take care of its own through extended family and village networks.

Similar to the urban and peri-urban poor in Vanuatu, rural areas are deprived relative to western standards. Only 5% of rural households nation-wide have access to electricity and only 20% have access to a shared telephone line (Henckel 2006). Meanwhile, over 40% of the rural population does not have continuous access to clean water (Henckel 2006). Despite considerable expenditure by the federal government and donor nations, penetration of basic education and health services into these communities remains poor (Henckel 2006). In 1999 for example, 17.7% of the rural workforce had received no education at all, while a further 29.2% had failed to complete primary school (Henckel 2006).

Rural communities have poor human development indicators yet such acute poverty experienced by many other developing countries is virtually non-existent. An abundance of high quality land on most islands means that small-holder and subsistence agriculture is able to sustain families while requiring only modest inputs of labour (Henckel 2006). However, rural households are increasingly required to supplement subsistence level agriculture with cash incomes in order to pay for public services (school fees, medicines) and necessities like salt, clothing, and kerosene.

Unfortunately, the mechanism for cash from urban economies to 'trickle down' to more rural areas is very weak (Henckel 2006). Low agricultural productivity, isolation from markets, poor infrastructure, lack of government services, and a range of cultural factors including land tenure all make it difficult for ni-Vanuatu in these areas to earn cash income, placing major strains on households and communities (Alatoa, et al. 2007). Rural women are bearing a disproportionate share of the burden, as the pursuit of income takes them away from their domestic and social roles (Alatoa, et al. 2007).

2.2 Food Security in Vanuatu

'Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle.' (FAO 2009)

The debate surrounding food security has been pushed to the forefront of public policy for both developed and developing world economies due to record high and increasingly volatile prices of food products and food staples. In 2008, food price indices soared to their highest levels in

over 30 years which, when coupled with the global economic downturn, pushed millions into poverty and hunger. Again, in 2011 food price aggregates jumped to record levels and have remained relatively high ever since (see Figure 2 – World Food Price Indices)

At a national convention on policy actions to address high food prices in Vanuatu in April of 2012, the Minister of Agriculture stressed to those in attendance that high food prices are a major concern for the Government of Vanuatu: “many of us in Vanuatu will recall vividly that during the most recent food price hike of 2008, people were paying more than doubled for imported foods such as rice and wheat flour. Similarly price increases were seen on produced foods from the main market centres." (Sisifa 2012).

Factors contributing to the recent trends in world food prices have included unstable economic conditions, fuel price upheavals, and climate change (FAO, 2012). As these factors are expected to persist, if not increase in severity in the medium to long term, we can expect future prices to remain high and volatile. This calls for increased efforts to be made by all levels of government and civil society to strengthen the resilience of small farmers to shocks and to increase nutrition security over the long term (FAO, 2012). In Vanuatu this means helping promote and retain smallholder agriculture in favour of increased dependence on imported processed foods and staples.

In 2007, among increasing concern of regional food insecurity in the South Pacific, a meeting of Health Ministers from Pacific Island Countries called for a joint Pacific Food Summit to be held. In the run-up to this event, Vanuatu held its own National Food Summit in 2009 which included key participants such as the Ministry of Agriculture, Ministry of Trade and Finance, UN and

regional agencies, food producers and traders. The Pacific Food Summit followed in 2010, convened by the World Health Organization and in collaboration with the FAO, Global Health Institute, and Pacific Island Forum Secretariat. Both summits were held in Port Vila, Vanuatu.

The main concern addressed at the summits was that consumption patterns in Vanuatu and across the Pacific Island Nations have been shifting from fresh local foods to imported, manufactured, and processed foods that are generally easier to prepare but also prove to be less healthy (Abel 2009). These changes along with declines in physical activity have led to Pacific island countries, including Vanuatu, having some of the highest rates of obesity and non-communicable diseases in the world (Abel 2009). For example, in at least 10 Pacific Island Countries (including Vanuatu) more than 50% of the population is overweight (Perry 2010). Furthermore, about 40% of the region's population of 9.7 million has been diagnosed with a non-communicable disease, notably cardiovascular disease, diabetes and hypertension (Perry 2010). Such non-communicable diseases currently account for three quarters of all deaths across the Pacific archipelago and 40–60% of total health-care expenditure (Perry 2010).

In Vanuatu, cases of diabetes and hypertension are increasing particularly quickly. Outpatient cases of diabetes grew from 112 (per thousand) in 1995, to 163 in 1996, to 247 in 1997 (Vanuatu Ministry of Health 2012). A study on the prevalence of diabetes, hypertension and obesity at different levels of urbanization in Vanuatu found increased frequency and severity of non-communicable diseases within more urban areas, contrasting with that of rural areas (Taylor, et al. 1991). Evidence also showed strong correlation between obesity and blood

pressure within urban samples, higher salt intake with modernization (urban areas), and lower levels of cholesterol within rural samples (Taylor, et al. 1991).

Besides having some of the highest levels of obesity and diabetes in the world, Vanuatu and the South Pacific also face increasing pockets of malnutrition and hunger (Russel 2011). Vitamin and mineral deficiencies (iodine, iron, vitamin A, folic acid and zinc) persist in vulnerable populations, contributing to birth defects, reduced brain development and learning ability of students and increased susceptibility to diseases (Abel 2009).

In 15 of 16 Pacific Island Countries (including Vanuatu), more than one fifth of children and pregnant women are anaemic (Perry 2010). In Vanuatu, iodine deficiency and related goitre are widespread while vitamin A deficiency is also a significant public health concern, causing blindness in children and conferring an increased risk of infection due to immune system impairment (Perry 2010). From a study determining prevalence of anemia and iron deficiency within urban, semi-rural, and rural populations of Vanuatu, it was found that plasma iron levels were highest in the urban sample and lowest in the semi-rural (peri-urban) sample (Jalaludin, et al. 1992).

The most vulnerable populations facing micronutrient deficiencies and malnutrition are those within urban squatter settlements and peri-urban areas (Welegtabit 2001). These demographics are increasingly embracing a lifestyle dependent on imported and processed food products while are often not able to afford adequate proteins and vitamins needed to properly supplement their imported food diets. Unfortunately, the potential offered by local

gardens and small-scale agriculture to source essential nutrients and vitamins is often overlooked.

Plain white rice and wheat flour have emerged as very common staples among households, both urban and rural. People claim to not only enjoy the taste of these products, but also the relative ease with which they are prepared and stored. Such features make rice and wheat products attractive alternatives to traditional root staples like taro, manioc, and kumala. Compared to rice, locally grown root crops are expensive in the local market (Sisifa 2012). For example, an 8-9 kg basket of sweet potato which costs 600 vatu in the market can at most provide only two meals for the family whereas A 600 vatu worth of rice would provide many meals for the same family (Sisifa 2012).

Having a diet based on these imported products without having them properly supplemented by important additional sources of protein and vitamins is detrimental to the health of Ni-Vanuatu. For example, to exemplify the dangers of a diet based solely on imported staples, it has recently been shown that a higher consumption of white rice may significantly raise one's risk of developing type 2 diabetes (Pan, et al. 2012). Recent consultation has suggested that Vanuatu government mandate nutrient fortification and supplementation within imported food staples such as rice and wheat flour to help combat the rise in nutritional deficiencies existent in urban and peri-urban areas (Knowles, Vanuatu Nutrition Survey 2007).

A study led by Dr. Staffan Lindeberg on the Melanesian island of Kitava in the Trobriand Islands of Papua New Guinea demonstrated that traditional, non-industrial diets of Melanesian countries give inhabitants a very low (practically undetectable) rate of heart attack, stroke,

diabetes, and overweight (Lindeberg, et al. 1999). The Kitavans in Lindeberg's study had diets consisting mostly of yam, kumala, taro, manioc, coconuts, fruit, fish, and vegetables – exactly the same traditional diet that many Ni-Vanuatu are abandoning while favoring imported staples and processed goods.

Malnutrition and non-communicable diseases associated with poor food security can have numerous effects on the welfare and productivity of Ni-Vanuatu society. First of all there is a direct loss stemming from mortality and reduced physical productivity, the latter of which is particularly essential within peri-urban and rural lifestyles (Knowles, Vanuatu Nutrition Survey 2007). There are also indirect losses to the potential development of communities and country as a whole due to poor cognitive development and lower educability (Knowles, Vanuatu Nutrition Survey 2007). Furthermore there exists a financial burden for governments due to increased health-care costs (Knowles, Vanuatu Nutrition Survey 2007).

Not only is Vanuatu experiencing increased levels of malnutrition and prevalence of non-communicable diseases but it also seeing a concurrent slide in agricultural productivity, inadequate growth of domestic food production to keep pace with population growth, and poor distribution of domestic food production to the general population (Welegtabit 2001, Pacific Institute of Public Policy 2011). Contributing factors, as identified by Vanuatu's food security summit in 2009, include: increasing population density in urban and peri-urban areas (especially within squatter settlements), limited human resources, lack of skilled labour due to high migration with islands and overseas, limited access to markets due to difficulty of

community outreach and inter-island transportation, declining soil fertility, natural disasters, and insecure property rights and tenure (Vanuatu Food Security Summit, 2009).

Highlighting Vanuatu's lackluster productivity performance in agriculture, FAO data shows that per-capita agricultural productivity in Vanuatu fell by 58% between 1961 and 2009 (Pacific Institute of Public Policy 2011). Furthermore, from Figure 3 we can see that Vanuatu and the Pacific Island Countries in general have greatly underperformed developing country averages in levels of agricultural productivity (Fugile 2010). Regarding agricultural exports, Vanuatu experienced a decrease of 1.5% to USD$247,500 between 1960 and 1999 (Fleming and Blowes 2003). Volumes and values of food imports are high, constituting 2.5% of total imports (Sisifa 2012).

Explanations for Vanuatu's poor performance in agricultural productivity include lack of a 'green revolution' and a social and cultural system with limited understanding and experience with business concepts and practices (Welegtabit 2001). Investment into smallholder agriculture is very low, while that within subsistence agriculture is practically non-existent. The lack of investment is resultant from a lack of incentive, which itself is largely due to local institutions and cultural systems enforcing customary property rights and inherent forms of resource sharing (Welegtabit 2001). Furthermore, incentives to increase productivity are hampered by the fact that there is a fairly limited domestic market which offers little potential for economies of scale (Welegtabit 2001).

Yields and productivity of Vanuatu's agriculture are expected to become increasingly vulnerable to the adverse impacts of climate change. A changing climate is raising sea levels, increasing

the frequency and severity of extreme weather events (cyclones, tsunamis), and increasing the variability in rainfall with an alternation of very dry and very wet periods (World Bank 2011). Resultant impacts on agriculture include saltwater intrusion into areas critical to sustaining food security, increased coastal erosion, loss of soil fertility, loss of water quality and quantity, and less favorable growing conditions for local crops (World Bank 2011). These effects will hamper what Vanuatu is able to produce, what potential profits are able to be earned, and overall levels of domestic food security.

Traditional agricultural production and storage techniques have helped Ni-Vanuatu to cope in times of famine or scarcity, often consequences of adverse climactic conditions such as drought or tropical cyclones. The local food staple manioc, for example, plays an important food security role as its matured edible roots can be left in the ground for up to 36 months (Lebot 2009). Yams too can be stored for 4-6 months in ambient tropical conditions without significant deterioration of their nutritional properties (Lebot 2009). If Vanuatu continues on a trend towards imported food products and staples, it risks losing the inherent food security benefits of such traditional root staples.[2]

There is growing evidence that declining crop yields in Vanuatu, in combination with longer term changes in climate, are related to soil erosion, loss of windbreaks, siltation of waterways and falling soil fertility (McGregor and McGregor 1999, Stocking 2003, Welegtabit 2001). Declining soil fertility is mostly a result of shorter fallow periods which in turn are a consequence of land pressure that is linked to increased monoculture farming of cash crops and

[2] Other examples of traditional food preservation techniques include: breadfruit fermentation and drying of nuts (Welegtabit 2001).

rapid population growth (Welegtabit 2001). Considering that efforts to reverse soil degradation are primarily driven by private benefit, 'tragedy of the commons' scenarios are commonplace on custom land (Stocking 2003).

Shifting cultivation is used by the vast majority of households involved in agriculture in Vanuatu. This is where land is cleared, cultivated for a number of years, and left fallow while producers move to a new plot of land (Welegtabit 2001). It has been estimated that it can take as long as 15 to 20 years for land to recover fully in the tropics (Welegtabit 2001). In previous decades, population pressures were not as intense as they are now and it was feasible for households and farmers to practice these kinds of fallow periods. Now however, population density pressures are forcing fallow periods much shorter (Welegtabit 2001).

Soil erosion is an increasingly serious problem for Vanuatu's rural and peri-urban populations that are most economically dependent on small-scale farming. Cyclones, bush fires, and the development of farming and agricultural practices are the primary factors contributing to the increased risk of soil erosion (Dumas and Fossey 2009). The areas most affected happen to be some of the most populated rural and peri-urban areas (see Figure 4 - Efate Soil Erosion Risk), where agricultural activity such as land clearing for food crops (yam, taro, sweet potatoes, cassava) is becoming increasingly concentrated (Dumas and Fossey 2009). Degradation of soil quality will continue to hurt the profitability and yields of Ni-Vanuatu agriculture, thus propelling the trend towards increased consumption of imported food products and staples.

Overall, food systems are changing as traditional village life is being renounced in favour of more urban lifestyles, where food is sourced from the grocery stores rather than from gardens

and small-scale agriculture. Furthermore, imports are increasingly required to feed the Ni-Vanuatu population as local food production fails to keep pace with population growth (Pacific Institute of Public Policy 2011). In order to stem the concurrent increase in non-communicable diseases and malnutrition, there needs to be concerted effort to increase the scale and productivity as well as consumption of local food products, especially among the demographics deemed at highest risk from food insecurity – urban squatter settlements and peri-urban areas. An increased focus on domestic agriculture should also be a priority considering the highly volatile price of world food staples and the adverse effects taking place as a result of climate change. However, many barriers exist which potentially hamper efforts of greater investment in agriculture and productivity including the country's customary land tenure.

2.3 Vanuatu's Land Tenure

"Land tenure is the relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land.[3] *It is an institution, a system of rules invented by societies to regulate behaviour defining how access is granted to rights to use, control, and transfer land, as well as associated responsibilities and restraints."* (FAO, Land Tenure and Rural Development 2002)

Vanuatu gained independence in 1980, prior to which it had been known as the New Hebrides, a jointly administrated colony under French and British rule defined as a 'condominium'. Much of the impetus behind the drive for independence was due to the Ni-Vanuatu peoples' alienation from their customary land. Colonial and expatriate interests had 'bought' swathes of prime agricultural and ocean front land, especially within the vicinity of the two main urban

[3] For convenience, 'land' is used to describe and include other natural resources including water and trees (FAO, Land Tenure and Rural Development 2002).

centres – Port Vila and Louganville. Upon independence, all land was returned to the custom owners and it was constitutionally guaranteed that the rules of custom shall form the basis of ownership and use of land (Jowit 2004). It is estimated that 98% of land and sea resources in Vanuatu are currently classified under 'custom ownership', the highest rate of custom level ownership in the world (Regenvanu 2008).

According to the country's new Constitution, customary land cannot be alienated or sold off (Jowit 2004).[4] This means that the land can only ever be truly owned by the customary inhabitants of the area, their villages, and chiefs. However, it is important to note that, while no free-hold tenure agreements exist in Vanuatu, land can be leased off via lease agreements which can have a maximum span of 75 years. From Figure 6 we can observe that significant amounts of the main island of Efate and area surrounding Port Vila have been leased off already (Scott, et al. 2012). These lease agreements however are not substitutes for stronger institutions of land tenure such as freehold. For example, prospective investors in Vanuatu land (expatriate and local) are often hesitant to make investments into fixed-capital as customary laws detailing transfer at the end of lease agreements are unclear and allow for a scenarios where investors are not compensated for by the traditional owners once lease agreements have expired (Manning 2006).

Overall, land tenure systems in Vanuatu have been depicted as a significant disincentive to investment and obstacle to optimal land use (Larmour 1997, Gay 2008, Fleming and Blowes 2003). Foreign investors have been discouraged from developing domestic export industries in instances where they have been unable to secure long-term leasehold on land (Gay 2008,

[4] See Figure 5 - Land Tenure and Vanuatu's Constitution for further information.

Fleming and Blowes 2003). Facing commercial scale estate agriculture's decline in Vanuatu, smallholders have become the dominant force in Vanuatu's agricultural export industries. However, they too encounter difficulties in undertaking agricultural development on custom tenured land (Fleming and Blowes 2003).

The effect of Vanuatu's custom land on investment into agriculture is in line with past research showing that secure property rights have often been associated with higher levels of investment and productivity in developing countries (North 1979, de Soto 2000, Feder, et al. 1988, Besley 1995, Deininger 2003). There are several established mechanisms through which property rights may influence investment in agriculture. Adam Smith proposed the possibility that farmer fears of expropriation or loss of control over land on which investments have been made might deter investment (Goldstein 2008). Also, access to credit may be hindered if property rights are not adequately defined so that land can serve as collateral for loans (Goldstein 2008). Furthermore, inability to capture potential gains from trade in improved land might reduce investment incentives (Goldstein 2008).

Vanuatu's system of customary land tenure is also expected to be affecting investment and agricultural production via its propensity to generate land disputes (Larmour 1997). This happens when people with different lineages claim custom ownership rights to the same plot of land. Claims on custom ownership can go back decades and overlapping claims are increasingly common place. Ensuing land disputes have potential to complicate, stall, or scare negotiations over land investment and hence affect Vanuatu's level of agricultural production and

productivity. Rapid population growth, urbanization, and ensuing land scarcity exacerbate the propensity for these land disputes to occur (Larmour 1997).

Being prone to generating land disputes, Vanuatu's customary land tenure puts a strain on the country's legal system (Larmour 1997). The Constitution requires the Government to arrange for appropriate customary institutions or procedures to resolve disputes concerning the ownership of custom land. Most of the time however, custom claimants deal with land disputes themselves and State never needs to get involved (Jowit 2004, Regenvanu 2008). Unfortunately, these parties are increasingly failing to resolve issues as uses for land are changing (Jowit 2004). People are no longer as willing to accept the legitimacy of custom settlements when settlements are not in their favour (Jowit 2004). The traditional dispute resolution system that has been dealing with custom land issues of relatively simple context for decades is being forced to evolve to cope with modern disputes (Jowit 2004).

To exemplify a typical custom land dispute case in Vanuatu and how complicated (or sometimes incongruous) custom ownership rights may be, consider the case of: Family Sope vs. Family Kalulu in 1995 (Nari 1995).[5] This case involved five different families and surrounded a dispute of land in the village of Pango (one of this paper's surveyed peri-urban villages). In the early 1990s one of the families allowed a plot of land to be leased to an investor. The other four families all subsequently claimed interest in the land.

One claim to the land was based on the fact that a relative had worked as a teacher in the 30s and never received a promised salary, instead being given the land. That person's descendants

[5] The court proceedings can be found from the Pacific Islands Legal Information Institute website (Nari 1995).

held garden plots on the land ever since. The land dispute court upheld this claim. Another family claimed the land was theirs through birthright. This was also upheld by the courts. The final two families were given land to use in 1937 and since then used the land for gardens. The court decided that usage of the land gave these two families claims to customary ownership (Nari 1995).

This case demonstrates the complexity of customary land claim issues and how ambiguous definitions of custom land tenure may be. For example, in this case, custom land rights were recognised after land was acquired as payment for a debt and took the place of money in a transaction (Jowit 2004).

In light of concerns and inherent problems with the existing legal system and administrative regime governing land dealings in the country, a Vanuatu National Land Summit was held in Port Vila from 25 to 29 September 2006 (Regenvanu 2008). At Vanuatu's National land summit, two opposing ideologies on land tenure and their proponents became clear. The National Council of Chiefs, the Vanuatu National Cultural Centre, non-government organisations and some women's groups wanted more emphasis on custom and traditional values, and the government and private sector, wanted land to be freed up for economic development and the country's future (Manning 2006).

While customary land tenure may impede facets of agricultural production, and perhaps the level of food security in a country, there are many arguments in favor of retaining and improving (as opposed to replacing) the (Larmour 1997). One such reason is the political difficulty of discarding communal land tenure systems in South Pacific countries (Larmour

1997). Also, some features of customary land tenure are beneficial to the welfare of Ni-Vanuatu. Especially the case in more rural areas (where land is relatively abundant), if an individual is unable to find a cash-paying job in town, they will be able to return to the traditional subsistence economy on their family's customary land. In this sense, having custom ownership guarantees that certain populations will be able to ear, be sheltered, and survive even in the worst conditions.

It is expected that land tenure change in Vanuatu is inevitable as the demand for land grows. Population growth is increasing the scarcity of land and thus raising its price and rent. This increasing price will provide incentive for those with property rights and those needing them for investment or agricultural production to come to an agreement on its use. However, changes in local attitudes to land tenure will occur only slowly (McLeod and Morgan 2007). Judging from experiences in neighbouring Papua New Guinea, any proposed intervention to reform land tenure systems or mobilize land in Vanuatu should be careful as to not provoke widespread resistance and discontent at the local, provincial, and national levels (McLeod and Morgan 2007). For this reason, a gradualist approach to tenure reform is preferable (Fleming and Blowes 2003).

3. Background on Research Location and Surveys

At first it was intended for there to be two different types of surveys – household and community. However, due to certain time and financial constraints, there was only enough capacity on behalf of the principal researcher to conduct a survey at the household level. A community level survey would have been useful in order to better compare socio-economic

conditions between villages from which surveys were taken. Without the community surveys, we have to rely on simple observations and word-of-mouth approximations of community level characteristics and comparisons. Very little information on the socio-economic characteristics of individual villages is available from the Vanuatu Department of Statistics while next to nothing is available in academic literature or online.

In order to capture the differences between peri-urban populations and more rural communities, the household survey included a mix of peri-urban and rural villages. Initially, it was intended that the household survey would include samples from urban populations too, but this idea was again abandoned due to capacity constraints.

3.1 The Household Survey

The household survey consisted of five sections: Part A: Household, Part B: Income and Expenditures, Part C: Agriculture, Part D: Crops and Livestock, and Part E: Perceptions and 'Other'. For more detailed information on the questions included in the survey, please refer to the Appendix.

Part A: Household recorded basic household demographic information. Personal level questions regarding each inhabitant included gender, age, years of education, and employment. Household level questions included data on community, household type, and Amenities. Data on household type was intended to be used as an alternative proxy variable representing the household's permanent income. The community variable is particularly important as villages in Vanuatu are very unique both from cultural and socio-economic perspectives. Thus the variable will be central in helping to capture inter-village effects in the analysis stage.

Part B: Income and Expenditures collected data on household wealth and expenditures. It included data on average monthly household income and expenses. Questions on household income and expenses were broken down into sub-categories.

Part C: Agriculture is considered the core section of the household survey. It collected vital information on household agricultural activity and took the most time to complete as compared to other sections. Data collected included individual households' agricultural plots, sales, production trends, soil quality, barriers, and fishing.

Part D: Crops and Livestock intended to accumulate data on what and how much was being produced by household small-holder agriculture. This included variables on types of staple root crops, vegetables, fruits, and livestock produced. This section was included to contribute to subsequent analysis of inter-village and peri-urban/rural differences in production.

The final *Part E: Other* was intended to capture all additional information regarding household food security and agricultural production which was not included in previous sections. This section collected data on whether the primary respondent had knowledge on the Agriculture Development Bank, microcredit, and other avenues for credit. The section also explored the respondents' opinions and knowledge of the country's recent accession to the World Trade Organization. Data on credit availability and perceptions of the World Trade Organization were intended to supplement side themes of the paper's core objectives.

3.2 Conducting the Surveys

The household survey was conducted by the principal researcher and two research assistants. One assistant was a recent graduate from the MA program in International and Public Affairs at

the University of Ottawa. The other was a local Ni-Vanuatu resident who took time off from their regular employment at the Reserve Bank of Vanuatu to participate in conducting the household survey. The surveying period spanned the whole month of June, 2012. Overall, primary data were collected on socio-economic and agricultural aspects of 78 households residing in five peri-urban villages (Pango, Eratap, Erakor, Teuma, and Airport) as well as several rural villages on the opposite side of Efate. Since the rural villages surveyed are relatively more homogenous in nature and are clustered relatively close together, they were aggregated together as 'rural' under the village variable for subsequent analysis. This means that the village variable will take the value 'rural' for all rural village households, regardless of which village they were from. This is different from peri-urban households which take a different value for the variable 'village', depending on which village they were within.

The original sample size intended for the study was 100 households, of which 1/3 were to be from urban areas, 1/3 from peri-urban, and 1/3 from rural. In the end however, due to capacity constraints, the sample size consisted of 78 households, of which 59 (3/4) were from peri-urban areas and 19 (1/4) were from rural. There were a total of 397 observations at the individual level. Only one respondent was required to conduct the survey regarding the entire household, barring that they were not children. The target villages were chosen in an attempt to accurately represent average peri-urban and rural inhabitants on Efate. However not all villages initially intended for the survey were able to be visited. This was often due to local advice that certain village chiefs were unlikely to approve of the study.

The official definition of peri-urban neighbourhoods is that they are "immediately adjoining urban areas; between the suburbs and the countryside".[6] In Vanuatu however, the definition becomes a little more flexible considering that urban areas have no distinguishing borders and can often physically resemble more distant and rural communities. Therefore, in order to distinguish between urban, peri-urban, and rural areas we adopted a classification based on proximity to the centre-town, Port Vila. The urban areas are considered those which are within a 15 minute drive (approximately two kilometer radius) of centre-town's central marketplace. Peri-urban areas are those which fall within a 15-45 minute drive (approximately two to eight kilometer radius) from centre-town while rural areas are considered those which fall outside of these boundaries.

Indeed we find that this classification of peri-urban and rural areas based on the proximity to centre town works well for the purposes of this survey. We can even confirm that villages from each of these classifications share homogenous traits by referring to observations on the physical structures of households and families' basic amenities (see Table 3 - Housing). Our definitions of peri-urban areas also match local interpretations of what it means to 'live in town'. All peri-urban villages included in the survey were understood by locals as not being urban or rural, rather villages somewhere in-between. See Figure 7 - Location of Peri-Urban Villages Surveyed for further geographic information of the peri-urban villages surveyed.

Upon arriving in Vanuatu, it was made clear by local professionals and contacts that it would not be recommended to show up unannounced to villages, especially for the peri-urban as

[6] Oxford English Dictionary, 2005

opposed to more rural. Instead, it was suggested that we first contact the big-chief[7] and arrange a meeting to present the grounds of our study and seek his formal approval. Having to do so for each village not only slowed down the process of survey administration but it also restricted the availability of which villages could be visited. For example, through word of mouth it was discovered that the chief of Ifira Island village may not have been very open to the idea of household surveys while Erakor and Eratap were more suitable. Consequently, the study was only able to include samples from select peri-urban villages as opposed to all of them.

In order to take a sample of households from rural areas a car was hired for two consecutive days to drive around to the other side of Efate and interview households. This method for sampling the rural areas worked remarkably well as the time to travel between households was reduced significantly. 19 rural households were surveyed in just these two days. During the rural surveys, stops were made to interview households at six different villages: Eton, Eikpe, Ebule, Sama, Emua, and Nguna (see Figure 8 – Location of Rural Villages Surveyed). Efforts to contact the village chiefs before administrating the rural survey were fruitless and so the surveys were conducted in an especially spontaneous nature.

Unfortunately, due to the nature of having to contact the peri-urban village chiefs before conducting the survey meant that they had time (village surveys were on average conducted 3 days after the respective meetings) to discuss with local inhabitants the purpose and details of the survey. The effects of which may have affected the results of the survey as participant households could appeal to be included in the survey. This is further discussed in section 4.6, Sampling Issues.

[7] Typically, a village in Vanuatu will have one 'big chief' and several 'small chiefs'.

For the household survey, it was required that only one respondent per household was required. The primary respondent did not need to be considered as the head of the household, as long as they were not considered children. They would be responsible for answering the entire survey themselves however, if more members of the household were available and willing to participate in the survey, they were allowed to do so but only for the survey section regarding personal level questions including: gender, age, years of education, and employment Allowing only one respondent for most sections avoiding potential complications with having to combine separate surveys of different household members. Unfortunately, allowing any household member (excluding children) answer the survey may have affected the quality of the results as perceptions and estimates on survey questions may differ between people with different household status, sex, and age.

4. The Survey Data

The goal of this research's data is to ascertain whether there exists a linkage between current food security issues and households' perception of land disputes as barriers to agricultural production. Additionally, while maintaining a focus the relationship between household perceptions on land disputes and food security, we would also like to explore some of the relationships that exist with other factors, for example trends in soil fertility. Unfortunately, the results from performing econometric analysis on the relationship between perceived land disputes and food security were inconclusive (see Section 4.4 Empirical Results). Therefore this paper draws heavily on the value added from a section on Descriptive Statistics.

It is important to note that one should not expect sample data to be representative of the whole population since it was not randomly selected. Specific villages were targeted instead of visiting all while the choice households within targeted villages was influenced by having to meet with the chiefs days in advance.

4.1 Indicators of Land Disputes and Food Security

Initially the study intended to use an indicator of property rights and land tenure as an independent variable to explore the effect on food security. However, we ended up not being able to collect sufficient data on household land tenure and property right characteristics. Soon after data collection began, it became clear that households were reluctant or unable to provide descriptions of their property rights and tenure. Furthermore, local village chiefs were not supportive of including the necessary questions in the household survey. Thus, the paper switched to focussing on land disputes, themselves posited as being generated from the country's system of land tenure.[8]

Data on land disputes came from a question on the survey which asked respondents whether land disputes or theft were considered issues or barriers to small-holder agricultural production. In response to this question, over 40% of respondents indicated that land disputes were an issue or barrier.

Unfortunately, the data on perceived barriers to agricultural production may have suffered from issues related to measurement error. Subsequently, potential problems may be posed as a

[8] Claiming that current land tenure and property right regimes promote the occurrence of land disputes is not too broad an assumption. Evidence of this stems from this paper's earlier exploration of past academic literature and firsthand accounts. See Section 2.3 on Vanuatu's Land Tenure for more information on the relationship between Vanuatu's land tenure and land disputes.

result of its inclusion in the empirical study of this paper. One problem arises from the way the question was phrased in the survey. The question asked directly whether land disputes or theft were barriers to their agricultural production. It is likely that household responses from this question are quite different from what they would have been if the question instead asked open-endedly which factors were barriers to agricultural production. As such, we acknowledge the possibility that the question may have increased the probability for a household to include disputes and theft as barriers.

One of the key objectives of the household survey was to create an indicator of food security specific to Vanuatu and use it as a dependent variable in OLS regression analysis. As current food insecurity in Vanuatu stems from the shift away from local staples and smallholder subsistence production towards exported staples, an ideal food security variables for this study should be based on how much of household food consumption is sourced from imported goods.

The variable that was ultimately chosen for use as an indicator of food security was the expenditure of imported food staples per household inhabitant.[9] One of the advantages of using this as the dependent variable is that it only includes data considered by the primary researcher to have been less susceptible to measurement error (such as total household

[9] Other food security indicators considered for inclusion were: the sum of imported food staple expenditures per total household food expenditures; and total household hours worked in the household's agricultural production over total hours worked in total. The first however does not work well with a sample population spanning across different income levels. A wealthier household may have a much lower ratio of imported food staples to total household food expenditures compared to a poorer household as it often has much higher levels of total food expenditure (including many non-staple imported products which the poorer household is unlikely to be able to afford) while having relatively similar levels of expenditure on imported food staples. The other indicator was abandoned after realising that respondents were unable to give clear and accurate measurements of each household member's contribution to agricultural work or total hours worked in total. Typical garden use for someone active in the garden is about 2 times per week, about 4-5 hours per day (FAO 1996).

income or hours worked in the garden). Furthermore, we feel that this chosen variable is able to sufficiently capture facets of food security between households. From a Vanuatu context, food insecurity stems from the country's increased expenditure and consumption of imported food staples and products in lieu of traditional crops. The chosen indicator primarily addresses the first aspect of food insecurity in Vanuatu – the increased consumption of imported staples – while is able to make inferences about the consumption of traditional crops. Households that have lower expenditures on imported food staples are deduced as to having more of their sustenance derived from local garden products and production. Similarly, if families are spending a larger amount of money on imported foods, we expect that they are consuming fewer locally produced food staples.

We were unable to use a food security indicator which directly includes aspects of local crop production, expenditure, and consumption due to inadequate or unreliable data collected during the survey. Questions describing how much time each family member spent in the garden were considered too inaccurate to include in analysis. Similarly, household respondents were simply unable to account and quantify reliably for how much of these products their family bought on average per month or week. The problem is expected to be that local food crops are not always included in the formal cash economy and would often be traded in-kind, shared, or gifted among households. This made recollection of expenses and consumption difficult. Furthermore, local root crop staples come in a large variety of different sizes which compounds the challenges inherent in recollecting how many meals were provided. Questions intended to quantify how much sustenance households sourced from local staples were not

included in the survey due to the expected amount of additional time required to administer the surveys.

The variable of imported food staples per household member was augmented to have a different weight attached to children in the household. That is, the total imported food expenditures per month were divided by each person in the household, with every age category having an equal weight of one except for children who were weighted at half. The smaller weight was given to children simply because they are expected to consume smaller proportions of food. With the weight included, the indicator will more accurately reflect what proportion of daily consumption comes from imported food staples. The indicator for household food security is shown below (note that imported food staples here are restricted to wheat products and rice).

4.2 Descriptive Statistics

Before inspecting the results and procedures of regression analysis, it is valuable to inspect some key descriptive statistics of the households surveyed. I will look at some aggregated characteristics of households and inter-village comparisons while periodically commenting more specifically on the expected and apparent relationships of household characteristics with select food security variables. This section will explore not only data and variables relevant to this paper's regression, but also additional data deemed interesting from a policy perspective. Important to note is that all of the data tables presented below are concerning that collected during the survey.

4.2.1 Demographics

Table 1 - Demographics

Village	male	children (0-14)	youth (15-24)	middle aged (25-59)	elder (60+)	Average members/household
Erakor	44.74%	18.42%	18.42%	42.11%	21.05%	4.75
Eratap	58.76%	26.80%	27.84%	38.14%	7.22%	5.11
Pango	57.28%	24.27%	22.33%	36.89%	16.50%	6.06
Rural	44.68%	34.04%	21.28%	39.36%	5.32%	4.95
Teuma	48.15%	24.07%	11.11%	57.41%	5.56%	4.15
Grand Total	**51.89%**	**27.71%**	**20.91%**	**41.06%**	**10.08%**	**5.09**

Vanuatu's population is young and quickly growing. National statistics put the growth rate of urban areas at 4.2% per annum, more than double the national average of 1.49% (Vanuatu National Statistics Office 2006). These values reflect the fact that Vanuatu has a high fertility rate and that many Ni-Vanuatu are migrating towards urban areas. Evidence of a youthful population is further confirmed through this paper's survey statistics. As shown Table 1 - Demographics, approximately 28% of the respondent population are children (under the age of 15) while approximately 21% are considered youth (15 to 24). Furthermore, 100% of survey respondents indicated that local youth populations were increasingly quickly.

Through informal discussion between the principal researcher and respondent households, it was evident that many families were concerned about the burgeoning population of village youth and the lack of their participation in society. This was particularly evident in neighbourhoods that were closer to formal urban areas of Port Vila (Pango and Erakor). Youth in urban areas were often described as being lazy, losing traditional values (including decreased participation in gardening and traditional agriculture), and becoming more involved with

alcohol, drugs, and crime.[10] For example, young men in urban areas are twice as likely to have consumed alcohol in a typical week compared with their rural peers (Vanuatu National Statistics Office 2009).

A quickly increasing youth population in Vanuatu is failing to be matched by adequate formal sector growth and is leading to many undesirable societal issues including unemployment, crime, and drug abuse (Welegtabit 2001). If these trends continue, traditional forms of agriculture as social safety nets will become even more essential to peri-urban and rural Ni-Vanuatu – an important consideration to keep in mind when suggesting any institutional change regarding land tenure and property rights.

Analysing the data on demographics, we notice that the villages with relatively higher levels of income, education, and closer proximity to urban areas (Pango and Erakor) have comparatively larger proportions of elders (60+) and fewer children (0-14). Intuitively this can be explained by there being higher fertility rates in more rural, more impoverished areas. Young women (15-19 years) living in rural areas have a higher fertility rate, with an estimated 77 live births per 1000 compared with 40 per 1000 in urban areas (Vanuatu National Statistics Office 2009).[11] Families living in more rural areas are likely to have fewer family planning initiatives and education, higher infant and adult mortality rates, and greater need for children as labour in agricultural production.

[10] This description was common among urban and peri-urban heads of family when describing the context behind youth demographic change as brought forward in Questionnaire: Household (1).

[11] The adolescent (15-19 years) birth rate is an important Millennium Development Goal (MDG) indicator of progress towards improving maternal health. Young adolescent girls are at greater risk of dying from childbearing complications and children of adolescent mothers have lower chances of survival (United Nations 2012)

We observe that Teuma, an area relatively farther from Port Vila's urban centre compared to other peri-urban areas surveyed, has a starkly lower proportion of youth (15-25) relative to other areas. A lower share of young people in a region or village may suggest that young people have migrated out for certain reasons of education, paid work, or some other reasons such as preferring to live in town (Vanuatu National Statistics Office 2009). Indeed, through personal discussion between the principal researcher and survey respondents, greater employment opportunities and the inability to source enough income from traditional forms of agriculture were often cited as common reasons for migration into more urban settings. Greater productivity in agriculture and larger participation among youth could have the potential to help stem some of the rural-urban migration taking place across Vanuatu and mitigate some of the subsequent socio-economic pressures.

Overall, we expect to see a positive correlation between food security and the number of children within a household. This is due to the expectation that families in relatively more rural areas have higher fertility rates and higher usage of local food staples. Conversely, we expect to see a negative correlation between the proportion of elders in a household and food security, as households closer to town have lower fertility rates and lower usage of local food staples. Moreover, elders are more likely to have physical constraints restricting their participation in agricultural production.

Regarding the sex of a household's occupants, we see a fairly even distribution amongst surveyed households and villages (average of 51.89% male for all households surveyed). However, we do see a slightly higher ratio of males within the two villages, Pango and Eratap. A

likely explanation for these villages having higher ratios of males to females is that there was an insufficiently large sample size for the survey data. It could also be due to the survey suffering from selection bias and being a non-random sample.

We expect that a positive relationship should exist between a household's consumption of local food staples with what proportion of the family is female. This is because, outside of caring for children, preparing meals, carrying firewood and water, the woman's role is to spend most of her day working in the garden (FAO 1996). Exemplifying this, a statistical study by Mackenzie-Reur found that "more Ni-Vanuatu women are involved in agriculture and other primary activities (82%) in comparison to their male counterparts (63%)" (Mackenzie-Reur 1995).

4.2.2 Education

Table 2 - Education

Villages	Number of Households	Highest Level of Educational Attainment Among Household Members			
		Percent with no formal education (0)	Percent with some or all of primary (1)	Percent with some or all of secondary (2)	Percent with some or all of tertiary (3)
Erakor	8	0.00%	50.00%	50.00%	0.00%
Eratap	19	5.26%	57.89%	36.84%	0.00%
Pango	17	5.88%	35.29%	52.94%	5.88%
Rural	19	0.00%	68.42%	31.58%	0.00%
Teuma	13	0.00%	84.62%	15.38%	0.00%
Grand Total	**78**	**2.56%**	**60.26%**	**35.90%**	**1.28%**

People's access to education in Vanuatu is crucial to building up capacity to function in the modern world. This applies not only to being able to make the most of economic opportunities

in Vanuatu and abroad but also to the social and political wellbeing of local communities (Vanuatu National Statistics Office 2009).

Levels of educational attainment for household respondents were categorized as being either: 0 (no formal education); 1 (some or all of primary); 2 (some or all of secondary); or 3 (some or all of tertiary). A household was assigned a rank corresponding to the highest level of educational attainment among household members. Primary education in Vanuatu is defined as being from grade one to grade six; secondary education is from grade seven to thirteen; tertiary is anything higher than grade thirteen (Vanuatu Ministry of Education 2010-2011).[12]

As expected, we notice from the survey data that villages with greater proximity to urban centres, and greater levels of household income reported higher levels of educational attainment. Pango, Erakor, and Eratap all have an above average proportion of respondents with ranking 2 or higher (some or all of secondary and some or all of tertiary). Conversely, Teuma and Rural areas reported the highest proportion of people with primary education or less.

In theory, having a higher level of education should have a negative relationship with food security indicators. That is, imported food expenditures per household member should be higher for families with greater levels of educational attainment. A family with greater levels of education is expected to obtain higher levels of income, which in turn would afford them the opportunity to buy greater amounts of imported foods. Additionally, a positive feedback

[12] Some primary schools, the so called 'centre schools' include classes up to Year 8 while others include classes to Year 6 (Vanuatu Ministry of Education 2010-2011). Also, some secondary schools start from Year 7 while others start from Year 11, dubbed 'senior secondary schools' (Vanuatu Ministry of Education 2010-2011).

mechanism occurs where greater levels of income enable families to send their children to school for longer.

On the other hand, the level of education a household receives may have a positive, albeit weak, effect on the share of locally sourced foods in household consumption. This is due to growing awareness and education on the importance of locally sourced foods in household diets and domestic economies. Education on the subject of food security is increasingly commonplace within traditional educational institutions (such as grades school) as well as through public advisory campaigns (government departments of health and agriculture).

Respondents were keen to suggest that a large and growing share of their household incomes went towards tuition fees for their children. Indeed, a large part of rural and peri-urban demand for participation in the cash economy stems from the desire to send children to school.

4.2.3 Housing

Table 3 - Housing

Villages	Number of Households	Percent with House Type 1	Percent with House Type 2	Percent with House Type 3
Erakor	8	25.00%	62.50%	12.50%
Eratap	19	10.53%	63.16%	26.32%
Pango	17	58.82%	23.53%	17.65%
Rural	19	0.00%	21.05%	78.95%
Teuma	13	0.00%	76.92%	23.08%
Grand Total	**78**	**17.95%**	**46.15%**	**35.90%**

In Vanuatu's peri-urban and rural areas, affordable building materials are in short supply and people tend to build with whatever they can find. Most self-built housing is constructed from

corrugated iron, wood, traditional thatch and bamboo, together with recycled bits and pieces of tin, plastic and wood. Those who have the means may build with concrete hollow blocks but, due to their high cost, building a home with these bricks can take years, with people often building one wall or partial wall at a time, as funds allow (Habitat for Humanity: Vanuatu 2006).

As part of the questionnaire, the principal researcher took notes on the basic housing conditions of each respondent household. The status of the homestead was then categorized into three levels: 1 (solid conditions, concrete structures, solid floors); 2 (standard conditions, mixed concrete/corrugated iron; solid or semi-solid floors); and 3 (poor conditions, thatched wood/corrugated iron, no concrete, dirt flooring/mats). These descriptions of household structure proved useful as indicators of household wealth – in lieu of adequately unbiased data on average monthly household income.

What can be observed from the data is that villages with greater proximity to urban centres and higher average household expenditures had a much larger number of households with solid conditions (grouping 1). Similarly, more rural villages with lower average expenditures had a much higher proportion of households living within standard or poor conditions (groupings 2 and 3). We expect there to be a positive relationship between the physical quality of a homestead and the expenditure of imported food staples per household member. This is because a wealthier family is expected to be able to spend more on imported food products.

4.2.4 Expenditures

Table 4 - Expenditures

Villages	Number of Households	Average Expenditures per Household per Month			
		Electricity, Water, Education, Medical, Food	Electricity	Water	Total Food
Erakor	8	VUV 21,513	VUV 3,538	VUV 3,563	VUV 10,938
Eratap	19	VUV 14,321	VUV 2,339	VUV 534	VUV 5,474
Pango	17	VUV 25,536	VUV 3,471	VUV 2,625	VUV 17,647
Rural	19	VUV 9,905	VUV 1,271	VUV 655	VUV 4,421
Teuma	13	VUV 10,339	VUV 962	VUV 538	VUV 4,346
Grand Total	**78**	**VUV 15,557**	**VUV 2,185**	**VUV 1,332**	**VUV 8,179**

The household survey data shows that a large discrepancy exists amongst village household expenditures. These discrepancies are largely indicative of differences in inter-village household incomes. The wealthier communities of Pango and Erakor, who feature larger proportions of household members employed in formal and semi-formal economies, earn larger cash incomes which support relatively more modern lifestyles, goods and services.

Figure 9 – Intra-village Household Homogeneity – Standard Deviations of Electricity and Water Expenditures

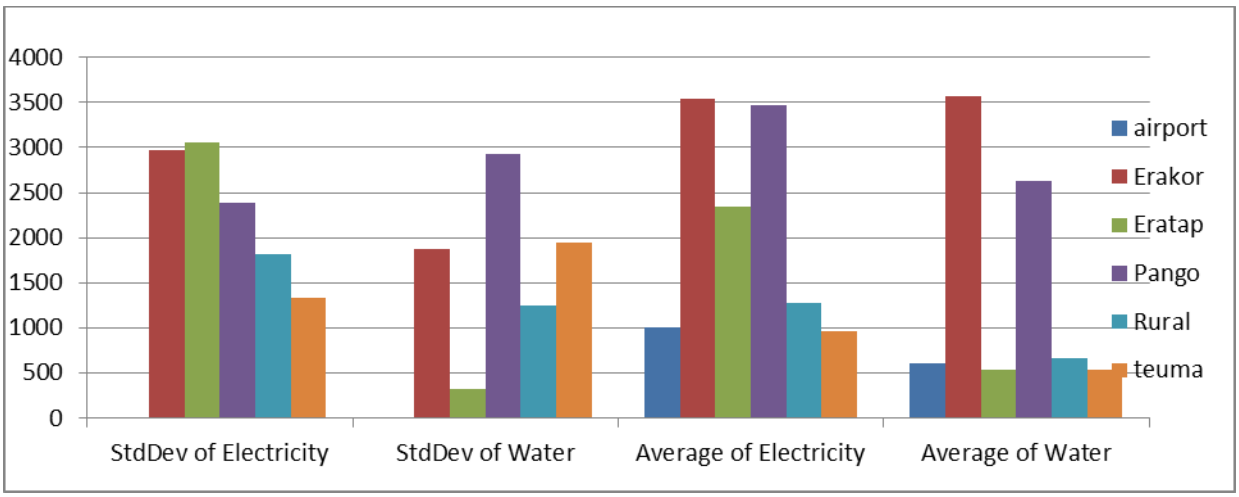


Table 5 - Food Expenditures

Villages	Number of Households	Average Expenditures per Household Member per Month		Percent of imported staples/total food expenditures
		Total Food	Imported Food Staples	
Erakor	8	VUV 2,812.50	VUV 1,073	0.38
Eratap	19	VUV 1,147.71	VUV 1,042	0.91
Pango	17	VUV 3,367.65	VUV 1,591	0.47
Rural	19	VUV 1,053.13	VUV 1,383	1.31
Teuma	13	VUV 1,562.45	VUV 1,292	0.83
Grand Total	78	VUV 1,833.05	VUV 1,278	0.70

From data on food expenditures, we notice that the wealthier village areas have much greater total food expenditures. For example, per household member, Pango and Erakor spend by far the most on all types of food with VUV 3367 and VUV 2812 respectively. However, we note that household expenditures on imported food staples (wheat flour and rice products) vary

considerably among villages, and do not follow the same pattern with respect to wealth or proximity to urban markets.

Erakor, the second wealthiest and closest in proximity to town, comes in tied for fourth in levels of imported food staple expenditures per household member, behind Teuma and Rural areas. This discrepancy is perhaps best explained by characteristics specific to each village, for example their inherent cultures, attitudes, and values towards locally sourced foods. Indeed, survey respondents in Erakor had relatively stronger opinions on the importance of custom agriculture and local food security compared to other villages.[13] They were also more actively involved in helping support local food production such as through ongoing consultations with chiefs over plans to construct a new local market house.

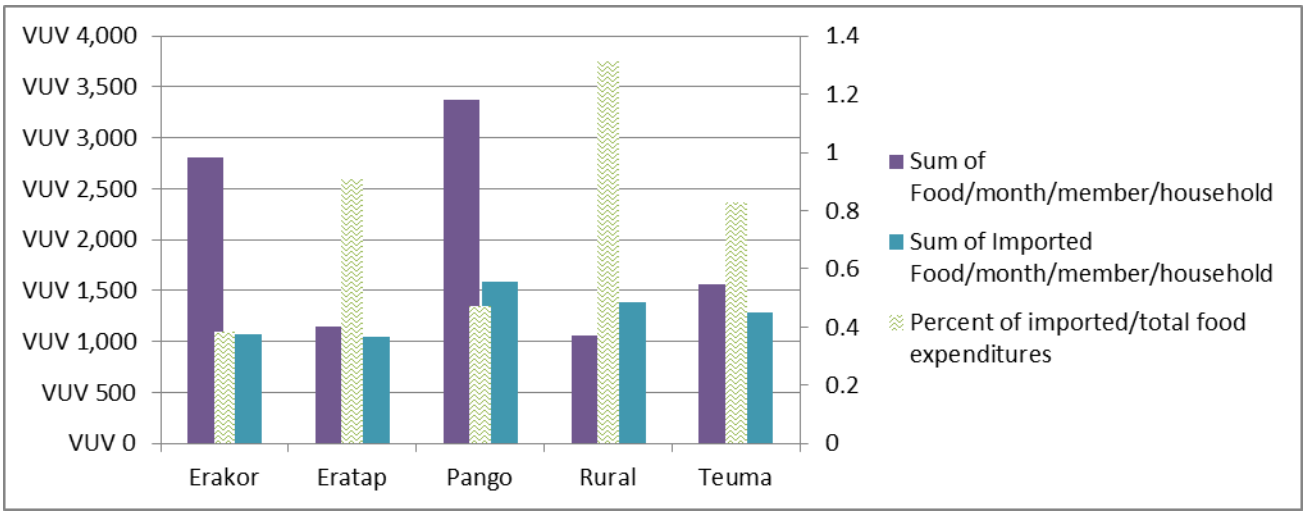
We also observe that the relatively more distant and poorer households spend a much larger share of their total food expenditures on imported food staples. Almost all of these communities' food expenditures are on imported staples – Eratap, Teuma, and Rural all feature close to 100% of food expenditures on imported staples. These communities tend not to buy local food products, instead opting to share or grow them themselves, and do not have the incomes to purchase relatively more expensive, non-staple imported products such as processed and canned goods. A typical family in Teuma, for example, will grow their own local food and complement it with purchased imported rice and bread products.

We notice that reported values of food expenditures highlight the problematic occurrence of measurement error and bias in this survey. It should not have been possible for households to

[13] This was evident from casual discussion with survey respondents when fielding additional comments after household questionnaires had been completed.

report a higher monthly expenditure on imported food staples compared to total food expenditures. Referring to Figure we notice that rural areas reported a particularly high ratio of these expenditures – close to —. Even though food expenditure questions were listed consecutively on the survey, no additional time was taken to make sure that the addition of food items matched up or made sense in this respect. Likely reasons for this occurrence are discussed further in Section 4.6 Sampling Issues.

Figure 10 - Food Expenditures



4.2.5 Theft and Land Disputes

Table 6 - Land Disputes and Theft

Villages	Average of Land Dispute Dummy Variable	Average of Theft Dummy Variable
Erakor	0.38	0.50
Eratap	0.47	0.58
Pango	0.24	0.24
Rural	0.53	0.63
Teuma	0.46	0.46
Grand Total	0.41	0.47

The survey asked households whether they perceived land disputes or theft as issues in their agricultural production or as barriers to increased investment and productivity of their plots. A surprising amount of respondents were keen to suggest that both land disputes and theft were issues, 41% and 47% respectively. This alone gives an idea as to how widespread perceptions of land disputes and small-scale agricultural theft may be in Vanuatu. However, it is important to restate that this data, being based solely on the perception of respondents, cannot infer any causality of theft or land disputes on agricultural production.

Some villages were seen to have a larger proportion of respondents indicating that land disputes and theft were issues in their agricultural production. Villages and areas farthest from urban areas had the highest percentage of respondents describing land disputes as issues in agricultural production – 53% in Rural, 46% in Teuma, and 47% in Eratap. Erakor and Pango on the other hand had significantly less, at 38% and 24% respectively. Regarding theft, we find again that Pango has the fewest mentions, at 24% of respondents, while Rural has the most, at 63% of respondents. Rates amongst remaining villages are quite high: Erakor (50%), Eratap (58%), and Teuma (46%).

It appears as if the wealth and proximity of a village to centre-town give it a lower likelihood of having land disputes and theft as issues in agricultural production. This may be explained by families relying less on small-holder and sustenance agriculture when they are closer to urban areas.[14] In Pango village for example, households do not participate in agricultural production to the same extent as say, rural areas. Because of this they are much less likely to respond yes

[14] All households included in the survey, both peri-urban and rural, had some land on which they practiced some form of agricultural production.

to the question on whether they consider land disputes or theft as issues in their agricultural production or as barriers to increased investment and productivity of their plots. This does not imply a negative relationship of perceived land disputes with expenditures on imported food staples however, as we observed previously (section 4.2.4) that no evident relationship existed between how much a household spends of imported food staples and how close they live to urban areas or with respect to their wealth.

We therefore expect there to be an overall positive correlation between consumption of imported food staples and perception of land disputes as barriers to agricultural production. This relationship depends primarily on the expectation that perceptions of land disputes (and theft) detract from the profitability and appeal of small-scale agriculture, therefore creating a positive relationship with our food security indicator (presence of land disputes and theft increase the amount of imported food staples per person out of necessity).

4.2.6 Soil Quality

Table 7 - Soil Quality and Fallow Periods

Average Plot Fallow Period in Years	Soil Quality Better 10 Years Ago		Number of Observations
	No[15]	Yes	
0	66.66%	33.33%	12
1	12.50%	87.50%	16
2	10.53%	89.47%	19
3	50.00%	50.00%	8
4	16.67%	83.33%	6
5	41.67%	58.33%	12
6	33.33%	66.67%	3
7	100.00%	0.00%	1
10	100.00%	0.00%	1
Grand Total	**25.76%**	**74.24%**	**78**

As all respondents from the survey practiced some form of agricultural production, we are able to discern some interesting relationships between average crop fallow periods and trends in soil quality. It should however be taken into consideration that some respondents included in the survey may not have been the most knowledgeable on the subject of fallow periods, particularly those who responded to the survey while the head of the household was absent. This appears to have mostly been the case with households that responded as to having no fallow periods for their crops and gardens. This is discussed later in Section 4.6 4.6 Sampling Issues.

In general we can see that a negative relationship exists between how long a household's average fallow period is for and whether soil quality was deemed better 10 years ago – The

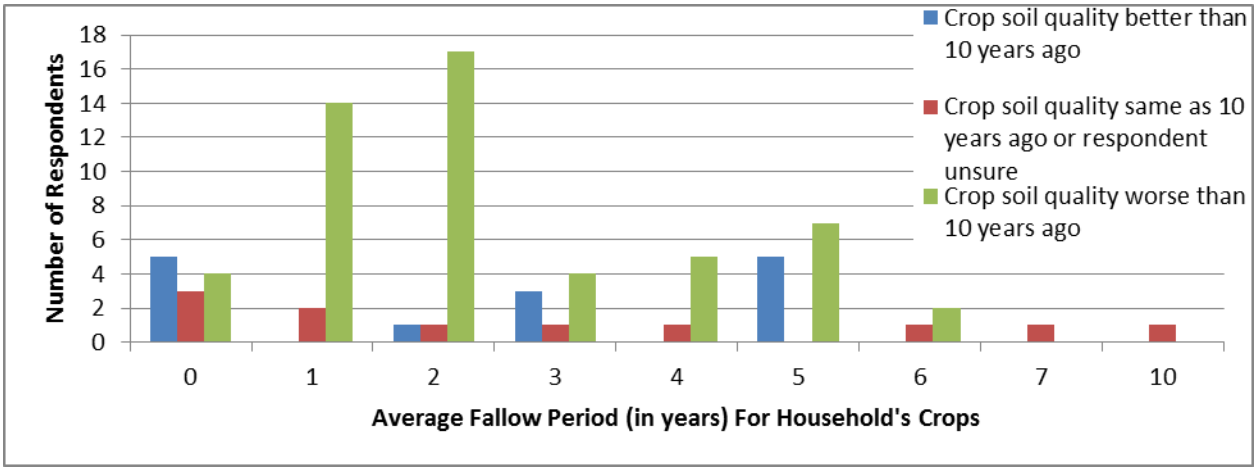
[15] Note that splitting responses on perceived trends in soil quality into yes and no was done to facilitate regression analysis. The 'no' category includes household the responses 'same' to the question of whether crop soil qualities were better 10 years ago.

negative correlation of -0.0931 is shown in Figure . This finding is to be expected intuitively. A household which practices longer fallow periods should expect to see relatively better soil quality in the medium to long run. As was mentioned in the section 2.2 Food Security in Vanuatu, traditional practices of clearing soil and the expedited use of soil for plots and gardens place risks on Vanuatu's soil quality. Improper soil management techniques and consequent trends in poorer soil quality are expected to hurt agricultural yields and thus how much of household food consumption is being sourced from local production.

Figure 11 - Correlation of Soil Dummy with Average Fallow Period

	Soil Dummy	Average Fallow Period (years)
Soil Dummy	1	
Average Fallow Period (years)	-0.0931	1

Figure 12 - Soil Quality Trends and Fallow Periods



4.2.7 Plot Numbers, Sizes, and Distances

Table 8 - Average Number of Plots, Aggregate Area, and Distances per Household

Villages	Average Plots per Household	Average Household Total Crop Area (m^2)	StdDev of Household Total Crop Areas (m^2)	Percent Average Distance from Households			
				0-1 Km	2-4 Km	5-10 Km	11 Km +
Erakor	2.5	4213	2575	30.00%	40.00%	30.00%	0.00%
Eratap	2.79	1442	1517	38.46%	42.31%	15.38%	3.85%
Pango	2.06	771	962	54.55%	31.82%	13.64%	0.00%
Rural	4.63	4368	6039	30.77%	30.77%	15.38%	23.08%
Teuma	5.15	7402	8818	58.82%	23.53%	17.65%	0.00%
Grand Total	**3.6**	**3280**	**5305**	**43.27%**	**33.65%**	**16.35%**	**6.73%**

From Table 8 - Average Number of Plots, Aggregate Area, and Distances per Household we can see statistics on the average number of plots, total plot areas, and plot distances from households for each of the villages surveyed. We notice that the villages farthest from urban areas have the greatest average number of separate agricultural plots – Rural with 4.63 and Teuma with 5.15. Other villages surveyed have a relatively homogenous average number of plots per household, ranging between 2.06 in Pango to 2.79 in Eratap.

We also notice that Pango village, being the closest in proximity to centre-town, has significantly smaller average aggregate plot area per household compared to other villages – 771 m^2 on average. We expect this to be a result of there simply being less available land in villages closer to more densely populated areas. This is likely also the case of the relatively densely populated village of Eratap which has the second smallest aggregate plot area of 1442

m^2. These two villages also appear to have very few plots farther than 4 kilometers from the homestead suggesting smaller scale agricultural production and dependency.

Erakor and Rural villages have significantly larger plot areas than Eratap and Pango. However, they also have larger shares of plots relatively farther away. This is particularly the case with Rural villages which collectively have over 27% of their plots farther than eleven kilometers away from their homes. Teuma stands out among the surveyed villages as having not only the largest average area of agricultural plots per household ($7402m^2$) but also having the largest share within 1 kilometer of the home. This characterises Teuma village as the best suited for commercial agricultural production. Indeed, we find that Teuma is situated in a part of Efate with expansive flat terrain and rich soil, conducive to agricultural production of a larger scale.

Looking at the standard deviation of household aggregate plot areas, we gain an idea as to how homogenous agricultural production is within villages. Teuma has the largest variation in plot sizes which is indicative of some households having more commercially sized agricultural plots.[16] Households within Rural and Erakor villages have slightly smaller, albeit relatively large variation in plot areas. Agricultural production in Eratap and Pango on the other hand is expected to be relatively homogenous due to the low variation in their household plot areas.

[16] The survey conducted in Teuma village included a couple of households with particularly large agricultural plots. One of which was concluded as an outlier and taken out of the sample data used in regression analysis.

Table 9 - Village Plot Sizes

Villages	% <200m^2	200m^2 ≤ % < 500m^2	500m^2 ≤ % < 800m^2	800m^2 ≤ % < 1500m^2
Erakor	0.00%	15.00%	0.00%	75.00%
Eratap	11.32%	58.49%	13.21%	11.32%
Pango	42.86%	37.14%	2.86%	17.14%
Rural	0.00%	47.73%	17.05%	45.45%
Teuma	0.00%	44.07%	16.95%	32.20%
	1500m^2 ≤ % < 25000m^2	**2500m^2 ≤ % < 5000m^2**	**5000 m^2 ≤ % < 1 hectare**	**% ≥ 1 hectare**
Erakor	5.00%	0.00%	0.00%	0.00%
Eratap	0.00%	0.00%	0.00%	0.00%
Pango	0.00%	0.00%	0.00%	0.00%
Rural	1.14%	9.09%	0.00%	0.00%
Teuma	3.39%	3.39%	8.47%	1.69%

We can look more closely at variation in plot sizes via

Table 9 and confirm that Eratap and Pango have a much higher proportion of relatively smaller plots – 70% and 80% under 500m^2. Erakor has a hefty proportion (roughly 75%) of their plots falling within 800m^2 and 1500m^2. Rural villages and Teuma have a wider range of plot sizes, ranging from 200m^2 to 5000m^2 in rural and from 200m^2 to more than one hectare in Teuma.

It is expected that household's with larger plot size will be able to have greater agricultural production and thus source more of their food staples locally. Therefore, we expect to see a negative relationship between plot sizes and the food insecurity indicator.

4.2.8 Agricultural Sales and Production Trends

Table 10 - Agricultural Sales

Villages	Number of Households Selling	Percent That Sell	Among Households that Sell Agricultural Produce:		
			Percent Selling in Village	Percent Selling in Central Market	Percent Selling in 'Other'[17]
Erakor	7	87.50%	71.43%	100.00%	0.00%
Eratap	14	73.68%	7.14%	92.86%	14.29%
Pango	14	82.35%	92.86%	14.29%	50.00%
Rural	19	100.00%	73.68%	100.00%	15.79%
Teuma	13	100.00%	7.69%	100.00%	23.08%
Grand Total	**67**	**88.16%**	**50.75%**	**80.60%**	**22.39%**

Regarding Agricultural Sales and Production Trends from Table 10, we notice that Rural and Teuma villages have 100% of respondents selling their agricultural produce in one form or another while the remaining surveyed villages range from 73.68% in Eratap to 87.50% in Erakor. This data shows how dependent the more rural villages are on market sales of agricultural produce. Villages such as Pango, Erakor, and Eratap are in closer proximity to town and therefore are able to find more formal employment. This means that they have less time for agricultural production or do not need it as a supplement to their cash incomes.

We also notice that everyone surveyed in Rural and Teuma villages reported selling their agricultural produce in town. This figure seems overly high. Perhaps respondents interpreted the question of where they sold their agricultural produce to include people in relatives' households. If this sample was perfectly representative of the village populations as a whole,

[17] Respondents included under 'Other': nakamals, village markets, restaurants, and hotels.

then we would expect the markets to be completely flooded with thousands of vendors whereas realistically the number falls within the hundreds.

Table 11 - Agricultural Production Trends

Villages	Household Produced More 10 Years Ago?					
	No		Same		Yes	
Erakor	3	37.50%	0	0.00%	5	62.50%
Eratap	6	31.58%	0	0.00%	13	68.42%
Pango	7	41.18%	5	29.41%	5	29.41%
Rural	6	31.58%	1	5.26%	12	63.16%
Teuma	4	30.77%	5	38.46%	4	30.77%
Grand Total	**26**	**34.21%**	**11**	**14.47%**	**39**	**51.32%**

When asked whether the household produced more in terms of agricultural production 10 years ago, about 34% of respondents indicated that they produced more now, about 15% indicated that they produce the same now as before, and the remaining 51% indicated that they did produce more 10 years ago. This suggests that agricultural production per household has been decreasing or is becoming more concentrated among a certain few. These results are interesting. However, their value is impacted by the fact that many household respondents were elders and did not produce the same amount as ten years previous simply due to their age and the physical constraints posed.

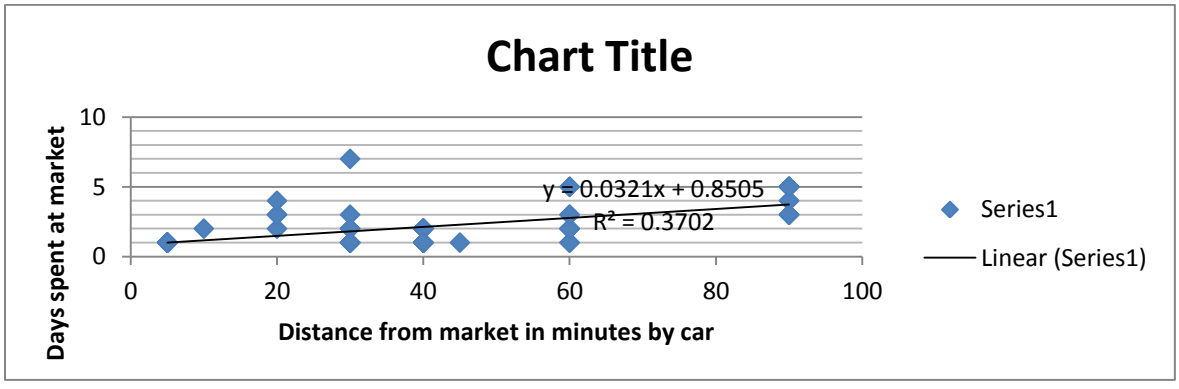
Nevertheless, we find interesting comparisons of production trends between villages. Rural villages were initially expected to have a relatively smaller change in agricultural production compared to more peri-urban villages. Instead, they have 63% of respondents claiming to have produced more 10 years ago, much more than the entire sample's average of 51%. This is

surprising considering that we expected to find a strong relationship between how far a village was from centre-town and how food secure they were.

We also observe that a large percent of respondents from Eratap village claim to have produced more 10 years ago (68%). From an interview with the village's chief it was understood that Eratap's population had more than doubled over the past 10 years and that population density was becoming an issue (Eratap Chief 2012). The ensuing effect on agricultural production was that plots were being split into smaller and smaller segments as fathers passed inheritance onto their sons which made it difficult for families to produce on a larger scale (Eratap Chief 2012). Furthermore, the chief acknowledged that soil quality was likely being hurt by the inherent increased intensity of production (Eratap Chief 2012).

We believe that change in population density is an important factor contributing to falling trends in agricultural production across villages. Previously, we expected to see a positive relationship between the density of a village's population and the proximity to urban areas. This does not seem to be the case with rural villages as their populations are growing rapidly regardless of their distance from urban areas and centre-town.

Figure 13 - Days Spent at Central Market vs. Distance from Central Market



Regarding market sales, we find that the amount of time a person spends at the market is highly correlated with the distance of that person's village.

4.2.9 Crops and Livestock

From Table 12 we can see what vegetables, staples, and livestock the sample population produces in their plots and gardens. We notice that not all villages are producing their own food staples (root crops: Manioc, Kumala, Taro, and Yam). Erakor and Pango villages, the wealthiest and closest in proximity to town, were the only ones not to have 100% of respondents growing their own manioc (cassava). Furthermore, these two villages had a starkly lower rate of respondents growing kumala (sweet potato), 38% and 24% respectively compared to the sample average of 53%. All villages reported fairly similar shares of households growing Taro and Yams.

Rural villages have a high proportion of households (32%) owning cattle (bullock) compared to the sample average of 12%. Rural households surveyed had on average 4.3 heads of cattle each. All villages reported to have been raising pigs however rural areas had the highest average number per household at 1.95. All villages reported raising a relatively similar average number of chickens per-household except Erakor which had no chickens.

Table 12 - Household Crop and Livestock Production

Villages	Percent of Households Producing:								
	Brocoli	Onion	Eggplant	Pumpkin	Tomatoes	Capsicum	Zuchini	Corn	Lettuce
Erakor	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eratap	0.00%	0.00%	0.00%	31.58%	0.00%	0.00%	0.00%	15.79%	0.00%
Pango	5.88%	5.88%	5.88%	17.65%	5.88%	0.00%	5.88%	29.41%	5.88%
Rural	0.00%	0.00%	5.26%	5.26%	15.79%	15.79%	5.26%	15.79%	26.32%
Teuma	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Grand Total	**1.28%**	**1.28%**	**2.56%**	**12.82%**	**5.13%**	**3.85%**	**2.56%**	**14.10%**	**7.69%**

Villages	Percent of Households Producing:							
	Beans	Carrot	Susut	Round Cabbage	Cucumber	Banana	Chinese Cabbage	Aelen Cabbage
Erakor	25.00%	0.00%	0.00%	0.00%	37.50%	75.00%	12.50%	62.50%
Eratap	31.58%	0.00%	0.00%	0.00%	5.26%	89.47%	0.00%	94.74%
Pango	17.65%	0.00%	0.00%	0.00%	11.76%	35.29%	5.88%	94.12%
Rural	21.05%	5.26%	5.26%	21.05%	15.79%	52.63%	31.58%	89.47%
Teuma	38.46%	7.69%	30.77%	15.38%	38.46%	61.54%	46.15%	100.00%
Grand Total	**28.21%**	**2.56%**	**6.41%**	**7.69%**	**20.51%**	**62.82%**	**19.23%**	**89.74%**

Villages	Share of Households Growing Staples:			
	Manioc	Kumala	Taro	Yam
Erakor	87.50%	37.50%	87.50%	75.00%
Eratap	100.00%	63.16%	94.74%	47.37%
Pango	94.12%	23.53%	94.12%	70.59%
Rural	100.00%	52.63%	94.74%	63.16%
Teuma	100.00%	76.92%	92.31%	46.15%
Grand Total	**97.44%**	**52.56%**	**91.03%**	**57.69%**

Villages	Share of Households Raising:			
	Chicken	Pigs	Bullock	Goats
Erakor	0.00%	37.50%	0.00%	0.00%
Eratap	84.21%	63.16%	10.53%	5.26%
Pango	58.82%	52.94%	5.88%	0.00%
Rural	73.68%	31.58%	31.58%	0.00%
Teuma	61.54%	30.77%	0.00%	0.00%
Grand Total	**64.10%**	**44.87%**	**11.54%**	**1.28%**

Villages	Average Number of Livestock:			
	Chickens	Pigs	Bullock	Goats
Erakor	0.00	1.13	0.00	0.00
Eratap	13.53	1.26	0.47	0.05
Pango	12.88	1.47	0.06	0.00
Rural	9.89	1.95	4.32	0.00
Teuma	7.46	0.92	0.00	0.00
Grand Total	**10.06**	**1.384615**	**1.17949**	**0.012821**

4.2.10 Knowledge of WTO

Table 13 - Knowledge and Approval Rate of WTO

Villages	Knowledge of WTO		WTO Approval		
	Yes	No	Yes	Unsure/Indifferent	No
Erakor	12.50%	87.50%			100.00%
Eratap	26.32%	73.68%	40.00%	40.00%	20.00%
Pango	47.06%	52.94%		50.00%	50.00%
Rural					
Teuma					
Grand Total	17.95%	82.05%	21.40%	42.90%	42.90%

At an early stage of the research, well before the survey was launched in Vanuatu, the principal researcher intended to explore the effects of Vanuatu's recent ascension to the World Trade Organization (WTO). In the end, it was decided to include three questions on the survey: are you aware of Vanuatu's recent ascension to the WTO, do you approve, and why.

We find that the vast majority of respondents were not aware of the WTO, or Vanuatu becoming a member country (only 18% were aware of the institution at all). The only village that had a significant proportion of respondents aware of the WTO was Pango, with 47%. Eratap and Erakor followed with 26% and 13% respectively. Of those with some knowledge on the WTO, 43% did not approve of Vanuatu joining, 43% were indifferent or unsure, and 14% did approve of Vanuatu joining. The fact that there were so few respondents in support of joining the WTO reflects public criticism that citizens were not sufficiently consulted or aware of the decision to join (sources). The source of information for those aware of the WTO included: discussion at nakamals, churches, and by radio.

An additional question on the survey gathered information on how many respondents were aware of the country's Agricultural Development Bank and the services it offers to small-holder farmers or those wishing to be involved in expanding their agricultural production. Only 4% were aware of the institution at all. That so few are aware of institutions having implications for agricultural production shows the severity of the lack of dissemination of information in Vanuatu.

4.3 Empirical Strategy

The final equation used for regression analysis, based on Ordinary Least Squares (OLS), was chosen after experimenting with several alternative equations and running regression diagnostics and tests. A summary of the diagnostics and tests used to help conclude with the final equation is contained within Section 4.5. The final OLS equation used is the following:

is the dependent variable, an indicator of household food security from a Ni-Vanuatu context. Further information on all of the independent variables can be found in Appendix C.

4.4 Empirical Results

Figure 25 shows the inconclusive results of the final regression equation. Note that only one of the independent variables is considered significant: Erakor. The signs of most coefficients however are largely consistent with the authors' predictions outlined in Section 4.2 4.2

Descriptive Statistics. Below we discuss the relationship of the independent variables with the dependent food security indicator.

4.4.1 Village Dummies

As expected, we see that Pango, the wealthiest and closest in proximity to centre-town, has a relatively higher rate of imported food staple consumption per family member. In fact, compared to rural areas, a household in Pango village will consume 695 vatu more per person, per month ceterus paribus (the variable's coefficient is however insignificant and should therefore be interpreted lightly). All other villages however, are seen to spend considerably less on imported food staples relative to rural villages. This is contradictory to what we previously expected and suggests that inter-village characteristics play a particularly strong role in levels of food security and household relationships with local agriculture. Prior to testing the relationship with food security, we expected that the farther a village was from the centre of town, the lower its expenditures on imported food would be.

The coefficient for Erakor village, the only significant coefficient in the regression with a P-value of 0.018, stands out as having the widest discrepancy compared to rural areas. Households within Erakor source much less of their food staples from imported sources – 1295 vatu per person per month – and consequently are expected to use local agriculture much more. Other peri-urban villages surveyed, Eratap and Teuma, also have lower expenditures on imported food staples per person compared to rural areas, their coefficients being -205 and -513 respectively (however not significant).

Contrary to the prior expectation that households closer to urban areas would have higher expenditures on imported food staples, we find that poorer rural areas, with relatively less

income from distant urban employment, actually spend more on imported food staples per family member. These rural villages are poorer and so it cannot be considered solely a wealth effect that causes a household to purchase more imported food staples. Instead, how much a family spends on imported food staples per person depends on their respective village. Some villages may be placing greater importance on growing their own local food products. Indeed while completing the survey in Erakor – the village with the lowest average imported food staple expenditures – it was clear that respondents were particularly keen on preserving local food production techniques and diets.

4.4.2 Gender

Previous to the regression and statistical analysis of the survey data we expected to see a negative relationship between the percentage of males in the household and the amount of food staples sourced locally. We developed this expectation on the fact that most gardening activity is done by a household's women. The regression results for the variable's coefficient turned out to be insignificant (P=0.491) however the value of the coefficient (β=-5.70) suggests that households with higher proportions of males had slightly lower levels of expenditure on imported food staples per household member.

The result of families with relatively more men sourcing more food staples locally is interesting and warrants further investigation. However, because the coefficient is insignificant it is impossible to conclude with this dataset that there is any real effect on how much a household spends on imported food staples.

4.4.3 Age

In the section 4.2 Descriptive Statistics it was explained how a negative relationship was expected between the proportion of children in a household and the food insecurity indicator. Similarly, a positive relationship was expected for the proportion of elders in a household. The signs of the regression coefficients for Percentchildren and Percentelder confirm these predictions (β=-2.72, β=+3.70) however both are found to be highly insignificant (P=0.702, P=0.498) .

4.4.4 Education

The variable Maximumadulteducation was expected to have a positive relationship with the food insecurity indicator. From the results of testing the regression equation we find that the sign of the coefficient (β=+161.78) is in line with expectations however the coefficient itself is insignificant (P=0.491).

4.4.5 Housing (Income)

Using the Housetype variables as proxies for household income, it was expected that they would have a positive relationship with the household food insecurity indicator. This meant that Housetype3, characterising households with poorest quality physical structures, was expected to have a negative relationship with the food insecurity indicator compared to the control dummy variable, Housetype2. Housetype1 on the other hand was expected to have a positive relationship with the food insecurity indicator compared to control dummy variable, Housetype2.

Both coefficient values turned out to be negative (β=-265.2 compared to β=-25.7), confirming what was expected for Housetype3 but contradicting prior expectations for Housetype1. However, the coefficients for both variables turned out to be insignificant (P=0.415 compared

to P=0.954). As the effect of moving from Housetype2 to Housetype3 gives a substantially stronger and more significant result than the move from Housetype2 to Housetype1, it may suggest that as a household's income increases, the marginal increase in consumption of imported food staples decreases.[18]

4.4.6 Plot Distance

The variable Mediumandup was included in the regression equation to help determine the effect of having only plots relatively far away from the household (2Km+) had on food security. Although insignificant, the sign of the variable's coefficient turns out to be in line with what was expected. That is, when a family has only agricultural plots that are far from the homestead, they will consume more imported staples in place of local staples.

4.4.7 Number of Plots

The Gardens variable was included in the regression equation to help measure the effect that having multiple plots had on the amount of imported food staples consumed. Unfortunately, the variable's coefficient is insignificant. However the coefficients sign is in line with prior expectations. That is, the more separate agricultural plots a household owns and operates decreases the amount of imported food staples consumed.

4.4.8 Individual Plot Size

The Mediumsmallanddown variable was included in the regression equation to measure the effect that a household only having relatively small plots (less than 800m^2) would have on food security. Unfortunately, this variable's coefficient turned out to be highly insignificant (P=0.751). The sign of the coefficient however is interesting and warrants further investigation.

[18] see Figure 26 - Proposed Relationship Between Income and Imported Food Staple Consumption

It was initially expected that a household with access to larger agricultural plots would be sourcing more of their food staple consumption locally. However insignificant, the sign of the Mediumsmallanddown variable's coefficient tells a different story (β=-152.67). It suggests that households with only relatively small individual spaces for agricultural production will not consume as much imported staples as those with larger plots. Perhaps this is a result of households with larger plots being wealthier or having higher societal status and thus being able to afford more imported foods.

4.4.9 Aggregate Plot Area

The variable Logtotalarea representing each household's combined total crop area was included in the regression equation to determine the effect of aggregate plot area had on a households consumption of imported vs. local food staples. Two effects were expected. First, it was presumed that families with more space to grow their own food would do so and thus consume fewer imported food staples. On the other hand, it was expected that families with more land would have higher income and societal status, thus being able to afford a diet high in imported food products and staples.

However insignificant (P=0.205), the sign of the variable's coefficient (β=+628.81) shows that the latter of the two effects is likely stronger. That is, the more aggregate land a household has will have a tendency to increase the amount of imported food staples consumed through an income effect.

4.4.10 Soil Quality

The Soildummy variable was included in the regression equation to measure the effect that negative trends in soil quality were having on a household's consumption of local and imported

food staples. However insignificant (P=0.241) the variable's coefficient (β=+584.29) shows that prior expectations that negative trends in soil quality would increase a household's consumption of imported food staples may have been correct.

4.4.11 Land Disputes

The variable Landdummy was included in the regression equation to explore the relationship between whether a household perceived land disputes as barriers to their agricultural production, and their expenditure on imported food staples per member. Unfortunately the regression results give a highly insignificant variable coefficient (P=0.999). Because the coefficient is so insignificant and the confidence interval relatively small, we can conclude that there is likely no relationship between this survey's measure of the perception of land disputes and how much a household consumes imported food staples. If there does exist an effect, it is likely that this survey did not determine it due to measurement errors and sampling bias (see section 4.6, 4.6 Sampling Issues).

4.4.12 Theft Occurrence

The Theftdummy variable's coefficient is not statistically significant in this analysis (P=0.247). The estimated effect of this variable on the amount of imported food staples a household uses is negative (β=-319.96), which counters our prior expectations and intuition. We had initially expected that if theft was perceived as an issue in household agricultural production then families would produce less and become more dependent on imported food staples.

However, the sign of the variable coefficient from regression analysis suggests that the opposite is true. This may be because families that were producing more agriculture were more

likely to notice theft or regard it as an issue, suggesting reverse causality. Overall, the lack of statistical significance prevents an interpretation of this as opposing our hypothesis.

4.5 Regression Diagnostics

In order to ensure that our originally specified model and data met the assumptions of OLS regression, we carried out a series of statistical tests and graphical analyses. Diagnostics and discussion were carried out in consideration of the following assumptions inherent in running an OLS: linearity, normality, homoscedasticity, collinearity, independence of error terms, measurement error, and model specification.

In the end we decided to run a regression while using STATA's robust option for estimating standard errors using the Huber-White sandwich estimators (UCLA 2012). Using such robust standard errors can deal with a collection of minor concerns about failure to meet assumptions, such as minor problems about normality, heteroscedasticity, or some observations that exhibit large residuals, leverage or influence (UCLA 2012).

4.5.1 Outliers

Having an outlier in the dataset can make a large difference in the results of regression analysis. For this reason we created a graph matrix in STATA to see if any points stood out. We only plotted graphs for variables which were included in the model and that were non-dummy. From Figure 23 – Graph Matrix for Non-Dummy Variables we can see that a significant outlier existed for total garden area. The outlier had a reported crop area of 320,000 square meters compared to the sample mean of 3190 square meters. Running a regression with this observation and without it showed very different results. We can justify removing it because it obviously applies to a household with significantly larger agricultural holdings, perhaps larger scale commercial

agriculture as opposed to more small-holder, subsistence level agriculture as is the focus of this study. The outlier was subsequently dropped entry from the dataset.

4.5.2 Normality

Proper OLS regression analysis needs to ensure that the model's residuals are normally distributed. This condition ensures that the p-values for t-tests and F-tests will be valid.

After running a regression analysis, we used STATA to capture the residual (error) values, and then tested them for normality. From Figure 14 - Kernel Density Plot – Residuals From Regression we see that the regression's residuals closely resemble a normal distribution. To further test the normality of errors, we conducted a Shapiro-Wilk W test for normality. As shown in Figure 15 - Shapiro Wilk W Test for Normality of Residuals, we see that the assumption of residuals being normally distributed cannot be rejected at a 1% significance level, based on a P-value of 0.01.

4.5.3 Homoscedasticity

Before using robust standard errors in the final regression,[19] White's test and the Breusch-Pagan test were used to detect the presence of heteroscedasticity of residuals. Both of which concluded that the null hypothesis assumption of homoscedasticity (constant variance of error terms) could be rejected under a 1% significance level (see Figure 17 - Breusch-Pagan Test for Homoscedasticity).

To check for homoscedasticity, we also plotted the residuals from the regression model against predicted values. From Figure 16 we can see that the distribution of data points becomes slightly wider towards the right end of the graph, an indication of heteroscedasticity. However,

[19] Robust standard errors are given by STATA option command 'robust'.

we conclude that any problem with heteroscedasticity has been dealt with through use of robust standard errors and no further correction is necessary.

4.5.4 Multicollinearity

We can conclude that multicollinearity is not an issue with this regression. To test for multicollinearity, we used STATA to compute the variance inflation factors for each variable, the results of which can be found in Figure 18 - Variance Inflation Factor Test for Multicollinearity. As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation (UCLA 2012). Considering that all variables display VIF values of lower than 10, we can conclude that multicollinearity is not an issue with this regression. Estimates for a model cannot be calculated if there exists a perfect linear relationship among independent variables.

4.5.5 Linearity

We found that the assumption of linearity was violated by the variable totalarea. To correct this we transformed it into its log form, logtotalarea.

In OLS we make the assumption that the relationship between the dependent and independent variables is linear. If this is not the case, then OLS is not a suitable model for our data as it will try to fit a straight line to data which clearly does not match. To test for linearity we plotted an augmented partial residual plot against each independent variable in the model (UCLA 2012). Setting lowess smoothing to a bandwidth of 1, we observe that the total crop area variable displays a non-linear relationship (Figure 19). Indeed, the variable shows signs of being highly skewed to the right from a normal distribution (Figure 20). To ameliorate this we transformed the variable into log form (lgtotalarea). The transformation helped greatly with the skewedness (Figure 21) and greatly lessened the deviation from normal distribution (Figure 22).

4.5.6 Model Specification

Model specification errors derive from irrelevant variables being included in the regression or relevant variables being left out. As a result, estimates of regression coefficients can be substantially affected (UCLA 2012).[20] To detect model specification errors in our model we used ovtest and linktest commands in STATA. The results from the ovtest (Figure 23) indicate that we cannot reject the null hypothesis of the model having no omitted variables. The results from the linktest are inconclusive (Figure 24) because the generated linear predicted value from our model is not statistically significant (UCLA 2012).

We conclude by acknowledging the possibility that certain relevant variables may have been left out of the model. However, due to the limited sample size of this survey, we are not able to include many additional variables due to the inherent lack of degrees of freedom and the implications on hypothesis testing. Furthermore, the questionnaire and survey lacked financial capacity to capture all required information from respondent households.

4.6 Sampling Issues

There are a number of sampling issues which arrived in this study. These include having an insufficient sample size and high probability of measurement errors.

4.6.1 Sample Distribution

Through word of mouth it was discovered that certain village chiefs (such as that of Ifira Island village) may not have been very open to the idea of household surveys while villages such as

[20] "If relevant variables are omitted from the model, the common variance they share with included variables may be wrongly attributed to those variables, and the error term is inflated (omitted variable bias). On the other hand, if irrelevant variables are included in the model, the common variance they share with included variables may be wrongly attributed to them." (UCLA 2012)

Erakor and Eratap were more suitable and Eratap were more suitable. Consequently, the study was only able to include samples from select peri-urban villages as opposed to all of them.

Due to the nature of having to contact the peri-urban village chiefs before conducting the survey meant that they had time (village surveys were on average conducted 3 days after the respective meetings) to discuss with local inhabitants the purpose and details of the survey. The effects of which may have affected the results of the survey as the selection of participant households was often influenced by households appealing to be included in the survey.

4.6.2 Sample Size

The research would have benefitted greatly from a larger dataset. This would have improved the estimation results by providing more accurate information and a more complete dataset. This study originally intended to collect data on households from urban areas, in addition to peri-urban and rural. This would have provided a stronger analysis on the comparison of different demographic zones. If the sample had been larger and the time dedicated to sampling longer, it would have been likely that urban observations could be included and this would have enabled a stronger conclusion about the effects of urbanization on the consumption of imported food staples and local food security.

There may not have been an adequate representation of each village. Especially given that only 15 were selected from the most sampled (Eratap). What may reduce the influence of this measurement error, and that may aid in more accurate inter-village comparisons, is that all of the participant villages are fairly homogenous in nature to begin with.

4.6.3 Measurement Error

Issues of measurement error appear to be extensive in this paper. Whether a result of respondents answering intentionally or them answering inaccurately by mistake, it is believed that the issue may have substantially affected the descriptive statistics and the regression analysis results.

Gathering accurate data on household income and expenditures was particularly challenging due to the fact that not all respondents were able to confidently recall or quantify totals. Sometimes, respondents would assert that they were unsure and were just using an estimate of what they thought was correct. Often too, respondents would need help in basic math used to calculate a monthly average. In this case, the survey administrator would aid by taking weekly data and multiplying by a factor of four to give a monthly measure. We note that imprecise measurement of household income and expenditure data may have posed issues in the empirical results of this study. Coefficients of estimator variables may have been influenced by measurement error. Furthermore, imprecise measurement may have been related to the educational attainment and age of the respondents, posing problems with endogeneity in later regression.

We know that some measurement error existed due to the fact that rural households reported a higher level of expenditure on imported food staples than total food expenditures (Table 5 - Food Expenditures). The implications of rural areas overstating their expenditures on imported food staples (or conversely understating their total food expenditures) could greatly affect the results of this regression. If rural household have all overestimated their imported food

expenditures then maybe with correct data we would find a stronger negative relationship between expenditure of imported food products and distance from urban areas.

The reason for why rural households overstated the ratio of imported food staples to total food expenditures is likely due to miscalculations on the part of respondents. There is a possibility that some respondents were confused as to whether total food expenditures included imported food staples since it had already been asked. It may also be due to certain respondents requiring assistance in calculating their monthly imported food staple expenditures. If a respondent was unsure of how to do the calculation, survey administrators would ask instead what quantity the household consumed per month, and then multiplied this by the standard market price (200 Vatu per 100 grams of rice). Unfortunately, helping quantify monthly expenditures this way meant that expenditures were overestimated in cases where the households would buy rice at cheaper prices, perhaps buying collectively in bulk thus lowering the marginal price. A final possibility is that respondents answered strategically by overstating the amount of imported food expenditures to improve the perception of their social standing. Especially in more rural areas, diets based on rice and bread are regarded as status symbols and households that consume more of such are regarded as 'wealthy'.

Another example of when respondents may have answered strategically, thus giving measurement bias to the regression results, was when they were asked respective levels of education. Having an education in Vanuatu is regarded as a status symbol and thus respondents may have inflated their actual educational attainment to make themselves look more

important. This is especially likely when the respondent was interviewed in front of family members or within earshot of other village members.

5. Conclusion and Policy Discussion

AS the results from this paper's empirical study are insignificant, we are unable to extract any specific policy recommendations from the analysis. However, we can conclude that it remains highly important for both the government and people of Vanuatu to consider the linkages between food security, land disputes, and land rights/tenure. Ultimately, to meet a food secure future in Vanuatu more needs to be done to raise the scale, competitiveness and appeal of locally produced food staples versus those imported.

Increasing the scale of domestically grown food crops to urban food markets should in economic terms decrease prices of these food items and thereby decrease the demand for imports (Welegtabit 2001). Producers who are currently producing at the semi-subsistence level must undertake more commercial production of food crops. This means improving methods of cultivation and extension of area devoted to food crops.

Academics have suggested that the government could adopt subsidization policies for increased commercial production of local food staples (Welegtabit 2001). This could be done by creating input subsidies on farm equipment, fertilizers, chemicals, and improving transport infrastructure (Welegtabit 2001). Another measure could be to impose tariffs or quotas on imported food staples (especially rice) whenever adequate supply of domestically grown food crops is available in the markets (Welegtabit 2001). Room for policy being able to increase the competitiveness of local food staples should be explored further however, it is expected that

such measures may have limited effectiveness considering the highly price-inelastic nature of rice and flour (Welegtabit 2001). Furthermore, the option for policy makers to manipulate the price of local products versus imported may be limited under WTO terms of agreement.

The sustainability of small-holder and household agricultural production in Vanuatu's peri-urban and densely populated areas should be safeguarded by alleviating pressures on soil fertility. Further progress needs to be made towards alternatives of current shifting cultivation practices. The Department of Agriculture should continue to advocate and disseminate information on approaches such as inter-planting, inter-cropping, and crop rotation practices using leguminous, nitrogen-fixing plants with traditional food crops (Welegtabit 2001).

Careful planning for the efficient use of land is becoming a major concern in light of current high population growth rates. As such, further research should be compiled on the effect of custom land tenure on small-holder and household agricultural production in densely populated areas. More needs to be explored on how the current system is affecting household access to credit, investment, and ultimately the ability to change production from semi-subsistence to commercial. Inherent in this is further understanding how Vanuatu's land disputes are affecting agricultural production. In conclusion, any inevitable future land reforms should prioritize the effect of those deemed at highest risk of food insecurity.

Appendix A – Figures

Figure 1 – Port Vila, Vanuatu

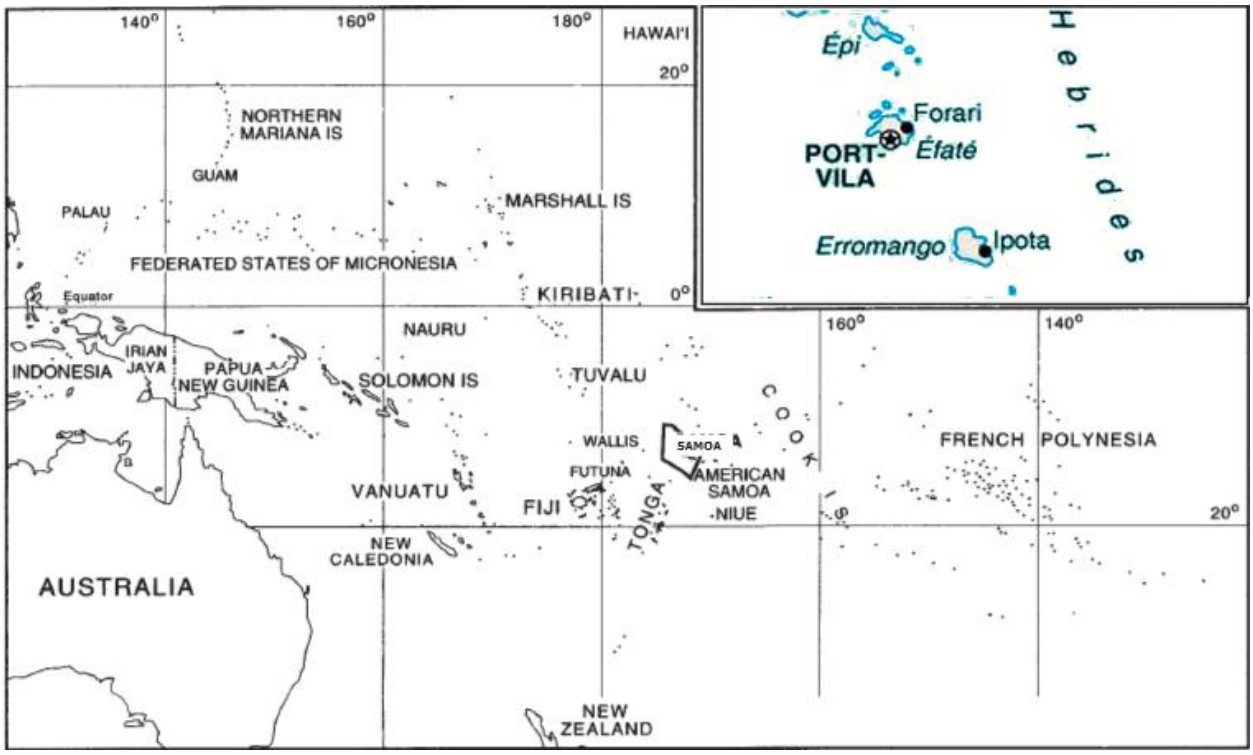
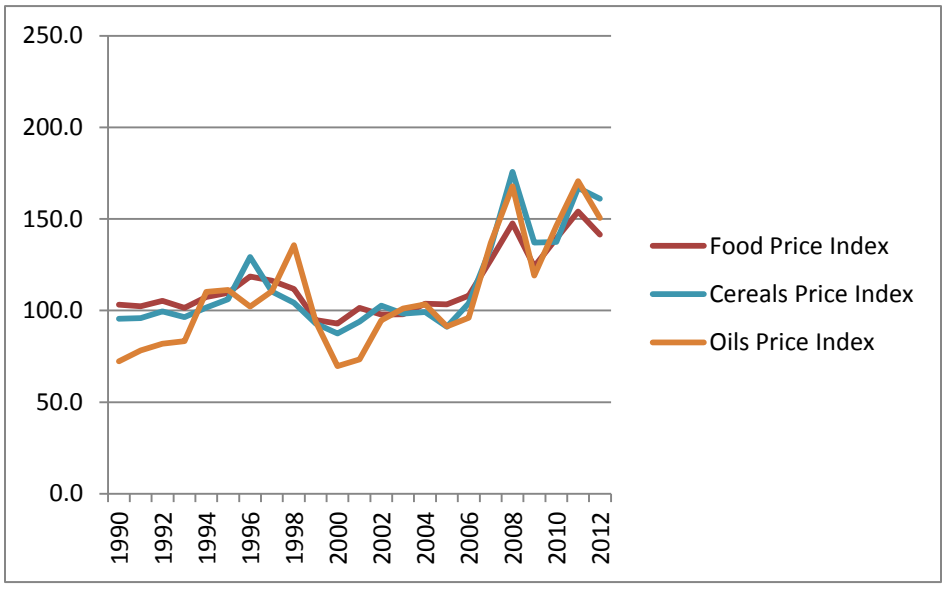


Figure 2 – FAO World Food Price Indices (2002-2004=100)[21]



[21] (FAO 2013) FAOSTAT. UN Food and Agriculture Organization. http://faostat.fao.org/. Retrieved March 20th, 2013.

Figure 3 - Declining Agricultural Productivity (1961-2007)[22]

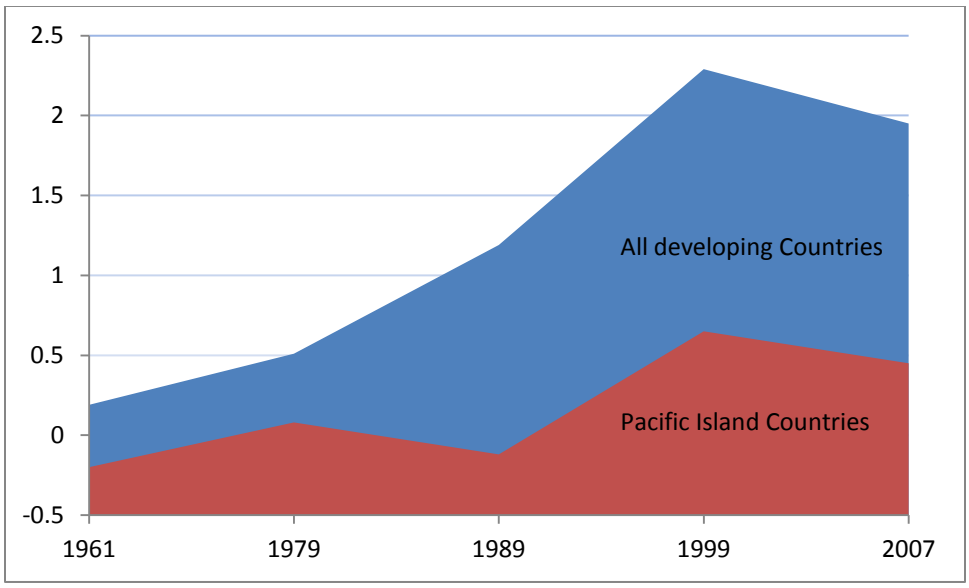
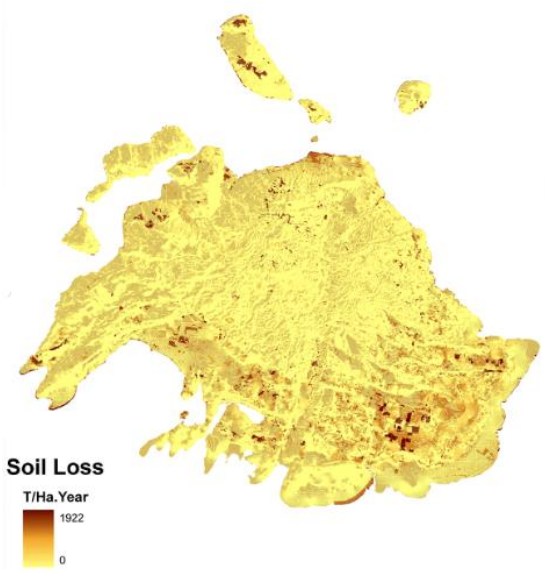


Figure 4 - Efate Soil Erosion Risk[23]



[22] Data sourced from (Fugile 2010), 'Total Factor Productivity in the Global Agricultural Economy: Evidence from FAO Data'. Productivity is measured by total factor productivity, which is the portion of output not explained by the amount of inputs used in production.

[23] (Dumas and Fossey 2009)

Figure 5 - Land Tenure and Vanuatu's Constitution

Articles within Vanuatu's Constitution Related to Cusomary Land Ownership and Dispute Resolution (Jowit 2004)**:**

Art 73: All land in the Republic of Vanuatu belongs to the indigenous custom owners and their descendants.
Art 74: The rules of custom shall form the basis of ownership and use of land in the Republic of Vanuatu.
Art 75: Only indigenous citizens of the Republic of Vanuatu who have acquired their land in accordance with a recognised system of land tenure shall have perpetual ownership of their land.
Art 78 (2): The Government shall arrange for the appropriate customary institutions or procedures to resolve disputes concerning the ownership of custom land.

[24] Overlay was constructed using a map of Efate land leases from the report: Vanuatu National Leasing Profile: A Preliminary Analysis (Scott, et al. 2012).

Figure 7 - Location of Peri-Urban Villages Surveyed

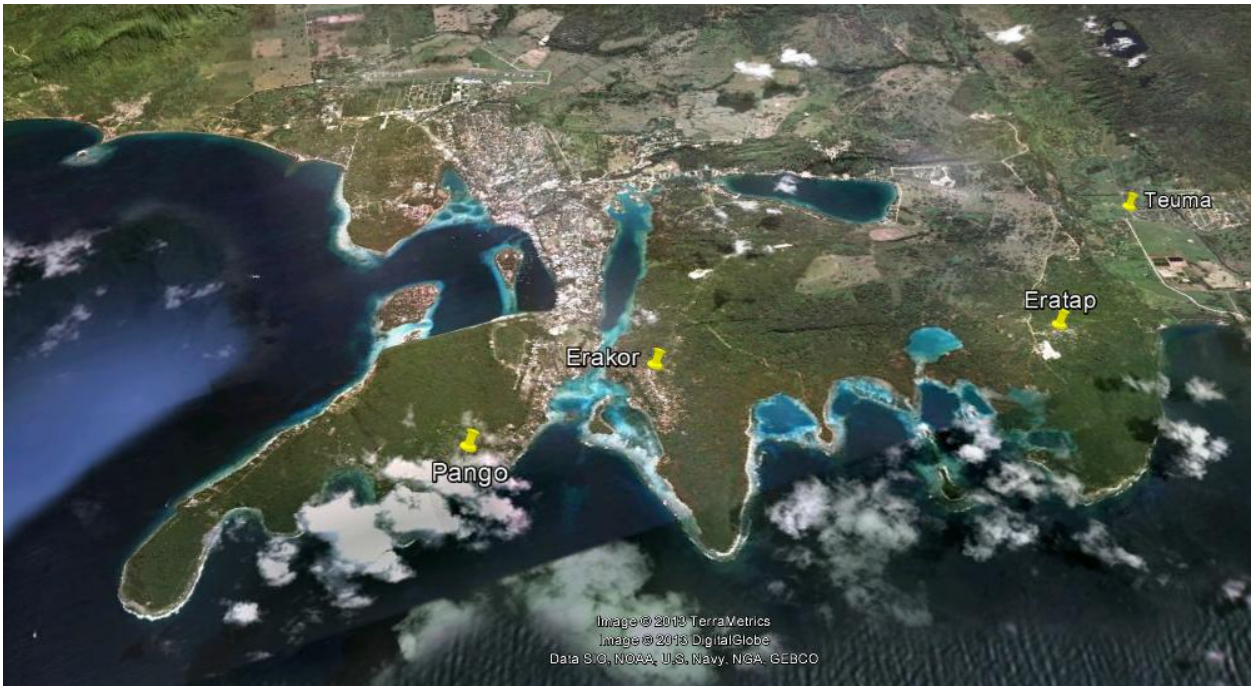


Figure 8 – Location of Rural Villages Surveyed

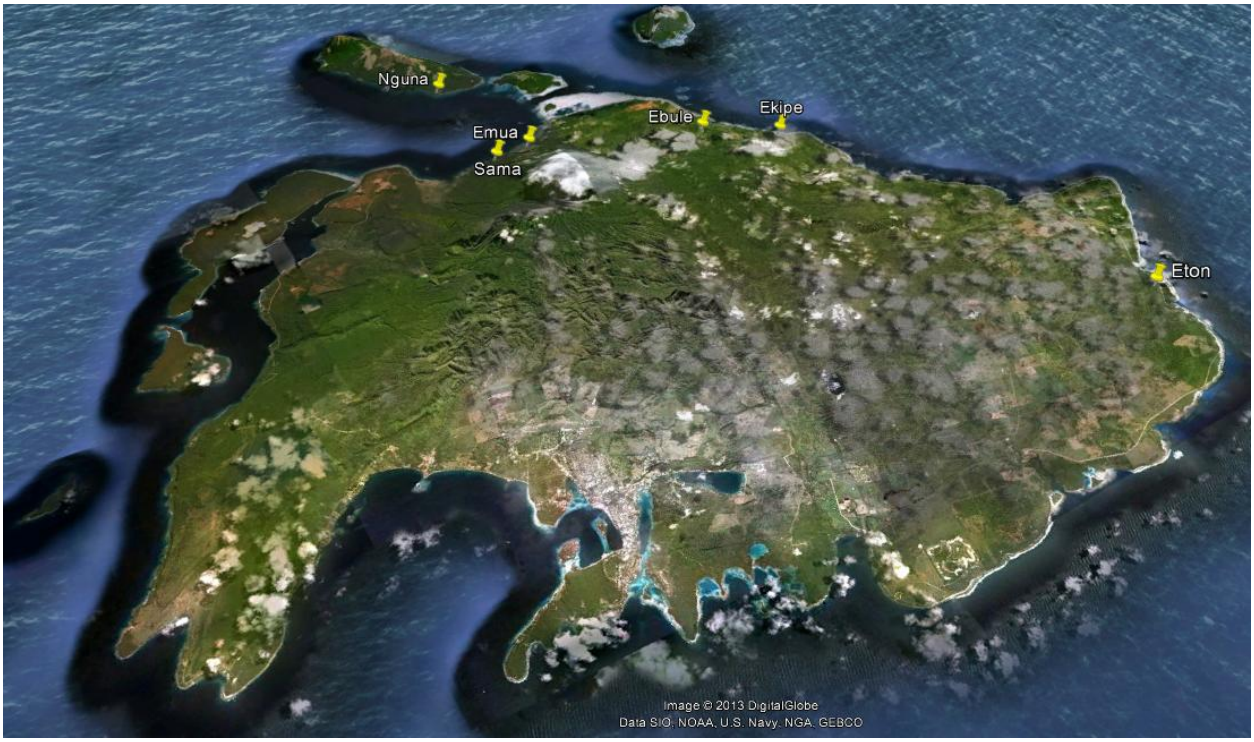


Figure 14 - Kernel Density Plot – Residuals From Regression

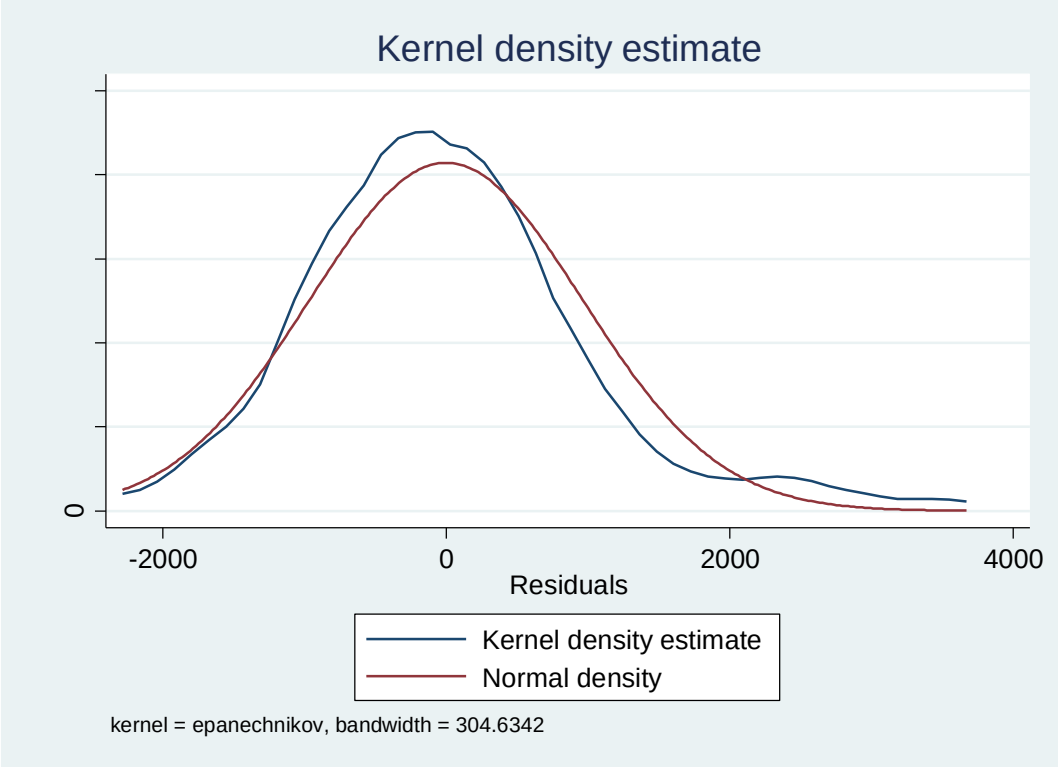


Figure 15 - Shapiro Wilk W Test for Normality of Residuals

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	77	0.95720	2.847	2.288	0.01107

Figure 16 - Testing for Homoscedasticity

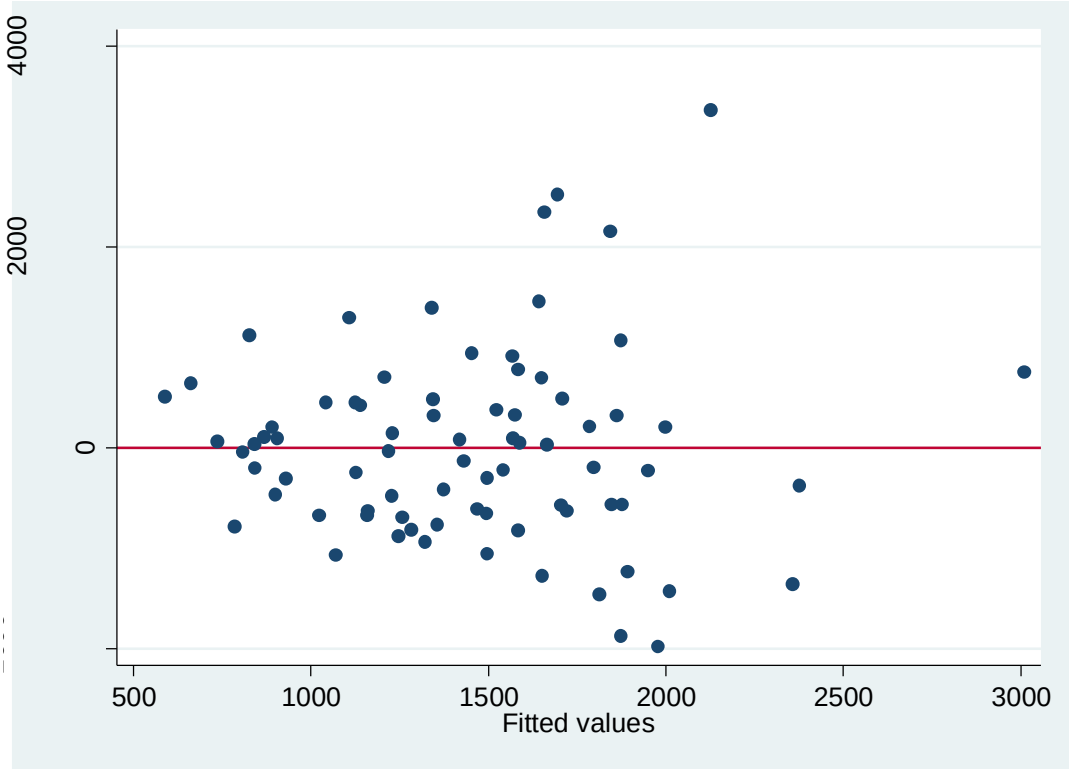


Figure 17 - Breusch-Pagan Test for Homoscedasticity

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Importedfoodmonthmemberweigh

         chi2(1)      =    14.53
         Prob > chi2  =   0.0001
```

Figure 18 - Variance Inflation Factor Test for Multicollinearity

```
. vif
```

Variable	VIF	1/VIF
Pangodummy	3.96	0.252606
Soildummy	2.29	0.436467
Teumadummy	2.19	0.456926
Eratapdummy	2.18	0.458954
Onlymedium~s	2.07	0.483693
Erakordummy	2.03	0.491818
Totalarea	1.89	0.528983
HouseType1	1.84	0.542066
gardens	1.82	0.550867
HouseType3	1.77	0.566444
percentelder	1.56	0.641580
percentmale	1.50	0.667880
mediumandu~y	1.45	0.688988
maximumadu~n	1.42	0.704387
percentchi~n	1.40	0.715340
Landdummy	1.35	0.741187
Theftdummy	1.26	0.794861
Mean VIF	1.88	

Figure 19 - Checking for Linearity - Total Area vs. Residual

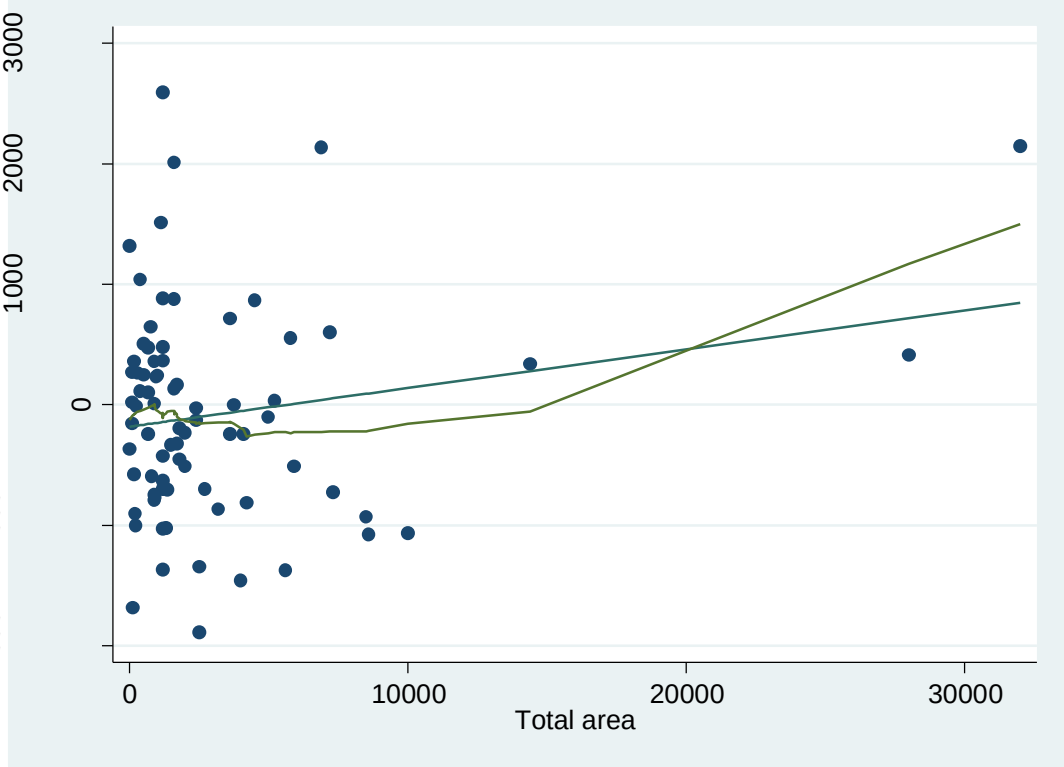


Figure 20 - Skewedness of Total Area

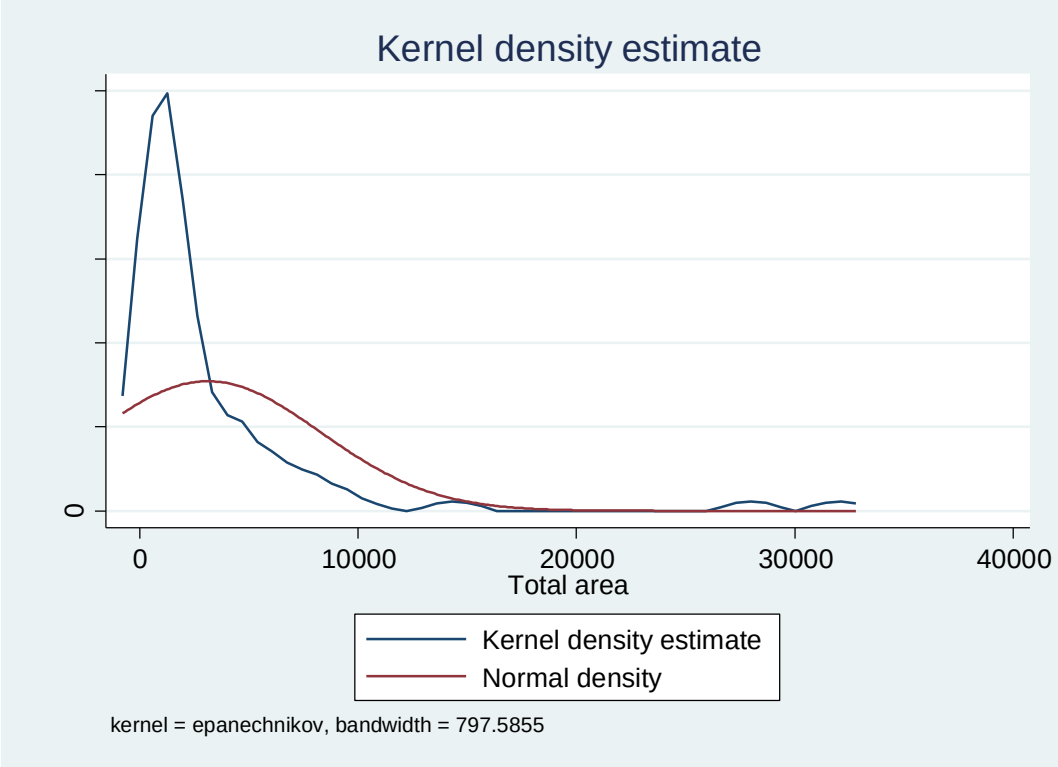


Figure 21 - Log of Total Area

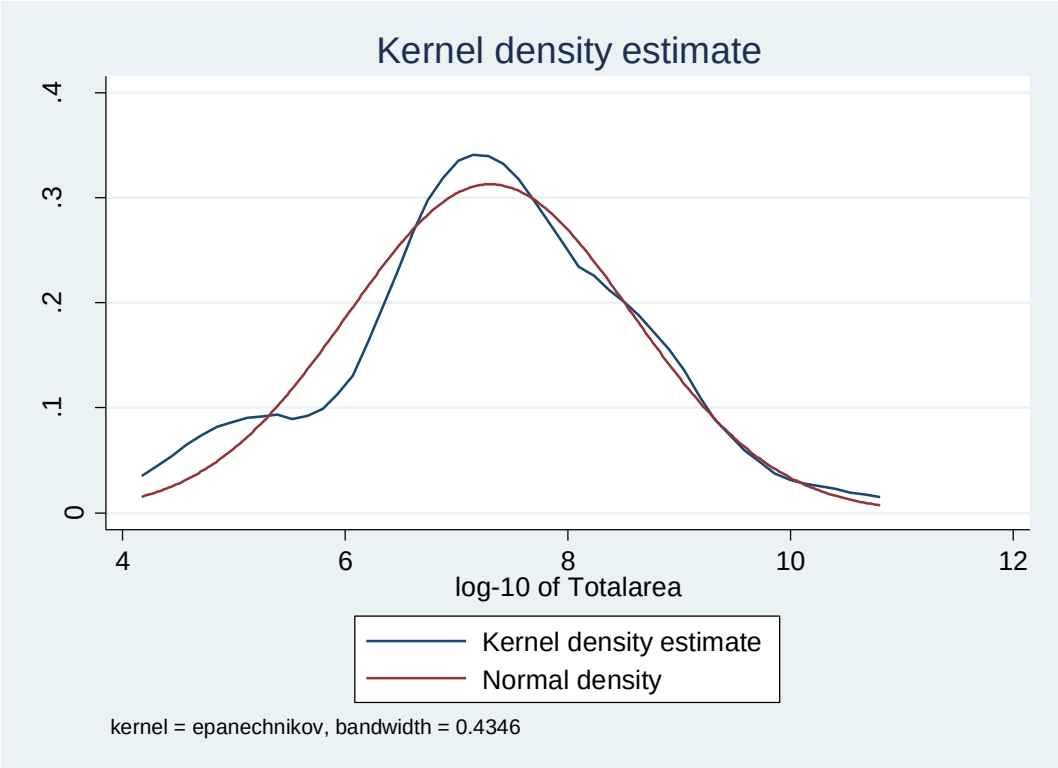


Figure 22 - Log of Total Area - fixing nonlinearity

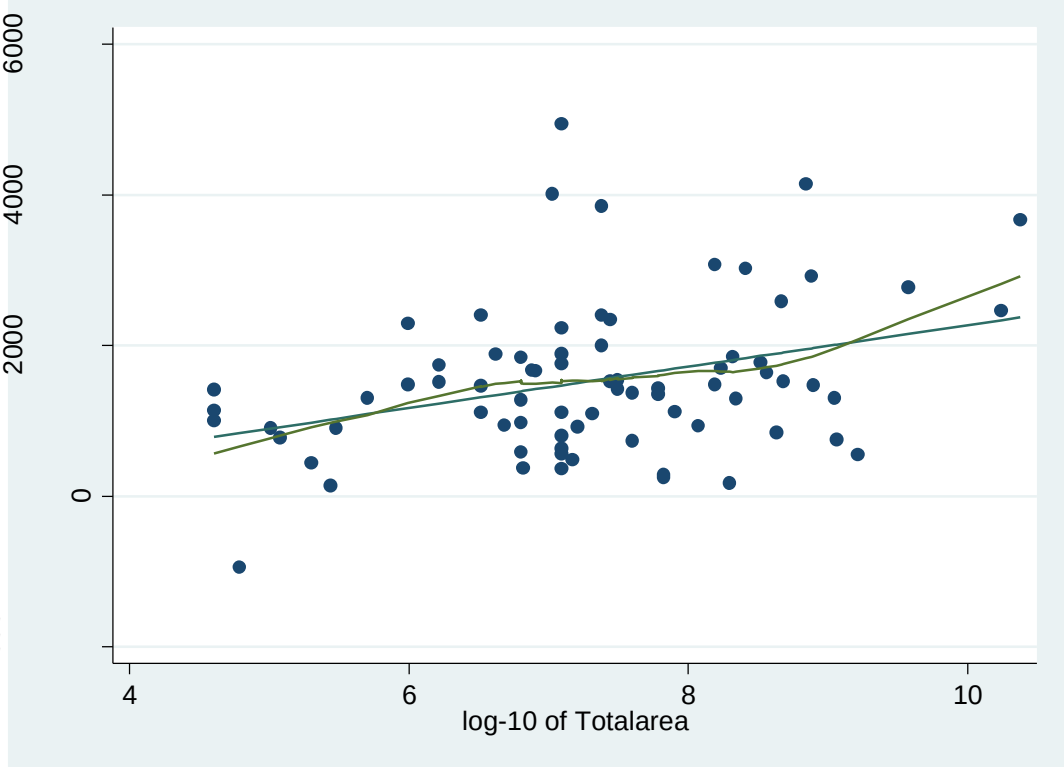


Figure 23 - Linktest - Testing for Model Specification Error

Source	SS	df	MS
Model	15473024.1	2	7736512.05
Residual	66353223.4	72	921572.547
Total	81826247.5	74	1105760.1

Number of obs	= 75
F(2, 72)	= 8.39
Prob > F	= 0.0005
R-squared	= 0.1891
Adj R-squared	= 0.1666
Root MSE	= 959.99

Importedf~gh	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	-.3478726	1.106265	-0.31	0.754	-2.553173	1.857427
_hatsq	.0004809	.0003839	1.25	0.214	-.0002845	.0012462
_cons	854.0465	782.7811	1.09	0.279	-706.399	2414.492

Figure 24 - Ovtest – Testing for Model Specification Error

```
Ramsey RESET test using powers of the fitted values of Importedfoodmonthmemberweigh
       Ho:  model has no omitted variables
                  F(3, 54) =      1.77
                  Prob > F =      0.1630
```

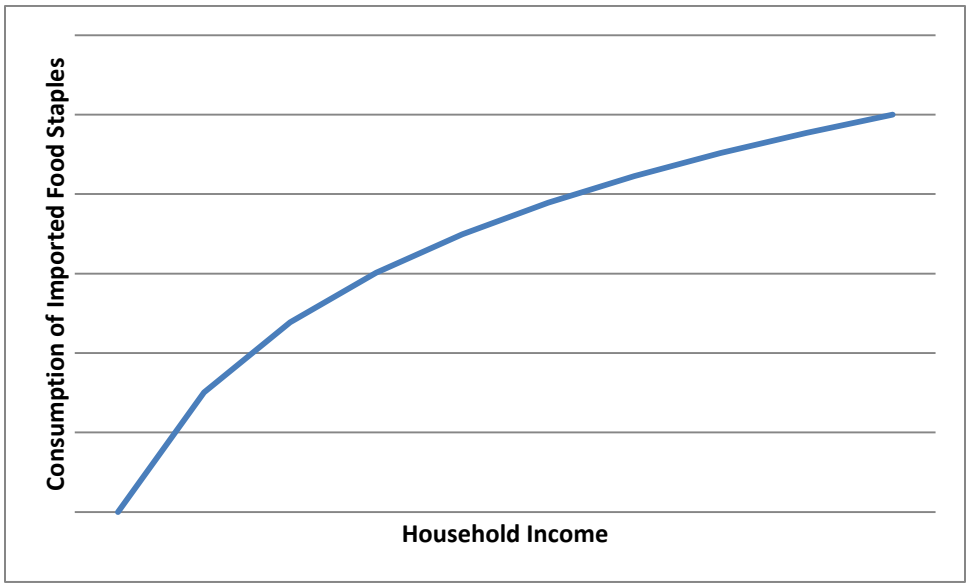
Figure 25 – Final Regression - with Log of Total Area

Linear regression

Number of obs	= 76
F(17, 58)	= 1.15
Prob > F	= 0.3337
R-squared	= 0.1759
Root MSE	= 1082.4

Importedfoodmonthme~h	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Pangodummy	706.0677	649.5416	1.09	0.282	-594.131	2006.266
Eratapdummy	-205.037	458.2596	-0.45	0.656	-1122.343	712.2694
Erakordummy	-1295.138	533.5777	-2.43	0.018	-2363.21	-227.0662
Teumadummy	-512.799	435.1637	-1.18	0.243	-1383.874	358.2757
percentmale	-5.703291	8.227806	-0.69	0.491	-22.17303	10.76645
percentchildren	-2.715192	7.064299	-0.38	0.702	-16.85592	11.42554
percentelder	3.704817	5.430033	0.68	0.498	-7.164576	14.57421
maximumadulteducation	161.7759	233.4211	0.69	0.491	-305.4672	629.019
HouseType1	-25.70432	445.7984	-0.06	0.954	-918.0667	866.6581
HouseType3	-265.1866	322.9295	-0.82	0.415	-911.6001	381.227
mediumandupdummy	181.4982	297.0067	0.61	0.544	-413.0252	776.0217
gardens	-68.92582	87.59311	-0.79	0.435	-244.2625	106.4108
Onlymediumsmallorless	-152.6668	479.114	-0.32	0.751	-1111.718	806.3841
logtotalarea	628.8134	490.6832	1.28	0.205	-353.3956	1611.022
Soildummy	584.2912	492.7834	1.19	0.241	-402.1219	1570.704
Landdummy	.390046	270.1817	0.00	0.999	-540.4373	541.2174
Theftdummy	-319.9571	273.7866	-1.17	0.247	-868.0004	228.0863
_cons	-353.2582	1920.703	-0.18	0.855	-4197.964	3491.447

Figure 26 - Proposed Relationship between Income and Imported Food Staple Consumption



Appendix B – Household Questionnaire

Part A: Household (1) - "May I speak with a head member of the household?"

Neighbourhood/Area:

1. Does any member of your household have children not living here in this house? YES..1 NO...2

2. How would you describe the youth population (14-25) growth in your area?

Order of Age	2 List every person living in the household MALE.1 YEARS FEMALE.2		3. How many years of education does [#] have? Education Levels: 0) No formal education 1) Some or all primary 2) Some or all secondary	4. Has this family members migrated to the current location from another	5. From what region/province did they come from?	6. Describe occupations within the last 12 months, in order of frequency (see specific occupation codes at end of sheet)	
						WRITTEN DESCRIPTIONS	OCCUPATION CODES
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

OCCUPATION CODES:
Small Scale Agriculture (1A)
Large Scale Agriculture (1B)
Fishing (2)
Government (3)
Services (tourism, restaurants, transportation) (4)
Manufacturing (5)

Part A: Household (2)

1. How long have your family been living in this dwelling?	YEARS:
2. In approximately what year was this dwelling built?	YEAR BUILT:
3. Do you own, rent, or is this not applicable?	OWN/RENT/NA:
4. If yes to RENT, what is approximate amount/month (VATU)?	RENT/MONTH:
5. Roughly how long is a regular commute to centre town (market)?	TIME:

6. Does your household own any of the following items?

ITEM	CODE	YES	NO	Comments
Stove	101			
Refrigerator	102			
Washing Machine	103			
Sewing Kniting Machine	104			
Television	105			
VCR/DVD	106			
MP3/CD Player	107			
Camera, Video Camera	108			
Cell Phone	109			
Bicylce	110			
Motorcycle	111			
Car/Truck	112			
Canoe	113			
Boat (small motor)	114			
Other:	115			
Other:	116			

Take Note of:

Toilet	
Water Supply	
House Material	
outer	
roof	
floor	
walls	
electricity	

Part B: Income and Expenditures

1. What is your household's gross income per month (on average) from the following:					
ITEM	CODE	YES/NO	VATU	OTHER	Comments
Average Total Household Income	101				
Agrciulture Sales and Wages	102				
Fishing Sales and Wages	103				
Government Income and Wages	104				
Service Industry (tourism, taxis, etc)	105				
Manufacturing Sales and Wages	106				
Remittances	107				
Donor Aid/Gifts	108				
Other	109				
2. What is your household's gross expense per month (on average) from the following:					
ITEM	CODE	YES/NO	VATU	OTHER	Comments
Average Total Household Expenditur	110				
Electricity	111				
Water	112				
Schooling	113				
Medical	114				
Food	115				
Rice	116				
Bread/Cracker	117				
Other Imported Goods (canned)	118				
Local Products	119				
Other	120				
Transportation	121				
Remittances	122				
Fuel (Kerosene)	123				
Clothing	124				

Part C: Agriculture (1) - "May I speak with a present member of the household who has the best knowledge of the household's agricultural activities?"

1. Has any member of your household recently (past 6 months) operated any agricultural land, forest land, pasture land or water surface? YES/NO:
2. If yes, do you own the land exclusively (no one else can grow/harvest from it)? YES/NO:
3. Does your household intend to increase overall agricultural production (hours worked) within the next year? YES/NO:
4. If yes/no to question 3, for what reasons? COMMENT:

1. If NO, skip to Part D

5. If you practice fallow, how long is the average fallow period? Years:
6. Do you consider current land disputes or theft as issues in your household's agricultural production (for example as barriers to increased investment and productivity of plots) COMMENT:

PLOT CODE	7. Please tell me about each plot of land belonging to your household? Please describe or give me the name of each plot. COMPLETE THIS QUESTION FOR ALL PLOTS. THEN ASK QUESTIONS 8-15 FOR EACH PLOT BEFORE GOING TO THE NEXT PLOT.	8. What is the area of the plot? *SQUARE METERS……1* *HECTARES..2* *LOCAL UNIT……..3*		8. What distance is the plotfrom your home? *TIME BY WALK……1* *KILOMETRES..2* *OTHER UNIT……..3*		9. What kind of land is this? Is it currently being used to grow annual crops or tree crops, or is it forest land, pasture land or water surface? ANNUAL CROP LAND..1 TREE CROP LAND.....2 FOREST.....3 PASTURE....4 WATER SURFACE....5 OTHER(SPE-CIFY_)....6	10. Has the productivity/soil quality of this land been increasing, decreasing, or are you uncertain? Increasing...1 Decreasing...2 Unsure.....3	11. What crops have you grown on this plot during the last 12 months? USE CROP CODES FROM PART (3). INDICATE IF FALLOW (F)				Could the size of this plot be easily expanded? (without having to pay for additional area or encroaching on others') YES 1 NO..2	Has there been any monetary investment into physical improvements of this plot during the last 12 months? YES 1 NO..2	12. Is this plot irrigated? YES 1 NO..2	13. How did your household acquire this land? INHERITED...1 CLEARED.....2 PURCHASED...3 USE RIGHT GIVEN BY LOCAL LEADER(S)...4 OTHER (SPECIFY).6	14. What legal title or ownership rights do you have for this plot of land? DEED.....1 SALES RECEIPT...2 CUSTOMARY RIGHT...3 OTHER (SPECIFY_).4 NONE.....5	15. If you were to sell this plot of land today, how much could you sell it for? (N/A)?
	NAME OF PLOT	AMOUNT	UNIT CODE	AMOUNT	UNIT CODE			SEASON 1 MAIN CROP	SEASON 1 2ND CROP	SEASON 2 MAIN CROP	SEASON 2 2ND CROP						
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

EQUIPMENT CO	1. Does your household own any [...]? FIRST ASK QUESTION 1 FOR ALL ITEMS. THEN ASK QUESTIONS 2-6 FOR EACH ITEM BEFORE GOING TO THE TYPE OF FARM EQUIPMENT	YES..1 NO...2 (»NEXT ITEM)	2. How many [....] does your household own? DO NOT COUNT EQUIPMENT	3. Does your household own any [...] jointly with any other household? YES..1 NO...2 (»6)	4. How many [...] are owned with another household?	5. What share of these [....] belong to your household? IF SHARE	6. If you sold one of those [...] today, how much money could you get for it? IF MORE THAN ONE ITEM, ASK FOR AVERAGE VALUE. AVERAGE SHOULD INCLUDE FULL VALUE OF
1	Large tractor (>12 horse power)						
2	Small tractor (<12 horse power)						
3	Machine pulled plow or harrower						
4	Animal pulled plow						
5	Mechanical water pump						
6	Sprinkler						
7	Motorized thresher						
8	Hand thresher						
9	Rice winnower						
10	Mill						
11	Machine to process livestock feed						
12	Motorized insecticide pump						
13	Hand insecticide pump						
14	Ox cart						
15	Small cart pulled by person						

INPUT CODE	1. Did your household purchase any [...] during the past 12 months? ASK QUESTION 1 FOR ALL INPUTS BEFORE GOING ON TO QUESTIONS 2 AND 3.		2. How much [...] did you purchase during the past 12 months?		3. Where did you purchase this [...] purchased during the last 12 months? RECORD THE RESPONSES IN ORDER OF IMPORTANCE PRIVATE INDIVIDUAL....1 PRIVATE FIRM..2 COOPERATIVE...3 GOVERNMENT....4 OTHER (SPECIFY__)...5		
	INPUT TYPE	YES..1 NO...2 (»NEXT ITEM)	AMOUNT	UNIT CODE	FIRST SOURCE	SECOND SOURCE	THIRD SOURCE
1	FERTILIZER #1						
2	FERTILIZER #2						
3	FERTILIZER #3						
4	MANURE #1						
5	MANURE #2						
6	PESTICIDE #1						
7	PESTICIDE #2						
8	HERBICIDE #1						
9	HERBICIDE #2						
10	FUNGICIDE #1						
11	FUNGICIDE #2						

UNIT CODES: KILOGRAM..1 50 LB. SACK..2 100 LB. SACK...3
LITER.....4 CARTLOAD.....5 OTHER (SPECIFY__)...6

Part D: Crops And Livestock (1)

1. Does any member of your household currently own any large livestock, such as cattle, horses, pigs, sheep or goats?

YES/NO:

	2. Does any member of your household currently own any [...]? FIRST ASK QUESTION 2 FOR ALL ANIMALS, THEN ASK QUESTIONS 3-4 FOR EACH ANIMAL BEFORE GOING TO THE NEXT ONE.		3. How many [...] does your household currently own?	4. If you sold one of those [...] today, how much money (VATU) could you get for it?
	ANIMAL	**YES..1 NO...2 (»NEXT ANIMAL)**	**NUMBER OF ANIMALS**	
1	Beef cattle			
2	Milk cows			
3	Breeding bulls			
4	Horses			
5	Donkeys/Mules			
6	Pigs for Breeding			
7	Sows			
8	Sheep			
9	Goats			

CROP CODE	1. Have you harvested any [...] during the past 12 months? ASK QUESTION 1 FOR ALL CROPS BEFORE GOING ON TO QUESTIONS 2-4		2. How much [...] did you harvest in the past 12		3. How much of the [....] you harvested during the last 12 months was sold?		4. What price did you get for the [....] that you sold? IF MORE THAN ONE PRICE, GET THE	
	CROP NAME	YES..1 NO...2 (»NEXT CROP)	AMOUNT	UNIT CODE	AMOUNT	UNIT CODE	PRICE	UNIT CODE
1	Manioc							
2	Taro							
3	Kumala							
4	Potatoes							
5	Yams							
6	Kava							
7	aelen cabbage							
8	beans							
9	brocoli							
10	capsicum							
11	carrot							
12	cauliflower							
13	chinese cabbage							
14	cooking banana							
15	corn							
16	cucumber							
17	eggplant							

CROP CODE	1. Have you harvested any [...] during the past 12 months?		2. How much [...] did you harvest in the past 12 months?		3. How much of the [....] you harvested during the last 12 months was sold?		4. What price did you get for the [....] that you sold? IF MORE THEN ONE PRICE, GET THE	
	CROP NAME	YES..1 NO...2 (»NEXT CROP)	AMOUNT	UNIT CODE	AMOUNT	UNIT CODE	PRICE	UNIT CODE
18	lettuce							
19	onion							
20	other							
21	pumpkin							
22	round cabbage							
23	susut							
24	tomatoes							
25	zuchini							
26	avacado							
27	banana							
28	breadfruit							
29	coconut							
30	guava							
31	lemon							
32	lime							
33	lychie							
34	mango							

UNIT CODES: KILOGRAM..1 50 LB. SACK..2 100 LB. SACK..3 LITER..4 CARTLOAD..5 OTHER (SPECIFY____)..6

CROP CODE	1. Have you harvested any [...] during the past 12 months? ASK QUESTION 1 FOR ALL CROPS BEFORE GOING ON TO QUESTIONS 2-4		2. How much [...] did you harvest in the past 12		3. How much of the [....] you harvested during the last 12 months was sold?		4. What price did you get for the [....] that you sold? IF MORE THAN ONE PRICE, GET THE AVERAGE	
	CROP NAME	YES..1 NO...2 (»NEXT CROP)	AMOUNT	UNIT CODE	AMOUNT	UNIT CODE	PRICE	UNIT CODE
1	nagatambul							
2	nakavika							
3	naus							
4	orange							
5	pamplemousse							
6	passionfruit							
7	paw paw							
8	pineapple							
9	soursop							
10	sugarcane							
11	watermelon							
	Nuts (specify)							
12								
13								
	Herbs (specify)							
14								
15								

UNIT CODES: KILOGRAM..1 50 LB. SACK..2 100 LB. SACK..3 LITER..4 CARTLOAD..5 OTHER (SPECIFY____)..6

Part E: Other

1. Are you familiar with the World Trade Organization? If so, what is your opinion of it and of Vanuatu's recent ascension?

COMMENT:

2. What do you think about small-scale agriculture as an opportunity for income? Would you recommend it to friends/family?

COMMENT:

3. Does anyone in your household have knowledge of the Agricultural Development Bank and its functions? Please explain.

COMMENT:

4. Does anyone in your family have knowledge of sources of microcredit funding (e.g. VANWODS)? Do you have access to credit? Please explain.

COMMENT:

Appendix C – Data Details

This section describes data and survey questions for each part of the survey. It also describes in detail the variables used in regression analysis. It supplements the information provided in Appendix B – Household Questionnaire. The household survey consisted of five parts: Part A: Household, Part B: Income and Expenditures, Part C: Agriculture, Part D: Crops and Livestock, and Part E: Perceptions and 'Other'.

Part A: Household

Part A: Household included personal level questions (for each inhabitant) including gender, age, years of education, and employment, while household level questions included data on community, household type, and Amenities. Gender is defined as being either male or female. Age is defined as the number of years the individual has been living. Years of Education is quantified as the respective years of highest educational attainment achieved by the individual.[25] Community defines what village in which the household is situated. Data on household type consisted of basic observations made on the materials, structure and size of house.

Part B: Income and Expenditures

Part B: Income and Expenditures included parent variables: average monthly income and average monthly expenses. Monthly expenses were broken down to include: electricity, water, schooling, medical, food, and other. Food expenses were further broken down to include rice,

[25] Primary education in Vanuatu is defined as being from grade one to grade six; secondary education is from grade seven to thirteen; tertiary is anything higher than grade thirteen (Vanuatu Ministry of Education 2010-2011). Some primary schools, the so called 'centre schools' include classes up to Year 8 while others include classes to Year 6 (Vanuatu Ministry of Education 2010-2011). Also, some secondary schools start from Year 7 while others start from Year 11, dubbed 'senior secondary schools' (Vanuatu Ministry of Education 2010-2011).

bread/cracker products, and local products.[26] 'Other' included any significant household expenses such as transportation, clothing, and remittances which were not included in previously mentioned categories.

Part C: Agriculture

Part C: Agriculture collected information on household agricultural activity. Parent variables included: plots, sales, production trends, soil quality, barriers, and fishing. The Plots variable included information on how many plots the household used, approximate sizes, proximity to household, and type of cropping system used. Sales included sub-variables on whether production was being sold, where it was being sold, and what were the main products being sold. Also included under sales was information on cost and travelling time to Port Vila's main market house and how frequently products were sold at market. Production trends captured primary respondents' perception on the change in production, market activity, and profitability over the past 10 years. Soil quality captured opinions on whether the primary respondent considered their crops' soil quality to have changed over the past 10 years, whether they practiced fallow periods for their crops, and how long average fallow periods were. Barriers included a question on whether the primary respondent considered current land disputes or theft as issues in their agricultural production or as barriers to increased investment and productivity of their plots. Fishing was added onto the agriculture questionnaire to explore whether the household fished and how often they would eat fish per month.

[26] Local products were defined as traditional livestock and small-holder crop staples.

Part D: Crops and Livestock

Part D: Crops and Livestock accumulated data on what and how much was being produced by household small-holder agriculture. This included variables on types of staple root crops, vegetables, fruits, and livestock produced.

Part E: Other

Part E: Other collected all additional information regarding household food security and agricultural production which was not included in previous sections. This included data on whether the primary respondent had knowledge on the Agriculture Development Bank, microcredit, and other avenues for credit. This section also collected data on respondents' opinions and knowledge of the country's recent accession to the World Trade Organization.

Regression Variables Described

is the dependent variable, an indicator of household food security from a Ni-Vanuatu context. It is takes the following formula:

Pango, Eratap, Erakor, and Teuma are all village dummy variables. The village dummy variable, *Rural*, was left out of the regression equation due to problems of multicollinearity.

Percentmale measures what percent of the household was male. *Percentchildren* shows what percent of the household was considered a child (0-14). *Percentelder* shows what percent of the household was an elder (60+).

Maximumadulteducation describes the highest level of educational attainment amongst household family members. This variable took the following values: 0 (no formal education); 1 (some or all of primary); 2 (some or all of secondary); or 3 (some or all of tertiary).

Housetype1 and *Housetype3* are dummy variables which, along with the omitted variable *Housetype2*, categorize the physical status of the homestead into three levels: 1 (solid conditions, concrete structures, solid floors); 2 (standard conditions, mixed concrete/corrugated iron; solid or semi-solid floors); and 3 (poor conditions, thatched wood/corrugated iron, no concrete, dirt flooring/mats).

Mediumandup, *Gardens*, *Mediumsmallanddown*, and *Logtotalarea* measure features specific to each household's agricultural plots. *Mediumandup* is a dummy variable which takes a value of 0 if households had any number of plots situated less than 2 kilometers away from the homestead and 1 if they only had gardens more than 2 kilometers away. *Gardens* is an ordinal variable indicating how many separate garden plots each household had.

Mediumsmallanddown is a dummy variable taking a value of 1 if a household only had plots that were less than 800m^2 in size and taking a value of 0 if a household had any plots which were more than 800m^2. *Logtotalarea* takes the log (base 10) of each households combined total crop area.

The final three variables, *Soil*, *Land*, and *Theft* are dummy variables. *Soil* takes a value of 1 if the respondent for the household considered soil quality to have decreased in quality over the past 10 years and 0 if otherwise. *Land* takes a value of 1 if the respondent indicated that land disputes were an issue or barrier to agricultural production and 0 if otherwise. *Theft* takes a value of 1 if the respondent indicated that theft was an issue or barrier to agricultural production and 0 if otherwise.

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