Poverty and the Agricultural Household
in Timor-Leste:
Some Patterns and Puzzles

Pobreza no
Uma-kain Agríkola
iha Timor-Leste:
Modelu no Sasiik Balun

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Summary

The purpose of this study is to undertake a preliminary analysis of some important questions around poverty in Timor-Leste. Given 80% of households in Timor-Leste rely on agricultural activity as a major source of income or to provide for their direct food needs, we focus on the role the agricultural sector plays in generating livelihoods and addressing basic needs. We use detailed household survey data to understand the nature of agricultural activity, highlighting the extent of reliance on subsistence agriculture, and the comparatively low level of productivity in agricultural production.

The analysis also links households' consumption of food with their agricultural production and other income-generating activities. It shows some interesting facts:

- It appears that a large proportion of the food that is produced is not subsequently consumed.

- While only a small proportion of food production is sold in markets, the data suggests that a relatively large proportion is shared informally across households. This is likely due to the absence of formal markets for most products in many areas, and a lack of cash income in many households.

- Household consumption of food does vary with income, but the variation is not uniform. Staple foods like rice and maize do not respond much to increases in income, rather the benefits of increased income are with increased diversity of food intake – households consume more meat, fruit and leafy vegetables.

- The extent to which food consumption increases with income varies enormously with the source of income: higher levels of food consumption are observed among households whose income is derived from selling their food crop production, selling cash crops (coffee) or from wage employment. When income is derived from transfers and non-labour sources, this income leads to only a small increase in household food consumption.

This research highlights a number of important questions and issues for policy and development initiatives. These are explored in the final section of the report.

Sumáriu

Objetivu hosi estudu ida-ne'e mak atu halo analizasaun preliminária ba pergunta importante balun kona-ba pobreza iha Timor-Leste. Porsentu 80 hosi uma-kain sira iha Timor-Leste depende ba atividade agríkola. Balun depende ba atividade agríkola hanesan fonte prinsipál ida ba sira-nia rendimentu, no balun depende ba atividade agríkola atu diretamente fornese sira-nia nesesidade ai-han. Tanba ida-ne'e ami foka ba papél ne'ebé setór agríkola hala'o hodi produz meius subsisténsia no atende nesesidade báziku. Ami uza dadus detalladu husi survei uma-kain hodi komprende didi'ak atividade agríkola iha Timor-Leste. Ami mós foka ba povu nia nivel dependénsia ba agrikultura subsisténsia no nivel produtividade ne'ebé relativamente ki'ik iha produsaun agríkola.

Analizasaun ne'e mós liga uma-kain sira nia konsumsaun ai-han ho sira-nia produsaun agríkola no atividade sira seluk ne'ebé produz rendimentu. Analizasaun ne'e hatudu faktus balun ne'ebé interesante:

- Hatudu katak ema la konsume proporsaun boot hosi ai-han ne'ebé produz, parese tanba laiha merkadu formál ba maioria produtu iha area barak.

- Husi ai-han ne'ebé produz, ema fa'an proporsaun ki'ik iha merkadu. Dadus hatudu katak proporsaun ai-han ne'ebé relativamente boot mak uma-kain sira fahe ba malu de'it.

- Iha variasaun iha uma-kain sira nia konsumsaun ai-han ne'ebé depende ba sira-nia rendimente, maibé variasaun ne'e depende ba tipu ai-han. Alimentasaun báziku hanesan foos no batar ladún aumenta se rendimentu aumenta, maibé diversidade ai-han mak aumenta bainhira rendimentu aumenta. Uma-kain sira ne'ebé rendimentu boot liu mak konsume naan no modo tahan barak liu.

- Variasaun iha konsumsaun ai-han ho rendimentu mós depende ba fonte rendimentu: uma-kain sira ne'ebé nia rendimentu mai hosi ai-han ne'ebé sira fa'an mak han di'ak liu bainhira sira-nia rendimentu aumenta. Uma-kain sira ne'ebé nia rendimentu mai hosi produsaun kafé ka rendimentu ne'ebé mai hosi saláriu mensál, mós han di'ak liu bainhira sira-nia rendimentu aumenta. Ba uma-kain ne'ebé nia rendimentu mai hosi transferensia (fo hahán ba malu) no fonte la'ós-servisu, iha relasaun ne'ebé ki'ik de'it entre sira-nia rendimentu ho nia konsumsaun ai-han.

Peskiza ida-ne'e foka ba pergunta no problema balun ne'ebé importante ba política no dezenvolvimentu. Kestaun sira-ne'e sei diskute iha seksaun finál hosi relatóriu ida-ne'e.

Relatoriu ida ne'e mos bele hetan iha lian Tetun.

Contents

1 Timor-Leste: Brief Background

As a new nation in 2002 following decades of foreign rule, Timor-Leste inherited little functional infrastructure, few operating institutions and widespread poverty. A strong commitment to development in the years that followed has seen notable progress in a range of social indicators, particularly in governance and education.

However, despite the commendable achievements, the most recent data suggests that Timor-Leste remains the poorest nation outside of sub-Saharan Africa in measures of multidimensional poverty (UNDP, 2013, based on 2009 data). World Bank analysis based on 2007 data also reports that 49% of the population lived below the consumption poverty line (World Bank, 2009).

Much of the infrastructure in Timor-Leste is still underdeveloped and a significant proportion of the population does not have access to basic services. The most recent estimates suggest that 31% of people in Timor-Leste lack access to an improved water source, 61% are without improved sanitation and until recently, 82% did not have electricity (UNDP, 2010; WHO, 2013). There is also substantial room for progress in health measures: the average life expectancy is 64 years, the under-five mortality rate is 54 deaths per 1000 live births, and 45% of children under five are underweight – the highest rate in the world (WHO 2010, 2013).

In recognition of these challenges, the Government of Timor-Leste has committed itself to promoting development and reducing poverty by fostering economic growth, investing in human capital and infrastructure, and strengthening public institutions (Government of Timor-Leste, 2007; Government of Timor-Leste, 2010a). A core element in the plan for growth is to improve the productivity and sustainability of the agricultural sector, although currently the sector is allocated a relatively small proportion of Government resources.

Agriculture is one of the country's main economic activities, constituting the primary source of employment for 84% of the labour force (Ministry of Finance, 2008), and contributing 97.7% of non-oil exports. As highlighted in the Strategic Development Plan 2011-2030, agriculture has an important role to play in reducing poverty, promoting rural development and assuring Timor-Leste's food security – both through food production and as a principal source of income for many of the rural poor (Government of Timor-Leste, 2010a; Government of Timor-Leste, 2012; World Bank, 2007).

The key challenge facing policymakers in the agricultural sector is that of converting the sector's potential to drive growth and poverty reduction into reality. There are a number of structural obstacles to overcome in order to see an improvement in agricultural productivity and to build well-functioning markets. The vast majority of agricultural activity is small-scale, subsistence agriculture, with minimal inputs, resulting in very low yields. Similarly, there are many impediments to seeing agricultural markets emerge, including lack of financial institutions, poor quality roads, inconsistency of supply and quality, and lack of demand for produce (Lundahl and Sjoholm, 2013).

This study will examine the functioning of the agricultural sector, highlighting some basic characteristics of the sector, and showing some of the impacts of agricultural activities on life for the typical agricultural household. This link is where we will reveal significant findings that highlight how critical the sector is to poverty alleviation, and that indicate the key areas to focus on in delivering agricultural development and poverty reduction.

2 A Macroeconomic Context

It is of value to first place this study of the agricultural sector in a broader context of the long term outlook for the Timor-Leste economy.

The Timor-Leste Strategic Development Plan 2011-2030 provides a foundational framework for understanding national development priorities. The plan includes heavy investment in large scale infrastructure, with electrification and roads as priority areas, as well as major port and airport redevelopments, on-shore oil processing facilities and establishment of special economic zones. The financing of such investment is made possible through revenues from Timor-Leste's sovereign oil and gas wealth in the Timor Sea, amounting to 80.5% of GDP (in 2011) and around 93% of state revenues (Budget 2014). Revenues into the Petroleum Fund have been strong for several years, but began declining in 2012, with virtually no new royalties revenue expected after 5-10 years. If government withdrawals from the Fund continue to grow as they have in recent years, the Fund will decline quite rapidly, and will be severely depleted within 10 years. This reinforces the imperative of developing a strong non-oil economy. The current strategy for creating an economy not dependent on oil revenue is to rely on the petroleum funds to facilitate major investment in infrastructure, with the aim of laying the foundations of strong non-oil growth in future.

The current reliance on petroleum fund revenues can be illustrated with reference to the Government Budget. Table 1 shows the 2014 budgeted revenue and expenditure. The revenue breakdown shows that the $903m withdrawal from the Petroleum Fund represents about 60% of total revenue. In addition, cash reserves comprise petroleum fund withdrawals from previous years that were not spent. So with this component, the Petroleum Fund contributes more than 85% of the government's 2014 revenue. Table 1 also shows the very small taxation base the government is currently working with, indicative of the low level of private sector activities.

National Accounts data (Ministry of Finance, 2013) provide a window into how economic activity is progressing. While the accounts show sizeable growth in GDP, averaging close to 10% per year for several years, when broken down by industry

they show the strong influence of government-led expenditure. Construction and public administration comprise the most rapidly growing and largest sectors in recent years, outside of oil and gas, and the vast majority of this construction expenditure is the result of government contracts for major and minor infrastructure projects, as revealed in the expenditure side of the budget in Table 1. To put the magnitude of the government sector in context, the budgetted Government expenditure of $1,500 million in 2014 is not far short of the budget forecast for non-Oil GDP in 2014 of $1,773. While some of government expenditure does not contribute directly to GDP (because it is spent offshore), a large proportion is, leaving a relatively small non-Government, non-oil economy.

Table 1 Government Budget 2014	
	$ million
Allocated Revenue	
Petroleum Fund sustainable amount	$ 632
Petroleum Fund excess withdrawals	$ 271
Domestic Revenues (taxes, fees & charges, electricity sales)	$ 166
Cash reserves (petroleum fund withdrawals from previous years)	$ 400
Borrowing	$ 31
Total Allocated Revenue	**$ 1,500**
Expenditure by Category	
Wages	$ 177
Goods & services	$ 440
Transfers	$ 336
Small Capital & Development Projects	$ 140
Major Infrastructure	$ 407
Total Expenditure	**$ 1,500**

Source: Timor-Leste Budget 2014, Book 1, various tables

The National Accounts also show the lack of progress in the agricultural sector: between 2002 and 2011 real GDP in agriculture, forestry and fishing has declined by 7.5%, while non-oil real GDP has grown by 79%. The agricultural sector represents only 17% of non-Oil GDP, despite being the primary economic activity of more than 80% of the population.

A clear message holds up consistently through any analysis of the data on economic activity: the economy remains in its infancy outside the oil sector and the other sectors it finances; agricultural production is relatively low, and appears to be declining overall in real per capita terms.

3   Measuring Poverty

In this section we provide a brief overview of how poverty is defined and measured in various analyses of poverty in Timor-Leste.

Consumption Poverty:

Historically poverty has been defined in terms of income levels. This is the source of often-quoted indicators like the number living on less than $1 per day, or in recent years, $1.25. However, much use of this measure indicates it is often poorly understood. Here is a simple intuitive understanding: First, in a given country, a large scale household survey is undertaken, collecting information on consumption behaviour of households, and local market values for food and other items. A poverty line is then defined as the dollar value of food intake that gives a household adequate calorie intake for minimum daily energy needs, plus the cost or imputed value of housing and other non-food expenditure that is typical of households with this minimum level of food consumption. A household is then defined as poor if the dollar value of the food, housing, etc that they consume falls below that line.

Note that some of a household's consumption can involve no actual cash income or cash expenditure at all. For example, with housing, most people do not pay rent for the home they occupy; the consumption measure imputes a value to the house by estimating the rental value of the dwelling. Similarly much food consumption is from self-production or gifts or barter, and is counted in the consumption measure of food by calculating what it would have cost to purchase that food in local markets.

We emphasise that the poverty line is very low, and focuses on the minimum number of calories needed to produce sufficient energy for daily functioning. The poverty line also sets no minimum requirement for what is needed in the areas of diversity of food intake, access to services, educational achievement, etc, in order for a household to classify as non-poor.

Multidimensional Poverty Index:

It is clear that a number of other factors ought to be taken into account in developing a complete picture of poverty. This is where multidimensional poverty comes in. While there is no clear-cut basis for the choice of indicators that comprise a Multidimensional Poverty Index (MPI), or how they are each weighted, the MPI is receiving wide acceptance because of the recognition that households can experience poverty in other areas besides food consumption. While other aspects of household

wellbeing are included in the consumption measure, no deprivation threshold is applied to these – the benchmark is what is typical of households who are at the calorific poverty line. The MPI takes a different approach, by applying basic minimum standards in areas that include education, health and non-consumption aspects of livelihoods.

The MPI used by the UNDP is widely quoted in relation to Timor-Leste. It comprises 10 indicators in three categories. The data used in the MPI is typically the most recent Demographic and Health Survey (DHS), which for Timor-Leste took place in 2009/10. The MPI calculation is not easily updated until a new DHS or similar survey is conducted.

The 10 indicators used in the MPI are listed here (UNDP 2013, Technical Note 4, adapted). If a household in the sample complies with one of these indicators, they receive points as in the "Points" column. A household with 12 or less points from the maximum of 18 is considered multi-dimensionally poor. 13 or 14 points is classified as vulnerable to or at risk of poverty.

In comparison to a consumption poverty level of 49% in 2007, the MPI shows a bleaker picture for Timor-Leste, with 68% having scores of 12 or below, and hence being classified as multi-dimensionally poor, and 86% having 14 or less points, thus being either poor or at risk of poverty.

Table 2 Multidimensional Poverty Index Components & Weights		
Dimension	Household Indicator	Points
Education	At least one person has completed five years of schooling	3
	All school-age children enrolled in school	3
Health	No person is malnourished	3
	No children have died	3
Living Standards	Has electricity	1
	Has access to clean drinking water	1
	Has access to adequate sanitation	1
	Has a floor material superior to dirt floor	1
	Does not use dirty cooking fuel (dung, firewood, charcoal)	1
	Has two of these assets: bicycle, motorcycle, radio, refrigerator, phone, television	1

4   Poverty in Timor-Leste

Poverty in Timor-Leste is:

Pervasive:

In the most recently available measure of consumption poverty (TLSLS 2007), almost half the population are classified as consumption poor (World Bank, 2008). The story becomes much worse when the broader measure is used: based on 2009/10 data, the Multidimensional Poverty Index (MPI) shows a massive 68% are classified as poor using the definition above (UNDP 2013). The indicators also suggest that a further 18% are at risk of becoming poor.

This MPI result is the worst of any nation outside Africa, with the next worst in Asia being Bangladesh, with 57.8%. When we talk poverty in the context of Timor-Leste, this is not an issue for those on the margins of society; it is a mainstream issue that affects the vast majority of the population directly.

Multidimensional:

When the MPI is decomposed, virtually all dimensions of the index pose difficulties for Timor-Leste. A significant percent of the population fail to achieve the minimum level specified for poor in every one of the ten indicators. The areas with highest levels of deprivation include nutrition and various housing conditions – clean cooking fuel, electricity, sanitation, quality of housing and basic asset ownership (OPHI, 2013 – Timor-Leste Country Briefing).

Deep Rooted:

Poverty in Timor-Leste has its roots in its long history of occupation and colonial exploitation. Moving out of poverty will be a long term process that requires patient investment in governance, modern institutions, infrastructure, human capital and development of a vibrant non-Government economy, in each case starting from a low base.

This multiple deprivation and deep rooted poverty exists to a large extent because of Timor-Leste's unique history as a Portuguese colony and then occupation by Indonesia. During both periods, there was little investment in human and physical capital, and under the Indonesian occupation, there was significant loss of human capital as a consequence of many of the more educated population fleeing overseas,

others involved in the within-country resistance movement, and not least the destruction left in the wake of Indonesia's withdrawal in 1999.

Potentially Destabilising:

The statistics on reported crime and civil unrest in Timor-Leste suggest a relatively peaceful society. However, there are a number of factors at work that cause many observers to be concerned at the risks of social unrest linked specifically to this widespread poverty. The risk factors that are highlighted include:

- The fact that Timor-Leste is a post-conflict society with unresolved disputes rooted in history.

- Land disputes that arise from the return to rural areas of many those who were internally displaced during the unrest of 2006.

- The rapid population growth creating pressure on scarce resources.

- The high levels of poverty and limited economic opportunities for most of the population, despite major escalation of government spending and growth in non-Oil GDP.

- The emergence of a growing elite and middle class, creating an impression of growing inequality of wealth and opportunity.

5   Agriculture and Poverty

Growth in the agricultural sector, particularly increased agricultural productivity, has proved to be a powerful tool for reducing poverty in many developing countries.[1] It is common in countries where the incidence of poverty is high for there to be a heavy reliance on agriculture as a source of employment and income, particularly for the poor. This is very much the case for Timor-Leste.

While long-term development in Timor-Leste, like many developing countries, will most likely involve a shift to modern sector development, the limited opportunities in the modern sector and the large percentage of the population working in agriculture imply that in the short run, improvements in agriculture and farm productivity can have a positive impact on the living standards of the Timorese people.

Below, we discuss some of the main channels through which development of the agricultural sector can contribute to broad-based poverty reduction.

First, increases in agricultural output through higher land and labour productivity lead to lower food prices, directly benefiting net food consumers in both rural and urban areas. Poor households typically spend a large percentage of their income on food. As such, lower food prices allow households to buy more food, or potentially more diverse, nutritionally rich food, which can have a positive impact on household wellbeing. The benefits of good nutrition can have positive flow-on effects in many areas, including further increases to labour productivity for both current and future generations, improved educational attainment and fewer health issues.

Secondly, improved agricultural productivity can also result in increased incomes for both small and large scale farmers as well as increase employment opportunities in the agricultural sector. While the occurrence of lower food prices and yet simultaneous higher farming incomes and increased demand for farm labourers may appear counterintuitive, a large body of evidence shows that higher agricultural productivity usually results in higher farming incomes – empirically, the gains in income through productivity improvements outweigh the loss through lower prices.

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[1] Studies have shown that countries or regions where agricultural productivity has increased the most have achieved the largest reductions in poverty - DFID (2003).

Thirdly, the potential higher real incomes of the agricultural sector combined with lower staple food prices can help free up funds for the household to spend in other areas of the rural economy. This helps stimulate demand for goods and services produced outside of agriculture and spurs the development of the non-farm economy.

Finally, increased productivity in tradeable goods (exports) can also help reduce the incidence of poverty, particularly if production of tradeable goods is broad-based. Increased cash crop production means increased incomes to households involved in the production of that crop. In Timor-Leste, coffee is virtually the only export good, and 21% of households who work in agriculture are involved in the coffee industry. The quality of coffee in Timor is generally seen as high, however the market base is small and production is irregular, making it difficult to build long term international supply relationships.

The following diagram summarises the main pathways through which agricultural productivity can decrease poverty.

Figure 1
Pathways to Poverty Reduction
Deriving from Increased Agricultural Productivity
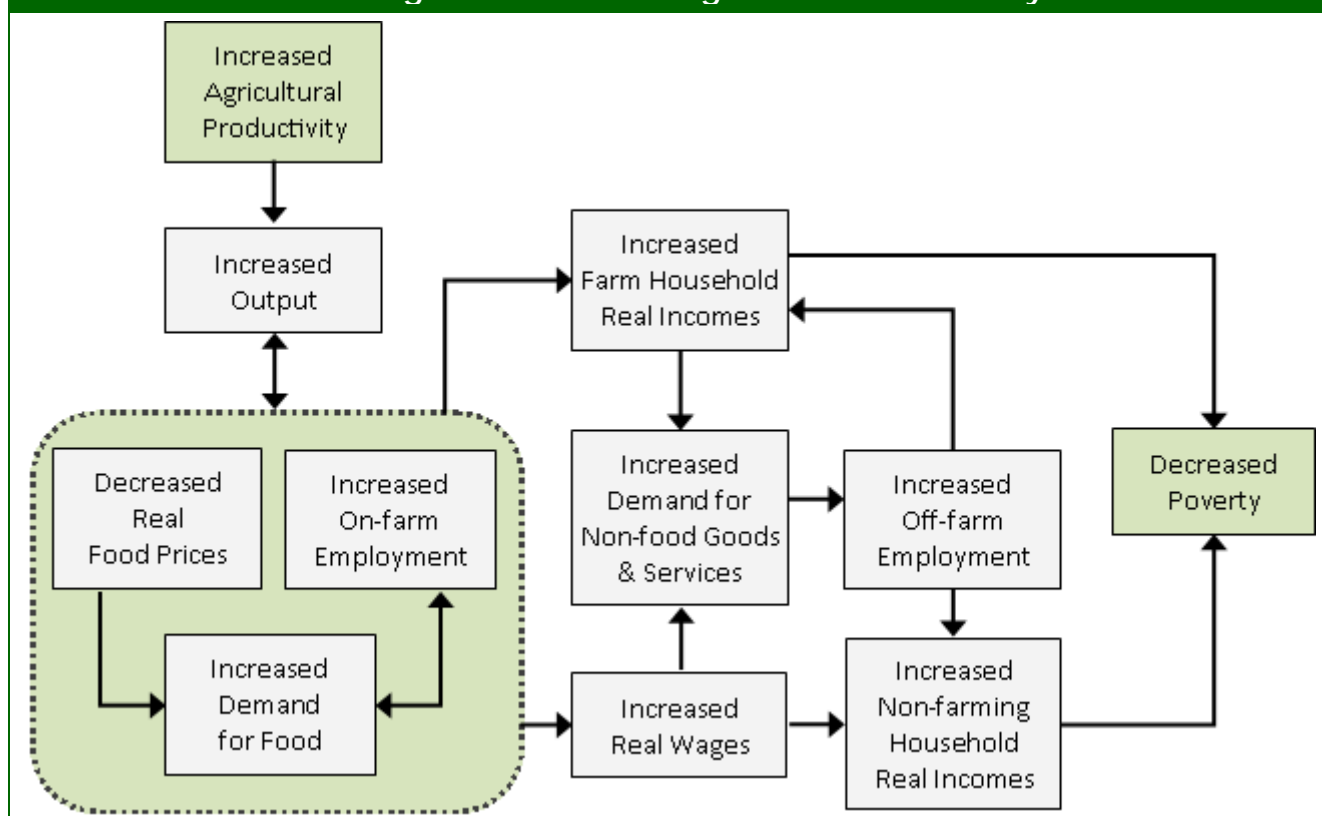
Source: Schneider and Gugerty (2011).

The Importance of Markets

For agricultural growth and increased productivity to successfully translate into poverty reduction, well-functioning agricultural markets are vital. When markets are working effectively, the framework is created for economies to be productive and to grow. Resources such as labour, capital and land can be allocated to exploit comparative advantage, specialisation will occur, improving productivity further and the benefits of growth in one area will flow through to other areas of the economy.

However, often there are obstacles to agriculture markets operating effectively, particularly in societies that are transitioning from a predominantly subsistence agriculture economy. Markets characterised by poor coordination, information flows or infrastructure are generally associated with slower overall growth for the country and fewer economic opportunities, including (or especially) for the poor.

6   Data Sources on Poverty

As is common in developing country contexts, a number of large scale surveys have been conducted in Timor-Leste since Independence. Each is sponsored by different agencies and has different emphases, strengths and weaknesses. In each case they have largely followed international conventions on how such surveys are designed and conducted.

The three potentially most useful surveys in poverty analysis are:

- Timor-Leste Survey of Living Standards (2007 and upcoming 2014) (TLSLS)

- Demographic and Health Survey (2009) (DHS)

- Household Income and Expenditure Survey (2011) (HIES)

It is generally possible to achieve a good level of comparability across waves of a particular genre of a survey. However, comparison between different survey types is difficult. It is tempting to undertake such comparisons because this is what may be needed in order to obtain an idea of trends in indicators across time. For example, the HIES of 2011 and the TLSLS survey of 2007 both collect information about households' consumption, and their productive / income generating activities. In principle, comparing these will tell us whether households have experienced improvements in consumption (and reductions in poverty) over this four year period. However, there are differences in how questions around household income and consumption are framed. These differences can be sufficient to make cross-survey comparisons difficult, and potentially misleading. This is not to say comparisons are

impossible, they just need to be done with care. For example, there is not an exact match between the list of consumption items between the TLSLS and the HIES, so matching is not simple.

There have been concerns expressed about the quality of HIES data. We cannot comment authoritatively here, but the HIES report does raise some puzzling questions. To give a specific example, later we report that the 2007 TLSLS average income from coffee sales was $42 per household per year, averaged across all households. Table 5.2.4 in the HIES 2011 reports average coffee income at $23.78 per month, or $285 per year. An average over all households of $285 is dramatically different to the 2007 figure of $42. Aggregate coffee production and price data does not suggest a substantial difference in total income earned from coffee between the two years, so the more likely explanation is some inconsistency in variable definition or data. 2011 data collected in Inder *et al* (2013) suggests the TLSLS figure is much more the appropriate order of magnitude.

There are other cases where comparisons across survey types are even more difficult. For example, the DHS surveys contain no information about incomes, and virtually no consumption information. The economic status of households is captured only by a series of asset questions, on the basis of which households are classified into wealth quintiles. In other studies, these wealth quintile classifications correlate reasonably well with consumption / income measures (eg Filmer and Pritchett, 2001), but this will not always be the case. TLSLS surveys contain similar asset information, so household wealth comparisons are potentially possible between TLSLS and DHS surveys. However, it is not possible to say whether a household's consumption poverty status is improving between a TLSLS-type survey and a DHS survey.

7 Empirical Findings

In this section we use detailed analysis of the 2007 TLSLS data to highlight various facts and patterns of relationships that help provide an empirical understanding of how agricultural households function. While much has changed in Timor-Leste since 2007, it is generally accepted that rural, agricultural life has not changed significantly for the vast majority of the population. So most facts and puzzles that we highlight are likely to still be very relevant to current discussions of policy and programs. We also acknowledge that over the period of this survey there was still a large amount of internal displacement from certain rural areas as a result of the conflicts in 2006.

7.1 The Agricultural Household

Crop-Growing Activity

First, we highlight the range of crops that households sell, and how much of those crops that are sold.

The More Common Crops:

Maize (96%) and Cassava (80%) are grown by the vast majority of households. Squash (pumpkin), bananas and sweet potatoes and taro are reasonably widespread, grown by 40-60% of households.

Production Volumes:

Typical volumes of production are small. To give an idea of magnitudes, we can make some simple calculations of the equivalent calorific benefit of these levels of production. Using the recommended nutritional norm of 2100 calories per person per day, and working with an average household size of 5 people (actual average is closer to 7 people, but we round down to adjust for the lower calorific needs of young children), a household that is self-sufficient in basic food requirements needs to produce enough consumable food to generate 10,500 calories of intake per day. We use maize as an example, since it is the most commonly grown crop, and has high calorific benefit per kg. The median annual production of 300kg of maize will generate approximately 2000 calories per household per day (note we have factored in the standard loss of weight in processing), which is less than 20% of the average household calories required.

Sales of Crop Production:

In most cases, a very small percentage of the harvest is actually sold, especially for the commonly grown crops. Note that the survey asks specifically about crops that are "sold" and asks for a price for these crops – in other words, this captures more formal market activities. We do not presume that all the crops that are harvested but not sold are subsequently used by the household for own-consumption. Some may be given away or bartered. We look into this more closely later. At this point, our focus is on the lack of exchange of crop production through cash sales in markets.

Table 3 shows wide variety in the percentage of a crop that is sold. For example, only 7% of rice produced is reported as sold, which highlights the lack of market for locally produced rice, possibly because it could not compete with imported rice, which benefits from an effective subsidy. Some crops have a higher access to market, with, for example, 33% of bananas sold, and more than half the other, smaller-volume fruits and vegetables being sold at market.

Table 3 What Crops do Households Grow?			
Crop	% of crop-growing households who grow this crop	Median kgs harvested per household	% of harvest that is sold
Maize	96%	300	7%
Cassava	80%	250	12%
Squash / Pumpkin	59%	100	15%
Bananas	53%	100	33%
Sweet Potato	43%	200	9%
Taro (Talas / Kontas)	41%	200	8%
Other Vegetables	32%	150	57%
Coconuts	24%	100	7%
Peanuts	21%	100	33%
Rice	17%	600	7%
Other Fruit	17%	150	60%
Kidney Beans	15%	100	46%
Gogo Rice	12%	300	16%
Soy Bean	9%	60	27%
Mung Bean	7%	100	36%
Potato	4%	100	11%
Coffee (cherry & parchment)	21%	230	83%

Figure 3 provides another window into the market for sale of crops that are harvested by households. It shows that 53% of crop-growing households report selling none of the crops they harvested over the past year. In other words, more than half the households who produce crops have not accessed cash markets with their produce. About 3/4 of all households sold less than 20% of the value of the crops they harvested. Of course, it remains an open question to consider why there is such low participation in markets. On the surface, one explanation could be that the levels of production are so low, that after taking care of their own food needs, households do not have surplus product to sell. Alternatively, perhaps a large percentage of production is shared informally with neighbours and relatives or bartered; none of this is likely to be measured as "sales".

Figure 3
What Proportion of their Crop Does a Household Sell?
Proportion of $ value of all crops excluding coffee
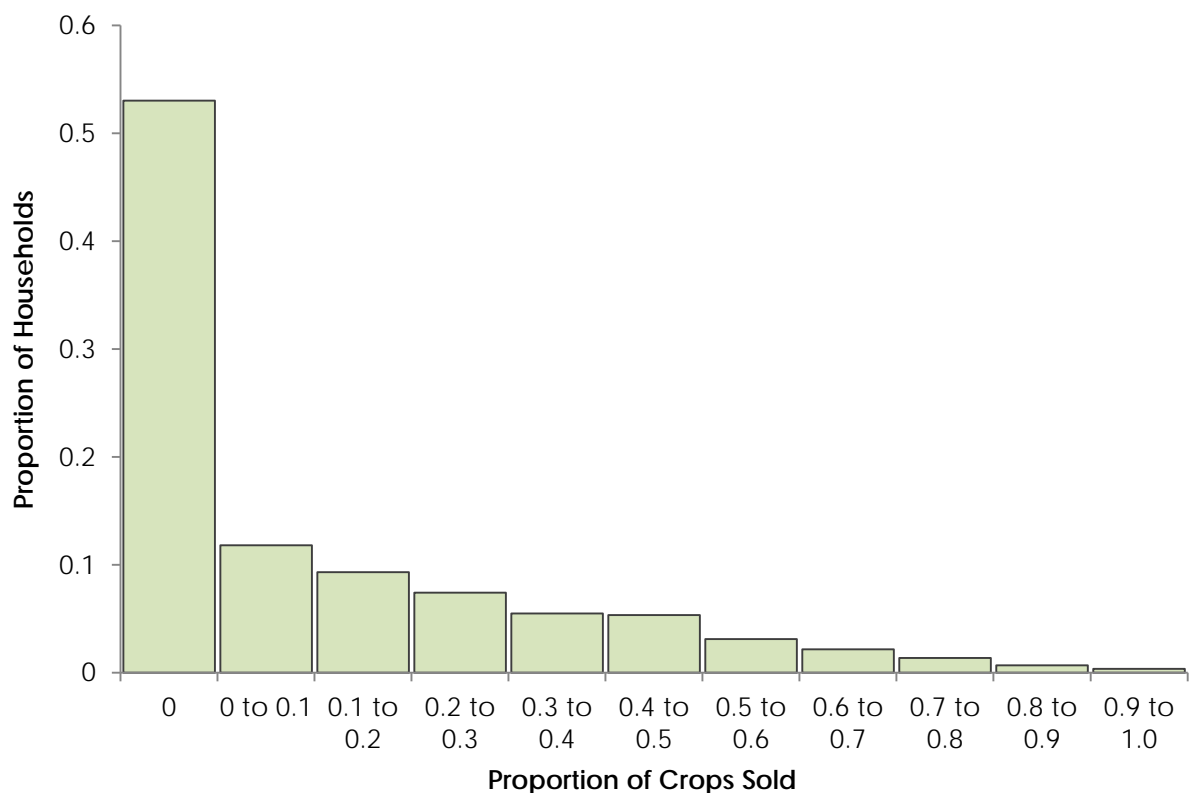
Crop-growing Land:

Next, we consider some basic features of the land where these crops are grown.

Table 4 What Size are the Plots on which Crops are Grown?	
Size of Plot (m^2)	% of Plots
< 250	8.6%
250 - 500	20.3%
500 - 1,000	32.9%
1,000 - 2,000	11.0%
2,000 - 5,000	15.0%
5,000 - 10,000	9.6%
10,000 - 20,000	2.2%
20,000 - 50,000	0.4%
> 50,000	0.1%

N.B. 1hectare = 10,000m²

The vast majority of plots of land are very small, with 97.3% being less than one hectare, and 73% being less than 0.2 hectares.

Table 5 What is the Slope of the Plots?	
Slope of the Plot	% of Plots
Flat	45%
Slight slope	37%
Moderate slope	14%
Steep slope	4%

While Timor-Leste is renowned for the very high proportion of hilly terrain, Table 5 suggests that most of the agricultural activity is taking place in areas of land that are relatively flat, with only a small percentage of plots reported as being on steep-sloped land.

Non-Crop Agricultural Activity

While production of food crops and coffee are the most widespread agricultural activities, many households also engage in a range of other productive activities. Here is a brief snapshot of these, with some basic facts about their scale and reach.

Livestock:

Table 6 shows the most common livestock that are sold by households, and average sale price. Pigs and chickens are most common, with more than 40% of households receiving some income across the year from sale of these. The responses can be used to compute the market value of an average household's livestock assets. 89% of all households report owning livestock, and the average value of this livestock is $610, with a median value of $244. Notably, of these households, the average amount earned from sales of livestock is $101 annually, with a median sales income of $25 per year. This provides another window into the mix between subsistence and non-cash agricultural activity and the level of market economy. The relatively low level of sales relative to stock or animals is consistent with the story for crops, that there is little market activity; most livestock is consumed at the household level.

Table 6 Sale of Animals		
Animal	% of Rural Households who Sold one or More of this Animal	Average Amount Earned from Sales
Chicken	42%	$17
Pig	40%	$94
Cow	12%	$265
Goat	11%	$55
Buffalo	6%	$351
Horse	2%	$116
Other	4%	$20

Eggs:

There is virtually no market for animal products except eggs, and this is very small scale: only 5% of rural households sold eggs, and 90% of these earned less than $20 in a year from these sales.

Forestry:

10% of households earned income from forestry activities, with almost half of these being for sales of firewood. Annual earnings are very low, with a median of $25, and 95% earning less than $200pa.

Agricultural Inputs:

Less than 4% of farming households use fertiliser, manure, herbicides, etc. Externally sourced seeds are more widely used as inputs; with expanded programs aimed at improved access to high-yield seed varieties in recent years, the prevalence of use of this input is likely to be even higher at present.

7.2 Production of Food Crops, and Consumption of Food

Results in the previous section show that only a small percentage of the food crops that households grow are actually sold in markets. It would be reasonable to presume that crops which are not sold are primarily intended for households' own consumption, or for consumption by family and neighbours. In this analysis we bring together two sections of the living standards survey, the food crop production section, and that on household consumption of food crops. This allows us to identify the extent of match between production and consumption of foods. We find many instances of a systematic lack of match both in aggregate and at the household level. While this finding is preliminary and needs further detailed investigation, it draws attention to a number of puzzles.

The first set of findings is based on Table 7, which shows the average amount of crops produced and consumed per week at the household level. Table 7 also shows for each crop the proportion of consumption that is sourced through self-production or gifts, not purchased at markets. Overwhelmingly households tend to consume crops that come via self-production as well as through the giving and receiving of gifts.[2]

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[2] Most households report that they consume the food they produce themselves; very few report consuming food that was received as a gift.

Crop	Amount Produced	Amount Consumed	Percent of Crop not Consumed	Percent Obtained through Own Production or Gifts
	Average kg per household per week			
Banana	2.2	1.7	25 %	77 %
Cassava	5.0	2.5	50 %	85 %
Coconut	0.9	0.5	47 %	83 %
Maize	8.2	4.6	43 %	85 %
Peanuts	0.4	0.2	56 %	68 %
Potato	0.1	0.1	0 %	16 %
Soybean	0.2	0.1	19 %	81 %
Squash	1.4	0.5	65 %	89 %
Sweet Potato	2.0	0.8	59 %	83 %
Taro	2.0	0.7	66 %	91 %

Table 7

Production and Consumption of Crops
Weekly average per household

To interpret the values in this table, use cassava as an example: the quantity of cassava produced in Timor is enough to provide, on average, 5kg of cassava to every household per week. However, the consumption results suggest an average household consumes only 2.5kg of cassava each week. The implication is that around half of cassava produced is not consumed. This mismatch between the quantity of produce supplied and the actual quantity consumed is typical to most of the common crops.

The results in Table 7 suggest on the surface that there are high levels of under-consumption relative to production. This could occur, for example, as a result of problems with post-harvest management of crops that results in sizeable losses. The magnitude of loss is such that it suggests addressing the causes of this loss would be a high priority.

Before jumping to such conclusions, though, we need to examine whether the results highlighted in Table 7 hold up to scrutiny. First, are the data reliable?

The consumption and production sections of the survey are framed quite differently, so there are legitimate concerns with consistency between the two. For example, consumption responses are based on consumption over the past 7 days, while questions about crop production ask about the level of production over the past year. For consumption, recall bias is typically smaller the shorter the recall period, so the consumption data is not likely to exhibit significant systematic measurement error. For production, longer recall periods tend to produce smaller estimates than the equivalent estimates based on shorter recall periods, so any systematic bias on the production side is more likely to be in the direction of understating production. There are other aspects of measurement of the production data (to do with units of measurement) which led us to omit a small amount of reported production, and make approximations in other cases (see Data Appendix for details). Conservative (lower) estimates were used in every case. This means the production data we have is likely to be lower than actual production, meaning the gap between production and consumption is likely to be even bigger than that reported in Table 7.

The 7-day recall period for consumption raises another possible source of inconsistency: if a household is surveyed in non-harvest time, when harvested supplies of a crop have been exhausted, then the 7-day consumption value will likely be lower than for a household which was surveyed soon after harvest time. For the analysis in Table 7, though, this timing issue is not a problem: the TLSLS sample comprises households surveyed across a full 12-month period, with similar numbers each month. So seasonality in differences between production and consumption would be averaged out over the full sample.

We also note that the large production / consumption gap does not exist to the same extent with all crops, particularly potato, where virtually all production was reported as consumed, but also with soybean and bananas. If the gap was a result of some systematic inconsistency in data measurement between consumption and production, one would expect this to be the case with all crops.

Finally, a comparison with a different country but similar survey design structure is informative. A Vietnamese study of rice production and consumption using the LSMS 2006 (Vu, 2008), found at aggregate level, very similar levels of production and consumption, after adjusting for typical weight loss in processing and for export volumes. In other words, using a survey with similar design to TLSLS, this study leaves no unexplained gap between production and consumption at the aggregate level, in contrast to the findings reported in Table 7.

So what explains the gap, assuming a reasonable case has been made that its existence is not some statistical anomaly? There are a number of plausible explanations.

First, perhaps some food crops are used to feed animals – cassava and maize are often used for this purpose. This is something that could be further analysed with the available data, but is currently set for future research. A brief perusal of the data on stock of livestock and their likely food needs suggests it is unlikely that there is sufficient stock of livestock to explain such a large and consistent gap between production and consumption.


Secondly, there is likely to be a risk aversion strategy to households' behaviour: with the inherent volatility in crop harvests, it makes sense to aim to produce more than what is needed, to protect against risk. This is a possible cause, but if this was the main explanation, it is hard to see why production at an aggregate level would be so much greater than consumption. It also begs the question of why excess production is not in turn made available to the market for others to purchase.

One remaining possible explanation for this apparent under-consumption is that a significant amount of the food crop is not being used for productive purposes, and is instead going to waste. Such a situation is more likely to arise if there is a lack of accessible markets for local crop production. A household with little access to markets of any form, formal or informal, must manage their own harvest, and given harvests occur only periodically (for most crops only once per year, and sometimes more often), post-harvest processing and storage becomes a major issue. If households have only basic processing or storage facilities, it is plausible that all these issues converge to see a large amount of wastage or sub-optimal use of crops.

Next we explore another dimension to this puzzle over production and consumption. While Table 7 highlights the mismatch between production and consumption in aggregate, there is further mismatch at the household level which is informative. Continuing with the cassava example, Figure 4 shows distribution of the difference between each household's average weekly production and consumption of cassava.

Figure 4
Difference between Household Production and Consumption of Cassava
Average kg per household
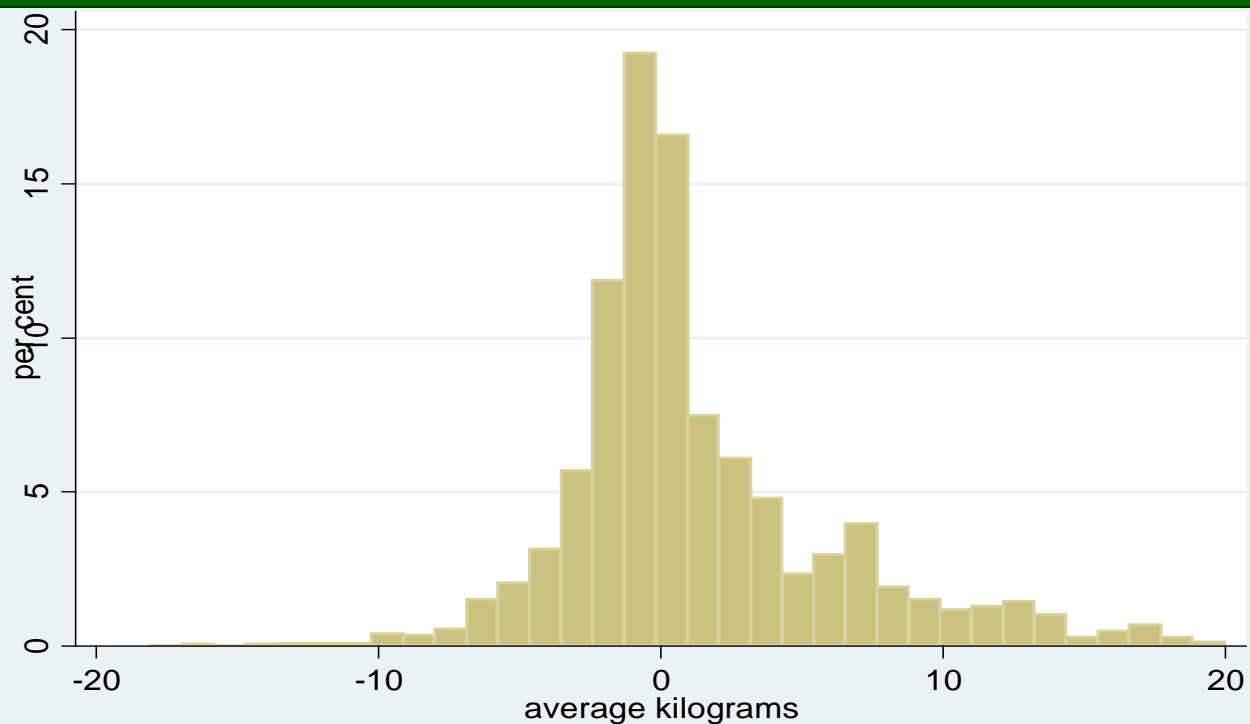
Bearing in mind that average production per household is 5kg per week, these values vary widely around zero. This can presumably be explained by the fact that those who produce more than they are consuming are selling, gifting or bartering to others who consume more than they produce. In other words, the data in Figure 4 suggests there is a large amount of exchange happening. But Table 7 shows that of those households that consume cassava, only 15% obtain cassava by purchasing it, and Table 3 shows that only 12% of cassava production is sold. We can thus conclude that the vast majority of exchange that is apparent from Figure 2 is non-formal exchange through barter or gifts.

The cassava story holds true for the majority of the staple crops in Timor-Leste. It appears that most of the mismatch between production and consumption of crops at the household level is not dealt with through the buying and selling of crops, rather (we assume) through informal means of exchange. Combined with the message of Table 7 that a high percentage of crop production fails to translate into consumption, this is consistent with a view that over-reliance on informal markets can make it difficult to clear the market and can lead to waste or sub-optimal use of produce. We cannot say with certainty that this is what is happening, but it certainly is worthy of further investigation.

7.3   Sources of Household Incomes

In understanding the realities of poverty, it is valuable to understand the sources of the income that households receive. This provides insight into where economic activity is at its strongest and conversely, where there is little evidence of economic activity from a household point of view. Ultimately progress towards poverty reduction relies at least in part on improvements in income of one sort or another.

In the context of this analysis, income is defined as either actual cash, such as financial gifts, the wage an employee earns or the payment for sales of crops or other produce, as well as "in kind" income, which is mostly in the form of food crops that a household produces and then consumes themselves. Where possible input costs are included in the calculation of income.

Table 8 shows the relative importance of different sources of income. Consider first the income from crops. We separate out the income earned from actually selling crops and the market value of the crops a household harvests but does not sell. Regarding the crops sold, observe that only 37.7% of households actually earn income from this source. Even in these cases, the amounts earned are typically quite low, with a median annual household income of only $65.

In contrast, more than 82% of households receive "income" as the imputed value of crops that they do not sell. One would assume that unsold crops are used for meeting the household's own food requirements, and possibly also those of neighbours and friends. This "income" source represents more than half the income of 54% of households, and is the only reported income source for 9% of households. In other words, for 9% of households, they report no cash income at all.

Consider now the income from coffee, the main cash crop. Only 16.2% of households reported earning income from coffee, and income of a typical coffee-growing household is quite low, with a median of $160pa. On the other hand, this is still substantially higher than the median income from sale of all other crops. While coffee, as the main export earner, is an important part of the agricultural economy, these data highlight that the coffee-growing sector impacts only a portion of households, and even in these cases, contributes only a modest amount to households' economic livelihoods.

Of the other types of agricultural activities, livestock is the most prevalent source of income, with pigs and chickens being the major animals. We should, however, stress that these values overstate their financial benefit. A proper analysis of the profitability of livestock activities for a household would need to take account of costs of inputs and of opening and closing stock of animals. There is insufficient data in the survey to be able to do this analysis properly, so we report here the income from actual sale of livestock, ignoring the input costs and change in inventories.

Table 8				
Income by Source, All Households				
	% Population with Actual or Imputed Income from this Source	**Annual Income for those who Receive Income from this Source**		**Mean Income across all Households**
		Median	Mean	
Market Value of Crops Harvested but not Sold	82.4 %	$ 220	$ 459	$ 378
Livestock	66.0 %	$ 105	$ 182	$ 120
Non-coffee Crops Sold	37.7 %	$ 65	$ 110	$ 41
Employment	22.3 %	$ 150	$ 202	$ 45
Food Assistance	20.8 %	$ 13	$ 23	$ 5
Coffee	16.2 %	$ 160	$ 260	$ 42
Forestry	7.0 %	$ 36	$ 131	$ 9
By-product	5.3 %	$ 5	$ 16	$ 1
Enterprise	5.2 %	$ 375	$ 1,069	$ 56
Fishing	3.0 %	$ 290	$ 669	$ 20
Other Assistance	1.9 %	$ 450	$ 1,107	$ 21
Pensions (mainly overseas)	1.4 %	$ 1,440	$ 5,068	$ 69
Cash Assistance	0.3 %	$ 700	$ 2,646	$ 9

Virtually all other agricultural activities are very small scale – only 3% of households earn income from fishing, 7% from forestry, and most of that is collecting and selling firewood locally, and animal by-products (almost exclusively eggs) yield a very small income (median $5) for only 5.3% of the sample.

Broader changes to the Timor-Leste economy between the survey period of 2007 and present raise questions about the relevance of data on income from employment and pensions. Specifically, social assistance packages through various pension schemes have expanded enormously in recent years (World Bank, 2013), so this income source would likely be far more important for many more households in 2014 than the 2007 data suggests. Regarding employment, there have also been a number of rural infrastructure development programs in recent years that have created some temporary employment in rural areas. Furthermore, sizeable increases in the minimum wage would affect the average incomes earned from employment. It is worth noting though that in the Labour Force Survey of 2010 (Table 3.1), 24% of households report receiving income from wage employment, and preliminary results from the 2013 Labour Force Survey suggest that 22.1% of the working-age population are employed. These are very similar to the 22.3% who earned income from this source in 2007, so while wage rates may have increased, it appears the reach of wage employment has not changed much at all since 2007.

The data on income from enterprise activities is based on households' estimates of their net income from such activities (income minus costs). There is wide variability in these incomes across households, indicating it captures both the small scale enterprise activity of a local kiosk through to larger family businesses. The most notable finding here, though is that only 5.2% of households report receiving income from this source.

7.4 Relationship between Income and Consumption of Food

In this section we develop a model of food consumption and its relationship to income by source. Food consumption is the component of expenditure / consumption that has the strongest impact on poverty. One would expect that as incomes increase, households would be able to increase their food consumption to ensure they are able to meet their basic nutritional and energy needs, although following Engel's Law, the share of income spent on food might decline as incomes rise (Chai and Moneta, 2010).

However, the story may not be quite that simple. In this section, for example, we show that the composition or source of income matters. For example, income earned from food crops has a much greater impact on food consumption than income from any other source. We also show that the impacts of higher incomes vary across different categories of food consumption (rice and cereals compared to meat / vegetables / fruit).

The base model (Table 9) involves relating a household's food consumption to their total income. Both variables are defined in monthly per capita terms, and the model contains control variables which allow for variation between households in urban or rural areas and across geographic regions, as well as variations across household size. The model provides an estimate of the marginal propensity to consume (MPC) food, and the estimate is a relatively low 0.23. In other words, for every extra dollar of income they earn, the model suggests that an average household consumes an additional 23 cents worth of food.

This estimate of the MPC appears low, but is not implausible. The model suggests that even households with very low incomes are able to achieve a minimal level of consumption of food, below which day-to-day survival is threatened. As income increases, consumption of food also rises, but not at a rapid rate. In subsequent

models we will see there is some complexity to the story that this aggregated model is not capturing, which sheds further light on this relatively low MPC.

Table 9		
How Household Food Consumption Relates to Income Both measured as monthly per capita		
Independent Variable	**Impact** Holding Other Variables Fixed	**Statistical Significance** |t-values| >1.96 Indicate a Significant Variable
Consumption in Rural Compared to Urban Area	- $ 6.02	16.7
How Average Consumption for this Region Varies from Dili: Baucau, Lautem, Viqueque	- $ 5.87	9.6
Ainaro, Manufahi, Manatuto	- $ 9.82	16.0
Aileu, Ermera	- $ 2.62	3.6
Bobonaro, Covalima, Liquica	- $ 3.87	6.3
Oecusse	- $ 7.31	11.2
Consumption per Person Changes by this Amount for Every Extra Person in the Household	- $ 1.93	28.2
Increase in Consumption for Every Extra $1 of Income	$ 0.23	16.5

To gain an idea of how much food consumption varies in response to the other factors in the model, we note that the estimated mean monthly per capita food consumption is $22.25 worth of food. So differences of $6.02 between urban and rural areas is reasonably substantial.

The first variation on this model to consider is whether this MPC varies with level of income. The sample of households is split in two: households with the lower 50% of incomes, and households with the upper 50% of incomes. When the model is estimated with these two groups separately, we find and MPC for the poorest 50% of 0.59, and for the richest 50%, the MPC is 0.21. It is apparent that the estimated MPC for the overall sample of 0.23 was hiding a great deal of variation in the MPC across income levels. The much higher MPC for the poorest half of households is consistent with the widespread finding that poorer households give highest priority to meeting their food needs, so food consumption for these households should be more responsive to increases in income than the richer households.

How Food Consumption Varies with Source of Income

Next, consider how MPC varies with the source of income. Because income from the different sources comes in different ways, with different regularity, it is plausible that changes in income from different sources can have differential effects on food consumption, particularly in an economy with limited access to financial services that means it is difficult for income to be smoothed across the year.

To explore this possibility, we decompose income into its various sources and include incomes by source in the estimated model. This model can be interpreted as a model that asks how the overall MPC of 0.23 varies with income source. If income source makes no difference to consumption behaviour, we expect all these coefficients to equal 0.23. How they vary from 0.23 suggests the extent to which income from this source is used by a greater or lesser extent towards food consumption as opposed to other possible expenditures.

The results are given in Table 10. We make the following observations from this model:

- Increased income from selling food crops has the strongest impact: an extra dollar of income translates to 87 cents more for food consumption.

- A higher income from the annual coffee harvest has an above-average effect on food consumption (MPC=0.63), more than double the average of 0.23.

- Increases in employment and enterprise income also have relatively high / above average impacts (MPC=0.53).

- Strikingly, the value of food crops harvested but not sold has a very small coefficient of 0.06. Other things being equal, one might expect this coefficient to be close to 1.0. This variable represents the food that a household produces for themselves and does not sell. One would expect that this food would mostly be used for the household's own consumption needs, with some shared with family and friends. If so, one extra dollar's worth of such food harvested would translate to a high proportion being consumed. What can explain this very low coefficient of 0.06? Some understanding of this unusual result can be found in the results of the previous section. There we found a surprisingly weak relationship between crop production and crop consumption at the household level, crop-by-crop, presumably because there is a high level of sharing and barter of food crops between households. None of this is captured by the data used in this model, so it is consistent with a finding of little direct impact of a household's food production on their food consumption, except via the income generated from crop sales.

Table 10

How Household Food Consumption Relates to Income by Source
Both measured as monthly per capita

Independent Variable		Impact Holding Other Variables Fixed	Statistical Significance | t-values | >1.96 Indicate a Significant Variable
Consumption in Rural Compared to Urban Area		- $ 5.13	14.3
How Average Consumption for this Region Varies from Dili:	Baucau, Lautem, Viqueque	- $ 4.49	7.3
	Ainaro, Manufahi, Manatuto	- $ 9.61	15.7
	Aileu, Ermera	- $ 4.26	5.5
	Bobonaro, Covalima, Liquica	- $ 3.57	5.9
	Oecusse	- $ 6.29	9.8
Consumption per Person Changes by this Amount for Every Extra Person in the Household		- $ 1.97	29.1
Increase in Consumption for Every Extra $1 of **Each Type** of Income:	Crops harvested but not sold	$ 0.06	2.6
	Crops harvested & sold	$ 0.87	9.2
	Coffee	$ 0.63	8.0
	Livestock	$ 0.20	5.2
	Other agricultural activities	$ 0.10	1.9
	Enterprise activity & employment	$ 0.53	15.8
	Cash assistance, pensions, other income	$ 0.30	8.6

The weak connection between food produced and food consumed provides some explanation for the low MPC overall for income (Table 9). Recall from Table 8 that the major component of income, on average, is the market value of crops harvested but not sold. It is this component of income that bears the weakest relationship to food consumption, with an MPC of only 0.06, contributing substantially to the overall MPC of 0.23 in Table 9.

Does this variation in MPC across income sources just reflect the likely different mix of income sources across income levels? The earlier result showed that MPC declines with income, so if certain income sources are associated with higher levels of income, the lower MPC on this source of income might just reflect this decline in MPC across income. To check this out, we rerun the model with sub-samples, with those in the lower 50% of incomes in one sample (Table 11, panel A), and the higher 50% in the other (Table 11, panel B).

Table 11
How Household Food Consumption Relates to Income by Source

Independent Variable		A		B	
		For Lowest 50% of Incomes		For Highest 50% of Incomes	
		Impact	Statistical Significance	Impact	Statistical Significance
Consumption in Rural Compared to Urban Area		- $ 3.36	7.2	- $ 5.61	9.9
How Average Consumption for this Region Varies from Dili:	Baucau, Lautem, Viqueque	- $ 3.44	4.7	- $ 3.76	3.5
	Ainaro, Manufahi, Manatuto	- $ 8.13	11.4	- $ 8.81	7.9
	Aileu, Ermera	- $ 3.33	3.0	- $ 3.14	2.6
	Bobonaro, Covalima, Liquica	- $ 2.15	2.8	- $ 2.42	2.3
	Oecusse	- $ 6.70	9.2	- $ 1.67	1.4
Consumption per Person Changes by this Amount for Every Extra Person in the Household		- $ 1.58	18.5	- $ 2.28	21.9
Increase in Consumption for Every Extra $1 of **Each Type** of Income:	Crops harvested but not sold	$ 0.33	2.1	$ 0.03	1.1
	Crops harvested & sold	$ 0.71	2.0	$ 0.90	8.4
	Coffee	$ 0.75	2.0	$ 0.61	6.9
	Livestock	$ 0.36	1.9	$ 0.17	3.9
	Other agricultural activities	$ 0.24	0.5	$ 0.11	1.9
	Enterprise activity & employment	$ 2.80	14.5	$ 0.46	12.1
	Cash assistance, pensions, other income	$ 0.40	1.1	$ 0.31	8.0

Impact: Holding other variables fixed; Statistical Significance: | t-values| >1.96 indicate a significant variable

Comments:

- The lower income sample results are far weaker than the upper. This reflects a pattern that the relationship between income and consumption for the poorest 50% is much weaker.

To illustrate, for the overall income equation, the MPC estimate for the poor was 0.59 (in models not reported here), but a 95% confidence interval for this value ranges from .36 to 0.84! For the upper income group, the confidence interval is much narrower (0.17 to 0.24). The much wider interval for the low-income sample suggests there is a huge amount of variation in the relationship between income and consumption for this sample, so obtaining accurate estimates of the relationship is very difficult. This lack of precision shows up in a much weaker set of results when income is divided up by source. Coefficients are reasonably similar to the overall sample, but several of the income effects are on the edge of statistical significance.

- The sample for the upper 50% of income levels shows similar results to the overall sample. This supports the view that we cannot attribute the differences in MPCs across incomes sources to the effect of a general decline in MPC with total income.

- There is one other striking comparison between the results in panels A and B of Table 11. While the income effects appear much weaker in panel A, the regional and rural/urban effects are as strong as or stronger than the upper-50% sample in panel B. This suggests that food consumption for those who earn little income (the lowest 50%) depends most of all on location. For households who rely mostly on subsistence food supplies shared informally at the local / community level, geography becomes a critical factor: food consumption depends mainly on the amount of food production in that local area, and food production varies significantly across regions. This has some important implications for food security, as a high dependence on locally produced food makes households and whole communities vulnerable to climate and other shocks.

Why would the different sources of income have such variable impacts on food consumption / expenditure. In theory, "a dollar is a dollar", meaning households make their decisions about how money is spent based on the relative benefits generated from various spending options, regardless of the source of income. But there are several reasons why source of income and its ultimate use are not so easily separated. We briefly suggest just a couple of possible explanations here.

- Gender differences within the household: in most households, a particular source of income will be earned / received by just one of the adults. Depending on how household decisions are made, this recipient may have a greater say in how the money is spent, and different adults will have different spending priorities. For example, it is often found that on average, when a mother receives income, more of that money is spent on direct family needs like food than if an adult male earns the income. It is likely that some of the income sources which most translate to food production (e.g. food crops sold at local markets) are primarily earned by women, and this may explain the higher returns for food consumption compared to other income sources that are more likely earned by men (eg employment income).

- Lack of access to savings: some sources of income are received by households in small amounts quite frequently (eg sales at markets) and other income is received in larger one-off lumps (eg coffee income is earned only at the annual harvest time). With the vast majority of households making no use of financial institutions, especially in rural areas, then households find it difficult to smooth their consumption. Income received only occasionally is thus more likely to be spent on items that are less frequently purchased, such as clothing, transport to city, celebrations, etc.

Impact of Income on Different Types of Food

Returning to the full sample, we now decompose total food consumption into types of food: Cereals (rice, maize, etc); and all other food (excluding tobacco and alcohol).

Panel A of Table 12, which presents results for consumption of cereals, suggests there is little income effect at all on consumption of these essential foods. This is the staple food that produces most basic energy (calories through carbohydrates). The model's estimates are consistent with a view that households source the required amount of this food from wherever they can, and that consumption of this food is not strongly related to income. Further, consumption of these foods does not increase much as households see increases in income – more, the next set of results suggest that they diversify into other foods. The regional effects are also interesting in panel A of Table 12: virtually all regions actually show *greater* consumption of cereal crops than Dili, while previous tables show the opposite effects for overall food consumption.

The estimates in panel B of Table 12 show a very similar pattern to the overall results for food consumption. There is a strong response to improvements in income, especially when that income source is from the sale of crops.

This set of results suggests that the impact of increased income on food consumption, which is the most basic of human needs, operates primarily through increases in food consumption outside the most basic staple crops that are mainly responsible for providing energy in the form of calories. Higher incomes allow households to increase their consumption of other vegetables and of meat and fish, which provide protein and other nutrients.

	Table 12			
How Household Cereal and Non-Cereal Food Consumption Relates to Income by Source				
	A		**B**	
	Cereal Consumption		**Non-Cereal Consumption**	
Independent Variable	**Impact**	**Statistical Significance**	**Impact**	**Statistical Significance**
Consumption in Rural Compared to Urban Area	- $ 0.16	1.3	- $ 4.73	16.0
How Average Consumption for this Region Varies from Dili: Baucau, Lautem, Viqueque	+ $ 1.19	5.4	- $ 5.22	10.4
Ainaro, Manufahi, Manatuto	- $ 0.66	3.0	- $ 8.21	16.3
Aileu, Ermera	+ $ 0.66	2.4	- $ 4.48	7.1
Bobonaro, Covalima, Liquica	+ $ 0.86	4.0	- $ 4.17	8.3
Oecusse	+ $ 1.72	7.4	- $ 8.24	15.6
Consumption per Person Changes by this Amount for Every Extra Person in the Household	- $ 0.44	18.2	- $ 1.39	24.8
Increase in Consumption for Every Extra $1 of **Each Type** of Income: Crops harvested but not sold	$ 0.03	3.5	$ 0.03	1.5
Crops harvested & sold	$ 0.15	4.5	$ 0.66	8.5
Coffee	$ 0.02	0.8	$ 0.53	8.2
Livestock	- $ 0.02	1.3	$ 0.20	6.2
Other agricultural activities	$ 0.04	2.1	$ 0.04	1.0
Enterprise activity & employment	$ 0.05	4.5	$ 0.43	15.4
Cash assistance, pensions, other income	$ 0.03	2.7	$ 0.27	9.4

Impact: Holding other variables fixed; Statistical Significance: | t-values | >1.96 indicate a significant variable

Summary: Patterns in the Consumption – Income Relationship

Here are some of the key findings in the consumption-income relationship:

- For the poorer 50% of households, the relationship between income (either cash or imputed) and consumption is highly variable across households, suggesting a good proportion of these households' consumption is sourced from some non-measured between-household sharing.

- The strongest determinants of consumption, especially for the poorest 50%, are location-related (region / district, rural / urban). This is consistent with households facing the widespread challenges of inadequate transportation infrastructure and hence being heavily reliant on local food production, which varies greatly by geographical area.

- Households in the upper 50% of incomes are less reliant on subsistence food consumption, and here income effects on food consumption are more consistent across households.

- The evidence is that households with higher incomes earned from sale of food crops or coffee, or from employment income, spend much more on food, especially non-staple crops.   There is less evidence of higher food consumption among households with higher incomes sourced from non-labour sources or from other agricultural activities.

- Households with higher incomes tend to consume little more staple crops; instead, their food consumption is typically considerably higher in non-cereal foods.

8 Implications and Recommendations

This paper has covered a wide range of issues, and benefited from valuable input from participants in a seminar in Dili hosted by La'o Hamutuk, and with DFAT staff in Canberra, Australia during May 2014. In this section we will try to summarise the main findings and indicate potential policy directions. With the breadth of issues covered, the conclusions remain tentative, but hopefully provide a useful stimulus for further discussion and research.

8.1 Agricultural Production and the Rural Sector

Broader Development Context

We have sought in this paper to develop a sound understanding of the current realities of the rural economy. Our discussion of ways forward is built on this foundation, focusing on realistic next steps.

We acknowledge that longer term structural changes are likely to emerge, such as rapid urbanisation, increasing farm sizes, more use of inputs and mechanisation, greater specialisation in production, etc, etc. Similarly, development in the agricultural sector will clearly be affected by developments in other sectors, not least due to their implications for the supply of labour – as more urban employment is created, there will be less labour available in rural areas, for example. All of these broader issues are vital, and need much more consideration than we have been able to provide in this paper. Hence our focus on incremental steps forward in developing the agricultural sector.

Current Realities

The various pieces of analysis presented in this study paint a picture of life for the majority of households in Timor-Leste based on subsistence, small scale agriculture. Accompanying this is a strong emphasis on communal sharing of production / food, and in contrast, very little participation in formal markets.

This subsistence lifestyle has a number of economic and social costs that are consistent with the high levels of poverty:

- Agricultural productivity is very low.

- For many households, there is insufficient food being produced to meet basic needs.

- In the absence of markets, households sensibly diversify their production, and are thus unable to experience the benefits of economies of scale or specialisation in production.

- Most households are largely unable to participate in markets.

- There appears to be a high level of post-harvest loss, in part as a result of lack of access to markets.

- Food consumption is very sensitive to geographical location, again consistent with low levels of exchange beyond communal sharing of production at the local level.

Coffee remains the main crop with a relatively well-functioning supply chain, and coffee is the source of a high proportion of the income earned from agricultural production sales. This is despite coffee yields being very low and quality variable.

Guiding Principles for Ways Forward

1.   First, the way forward needs to be built on a realistic understanding of these current realities. Strategies need to acknowledge the current heavy reliance on subsistence agriculture.

2.   In order for livelihoods of agriculture-dependent households to improve, programs will need to be developed or expanded that address some of the hindrances to improving production and expanding market access.

3.   While post-harvest loss is clearly a major problem, at least some of the problems of post-harvest loss will be addressed with well functioning markets where surplus production can be sold in a timely manner.

4.   The example of coffee suggests that the whole supply chain must be established and supported for markets to grow. This is even more critical than investment in improved productivity.

5.   Improving agricultural market activity is not purely a supply side issue: demand must also be stimulated. It is fair to say that there at least some broad-based demand for marketed goods; in other words, there is cash in the economy. A demonstration of this is that even in the 2007 survey, 75% of households report purchasing imported rice in the past week, despite mostly having access to alternative staple foods like corn. In more recent years, with growing social transfer systems, more rural-urban migration of some family members (with associated remittances) and more widespread government-funded local employment programs, rural economies are likely to be even less cash-constrained. However, the magnitude of these other sources of rural income should not be overstated: they each reach only a moderately small proportion of households. There is still a case to say that much of the lack of market activity is due to inadequate demand because of a lack of cash in rural areas.

Specific Recommendations

1. Locally based rural development programs that address the whole supply chain and market constraints

This should include improvements to productivity and improving consistency of quality and supply, establishing a physical supply chain and relationships to buyers, providing savings and loans facilities, building financial literacy, etc.

The emphasis on locally-based programs is derived from recognising that constraints and obstacles are often specific to a particular community and region, and that obtaining buy-in from locals to adapt their approaches to production and markets requires a high level of trust that must be earned.

2. Focus on crops with an existing level of marketed surplus, and those with obvious market potential

In most cases, it will be easier to expand activity and income from crops that are already currently marketed than to start at the beginning with crops that are grown almost exclusively as subsistence crops. More immediate benefits will be obtained from improving productivity, quality and a more responsive supply with a supply chain that already exists but that could be expanded or improved, rather than starting from scratch.

Similarly, crops that have clear market potential ought to get higher priority. The most obvious way to ensure market potential is through identifying products whose consumption is largely based on imports, but where there is some local production. Examples include eggs, rice, honey, peanuts, spices, among others. In these cases, the markets clearly exist, so the opportunity is there for claiming a growing market share for a locally produced variety of comparable quality and price, with an equally (or more) reliable supply chain. This strategy is referred to as import substitution, an approach that used to be prominent in development circles, but in more recent decades has come under some criticism. However, the context of import substitution we are presenting here is completely different to that practiced in the past. In the past, import substitution stood for high tariffs or quotas on imported products to protect an infant industry, based on the presumption that the main impediment to domestic production is an inability to compete on price with the imported version. In the current context, we would argue this is not

the main constraint to competitive domestic production: it is more about the absence of the full supply chain that can guarantee consistency in quality and supply.

Of course, there are risks associated with expansion of crops with existing or potential marketed surplus and access to markets. If households invest more resources (land, water, time) in crops for markets and less resources in subsistence food crops for own-consumption, they are vulnerable to failures in the supply chain, market price fluctuations, etc. There are also potential shifts in power relationships within households (for example, between men and women) that add to the risks in such a move. In acknowledging these risks, we would advocate that agricultural development programs need to be designed to take a locally-based, holistic approach that is based on an understanding of community and household power dynamics, and that seek to address household livelihood and welfare needs, in addition to pursuing improvements in productivity and marketed surplus.

3. Establishing Food Processing Facilities

As Timor-Leste seeks to expand the private sector and increase formal employment, a natural direction to pursue is with secondary processing of locally produced food. This will generate growing demand for the inputs, hence improving producer incomes, as well as creating local employment and generating a product(s) that can compete with imported alternatives. Appropriate choice of foods and technology that results in non-perishable products can also help deal with some of the challenges with transportation.

Already there have been initiatives to establish food processing facilities within Timor-Leste – for example, roasted coffee for the local market, and Timor Global's food processing facility in Railaco. But the potential is there for a significant expansion of such activities.

4. Researching key impediments to markets

While it is well recognised that there is enormous scope for expanding markets in Timor-Leste, and the specific recommendations in this section are pushing in that direction, the reality is we understand little about why markets are not already prevalent. Action should not wait until research has "answered" all the questions, but nor should we neglect seeking a better understanding of the "why" question. Such understanding of the critical impediments to markets will surely guide priorities in development programs going forward. Many opinions are put forward to explain the lack of markets – for example, a poor road and transportation network, lack of financial markets and financial literacy, lack of entrepeneurship among the Timorese people, an absence of traders and wholesalers who broker relationships between producers and buyers (again, perhaps because of a lack of entrepeneurship), weak demand for food crops due to lack of cash, variability in quality of produce, lack of consistency in supply, food crop production that does not align with trends in consumer tastes, etc.

Research will allow us to tease out just which of these many factors are really critical, and which are of secondary importance, or will perhaps resolve themselves as the more fundamental issues are addressed.

8.2 Food and Nutrition

This research has shown striking links between the economic activities of households and their food consumption, including the mix of foods they consume. The link of food consumption and food diversity to nutritional outcomes has been well researched. While it is acknowledged that many other factors beyond food contribute to nutritional outcomes (eg sanitation, water, housing, health services, etc), food intake and food diversity are vital. The patterns highlighted in this research can provide valuable input into the wider strategy around nutrition in Timor-Leste. The specifics are beyond the scope of this research, but potential issues to consider are:

1. Income sources matter to food intake. For example, providing greater access to local markets for locally produced food is a key to improving food consumption and food diversity.

2. The results on the income-consumption link are a clue to the importance of understanding what happens within the household in terms of who receives income and how decisions are made about the ways it is spent. For example, there is a big risk for Timor-Leste with the emergence of a growing middle class and openness to imported processed food, that spending decisions slant more towards consumption of items which symbolise economic success, at the expense of food items that best meet nutritional needs. Understanding and influencing decision making power within the household is critical here.

3. Poverty is a big problem – this is obvious but needs to be said. Moving from the bottom income decile to the fifth decile in Timor-Leste would appear to do little to improve the typical household's intake of nutritional foods; the benefits only begin to appear when households move well into the upper 50% of incomes. The nutritional challenges are deep and will require a significant economic transformation to be addressed sustainably in the long term.

4. The 2013 National Nutrition Survey provides an excellent opportunity to identify the role of food in nutrition, including looking at district and regional variations in the types of food available, and how this might affect nutritional outcomes. Ultimately this can inform strategies for targeted interventions to address nutritional needs in particular areas or in particular seasons.

8.3 Institutional and Structural Factors

Institutional factors are vitally important in implementing the specific actions described above. It is beyond the scope of this paper to discuss institutional arrangements in depth, but we make some brief comments here.

1. The Timor-Leste government largely relies on the Ministry of Agriculture, Forestry and Fisheries (MAP) to drive agricultural planning and extension work. The Ministry of Commerce, Industry and Environment also play a role in assisting local producers to improve market access, etc via supporting the establishment of local co-operatives. The co-operative strategy builds on long term cultural values in various parts of Timor-Leste society, and hence has the potential to be a valuable mechanism for building trust and community

support for change. At the same time, local co-operatives will need the support of organisations who have a broader perspective and experience, who can identify markets, facilitate the whole supply chain, bring in appropriate technical expertise, etc.

2.   As already emphasised, specific local solutions are needed, and investment in relationships at the local level are vital to programs that are to be effective. This suggests much of the ongoing, local-level work of development will likely occur outside the domain of current MAP structures. This is not to say MAP does not have a role, but more that its role can be to facilitate such locally-based activities, within a broader national framework.

3.   There is great potential for involving the private sector in the kinds of programs described above.   However, it is likely that private sector investment will need to be accompanied by public or international support, for a few reasons. First, the risks are high in building supply chains and new markets, so private investors will be reluctant to take such risks alone. Further, development must be holistic and take account of dimensions beyond improvements in yield, quality and consistency of supply. They need to take account of impacts on household welfare – the households involved are too vulnerable to be able to carry the risk of changes in the way their daily livelihoods and food needs are generated. The private sector is unlikely to make sufficient provision for such dimensions of programs.

8.4   Final Comments

To conclude, there is an urgent need for rural and agricultural development in Timor-Leste. This need is driven by the genuine poverty and hardship experienced by the majority of Timor-Leste's population on a day-by-day basis. It is not an option to pursue strategies that make no difference in the short or medium term to the lives of the vast majority of the population who classify as poor by any measure. It is hoped that this research can shed light on some ways forward, for the good of the people of Timor-Leste, both present and future generations.

References

Chai, A. and A. Moneta (2010), Engel Curves, *Journal of Economic Perspectives*, 24, 225-240.

Department for International Development (DFID) (2003), *Making agricultural markets work for the poor*, Renewable Natural Resources and Agriculture Team, DFID Policy Division Working Paper.

Filmer, D. and L. Pritchett (2001), Estimating wealth effects without expenditure data – or tears: an application to educational enrolments in states of India, *Demography*, 38, 115-132.

Government of Timor-Leste (2010), *Timor-Leste's Strategic Development Plan 2011-2030*.

Government of Timor-Leste (2012), *Program of the fifth Constitutional Government: 2012 – 2017 Legislature*.

Government of Timor-Leste (2013), *State Budget 2014, Book 1*.

Inder, B., Cornwell, K. and D. Lloyd (2013), *Coffee, poverty and economic development in Timor-Leste*, Centre for Development Economics, Monash University.

Lundahl, M. and F. Sjoholm (2013), Improving the lot of the farmer: development challenges in Timor-Leste during the second decade of independence, *Asian Economic Papers*, 12, 71-100.

Ministry of Finance (2008), *Final Statistical Abstract: Timor-Leste survey of living standards 2007*.

Ministry of Finance (2013), *Timor-Leste National Accounts 2002-2011*.

Oxford Poverty and Human Development Initiative (OPHI) (2013), *Country Briefing: Timor-Leste*.

Schneider, K. and M. Gugerty (2011), Agricultural productivity and poverty reduction: linkages and pathways, *The Evans School Review*, 1, 56-74.

United Nations Development Program (UNDP) (2010), *Human Development Report 2010- The Real wealth of nations: pathways to human development*.

United Nations Development Program (UNDP) (2013), *Human Development Report 2013- The Rise of the South: Human Progress in a diverse world.*

Vu, L. (2008), *Essays of the Economics of Food Production and Consumption in Vietnam*, PhD thesis, University of Minnesota.

World Health Organisation (WHO) (2010), *World Health Statistics 2010.*

World Health Organisation (WHO) (2013), *World Health Statistics 2013.*

World Bank (2007), *World Development Report 2008 – Agriculture for Development.*

World Bank (2008), *Timor-Leste: Poverty in a Young Nation.*

World Bank (2011), *Timor-Leste: Expanding Near Term Agricultural Exports.*

Appendix: Data Issues

Measuring Production

While the consumption data used in this research can be considered quite reliable, the production data are subject to a higher degree of measurement error. First, production data were collected by asking households to recollect the quantity of crops produced over the last year. This is likely to result in some degree of recall error on the part of the household. Second, the quantity of crops produced were recorded using one of six different units: 1kg, 50kg, 100kg, 1 litre, 390 grams and *buah*, with the measurement used differing across crops and between households.

The different measurement units presented us with two main problems when calculating total quantity of crops produced in standardised units. First, it was not clear how to convert the 1 litre, 390 grams and *buah* crops into 1kg units and as a result these are not included in our data analysis. While these units were used only for a small number of crops (the 50kg unit is the most common unit recorded) the exclusion of these observations may result in an underestimate of the total quantity of crops produced, particularly for coconut (60 per cent of households reported volumes in *buah* terms) squash (58 per cent) and bananas (19 per cent). Second, on converting the crops recorded in 50kg and 100kg units into 1kg units, the data showed that a number of households recorded particularly high annual crop yields yet sold none. We find this to be unlikely and have eliminated these outliers from the analysis in order to avoid overstating the total quantity of crops produced.

Valuing Production

For crops that are harvested but not sold, it is necessary to impute a value for this crop production, to count as a part of a household's income. This is straightforward when a household sold some of the particular crop: we have unit price information for the crops that were sold, and use that price to value the unsold crop production. When a household did not sell any of a particular crop, there is no household-level price information, so the median selling price of that crop across the whole sample is used.

Outliers

There are a number of outliers in many variables. To deal with this, we have used medians where appropriate as measures of "average". In the models, we have excluded households with outliers from the analysis as they can have undue influence on the estimated models. We take a reasonably conservative view about identifying outliers (only excluding a household when the outlier is extreme and obvious). This resulted in losing less than 5% of the sample of households. A more inclusive definition of outliers was also used to check robustness, and the model results remain virtually unaffected.