Poverty and the Agricultural Household in Timor-Leste:

Some Patterns and Puzzles

Brett Inder^, Anna Brown*, Gaurav Datt^

^ Centre for Development Economics and Sustainability, Monash University
* Department of Foreign Affairs and Trade, Australian Government

Draft for Feedback May 2014

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 TL 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 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, there is little link from this type of income to 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.

I. 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. It is estimated 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 in the world (WHO 2010, 2013).

In recognition of the challenges the nation faces, 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 receives very few Government resources.

Agriculture is the country's main economic activity, constituting the primary source of employment for 84% of the labour force (Ministry of Finance, 2008),and contributes 97.7% of non-oil exports (DGE 2013). 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).

A key challenge in this plan is that of converting the agricultural sector's potential to drive growth and poverty reduction into reality. There are a number of structural challenges to overcome in seeking to improve agricultural productivity and in building 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.

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 agricultural household. This link is where we will reveal significant findings that suggest how critical the sector is to poverty alleviation, and that indicate the key areas to focus on in delivering agricultural development and poverty reduction.

II. A Macroeconomic Context: The Petroleum Fund, Budget and Economic Activity

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). An optimistic view of the use of these petroleum revenues is that while the petroleum revenues are available, this focus on investment in infrastructure lays the foundations of strong non-oil growth for the economy in future. Revenues into the Petroleum Fund began declining in 2012, with virtually no new royalties revenue expected after 5-10 years. Consequently, if government withdrawals continue to grow as they have in recent years, the fund will decline quite rapidly, and will be severely depleted with 10 years. This reinforces the imperative of moving in the direction of a strong non-oil economy.

On the government budget side, Table 1 shows the 2014 budgeted revenue and expenditure. The revenue breakdown shows how heavily the budget relies on the petroleum fund. The $903m withdrawal represents about 60% of total revenue; the cash reserves are virtually completely comprised of petroleum fund withdrawals from previous years that were not spent. So with this component, the PF contributes more than 85% of the government's 2014 revenue.

Table 1 highlights how domestic revenue is raised, and shows the very small taxation base the government is currently working with, indicative of the low level of private sector activities and hence the low taxation base. Consistent with this, the Budget papers forecast a non-Oil GDP for 2014 of $1,773 million, a (nominal) 15.5% increase on the projected 2013 outcome. Notably, with Government expenditure forecast to be $1,500 million, there is relatively little measured economic activity outside that stimulated by the government sector.

The National Accounts provide another window into how economic activity is progressing. The accounts broken down by industry reflect the strong influence of government-led expenditure, with construction and public administration comprising the most rapidly growing and largest sectors in recent years, outside of oil and gas. The 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.

While it is difficult to get a complete picture of the economy, a basic 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 in real per capita terms.

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 and Development projects	$140
Major Infrastructure	$407
Total Expenditure	$1,500

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

III. Consumption Poverty & Multidimensional Poverty

In this section we provide a brief overview of how poverty is defined and measured.

Consumption Poverty: Historically poverty has been defined in terms of income levels. This is where concepts of the number living on less than $1 per day, or in recent years, $1.25. However, popular 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 with a focus on consumption behaviour of households, and prices paid for food and other purchases. Alongside this, a benchmark is set for the minimum number of calories a person would need in order to be able to function on a daily basis. A poverty line is defined based on what it would cost to purchase the food and housing, etc needed to live at a most basic level (in particular, with sufficient calories). A household is defined as poor if the dollar value of the food, housing, etc that they consume falls below that line. Note that much of a household's consumption involves no actual cash income or cash expenditure at all. For example, with housing, most people occupy their home, but do not pay rent for it; the consumption measure imputes a value to the house by estimating the rental value of the dwelling. Similarly with food consumption, 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.

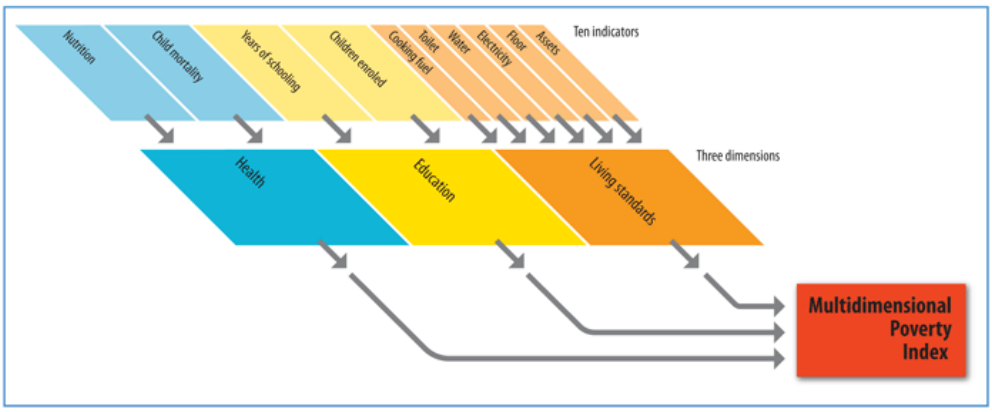
We emphasise that the poverty line is very low: the line is the dollar value of food intake that would be of a sufficient level to give that household adequate calorie intake to meet minimum daily energy needs, plus the cost or imputed value of housing and other nonfood expenditure that is typical of households with this minimum acceptable level of food consumption. This poverty line takes no direct account of diversity of food intake, or of access to services, or of educational achievement, etc, etc.

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, there is 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.

Components of the Multidimensional Poverty Index

MPI—three dimensions and 10 indicators



Note: The size of the boxes reflects the relative weights of the indicators.

Source: Alkire and Santos 2010.

It is worthwhile understanding the detail of how the MPI is constructed (UNDP 2013, Technical Note 4, adapted), since the data from this report is so widely quoted.

The 10 indicators are listed here. 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 multidimensionally poor. 13 or 14 points is classified as vulnerable to or at risk of poverty.

Table 2: Components and weights of the Multidimensional Poverty Index

Household Indicator	Points
At least one person has completed five years of schooling	3
All school-age children enrolled in school	3
No person is malnourished	3
No children have died	3
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

In comparison to 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 multidimensionally poor, and 86% having 14 or less points, thus being either poor or at risk of poverty.

IV. What characterises 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. 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 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 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.

In part this multiple deprivation and deep rooted poverty exists because of Timor-Leste's unique history, one of occupation by Portuguese and then Indonesians. During Indonesian occupation, there was little investment in human and physical capital, 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 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;
-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, highlighting the growing inequality of wealth and opportunity.

V. Agricultural Development 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 good 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, 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.

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 this economy. This helps stimulate demand for goods and services produced outside of agriculture and spur 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

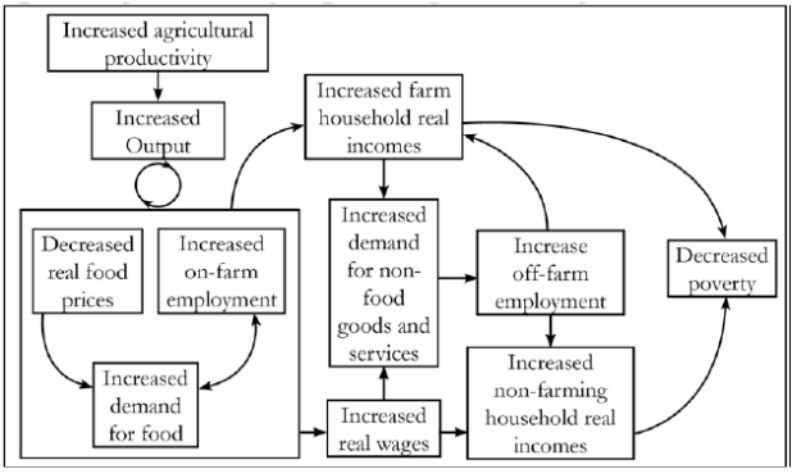
[1] Studies have shown that countries or regions where agricultural productivity has increased the most have achieved the largest reductions in poverty. Thirtle et al 2003. http://dfid-agriculture-consultation.nri.org/summaries/dfidwp2.pdf

that crop. In Timor-Leste, coffee is the country's main export good with 21% of households who work in agriculture involved in the coffee industry. The quality of coffee in Timor is generally see as high, however the market base is small and production is irregular, making it less attractive to foreign investors than other coffee exporting countries.

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

Figure 1

Pathways to poverty reduction deriving from Increased Agricultural Productivity



Source: Agricultural Productivity and Poverty Reduction: Linkages and Pathways (2011). The Evans School Review

The Importance of Markets

For agricultural growth and increased productivity to successfully translate into poverty reduction, well-functioning agricultural markets are vital. From a theoretical perspective, when markets are working efficiently, economies will be productive and will grow. Resources such as labour, capital and land will be allocated efficiently, specialisation will occur, improving productivity further and the benefits of growth in one area will flow through to other areas of the economy.

However, markets, agriculture markets in particular, are prone to failure, and the degree of market failure is a determining factor in the extent of economic growth. Markets characterised by inefficiency and poor coordination are generally associated with slower overall growth for the country and fewer economic opportunities – including for the poor.

VI. 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 the surveys have largely follow 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, 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 one example suggests some puzzling findings in the HIES report. To give a specific example, later we report that the 2007 TLSLS average income from coffee sales was $260 per household per year, for the 16.2% of households that received income from that source. Across all households, that average becomes $42 per household (many households have $0 coffee income). In the HIES 2011 report, Table 5.2.4 reports average coffee income at $23.78 per month, or $285 per year, but does not specify how many households this applies to. The implication from aggregation of incomes in the HIES report is that this is the average across all households (i.e. includes many households with zero income from coffee); if so, 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 of $260 per household per year for coffee producing households 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. 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.

VII. Empirical Findings: Patterns & Puzzles

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 draw out 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.

A. The Agricultural Household

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

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%

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.

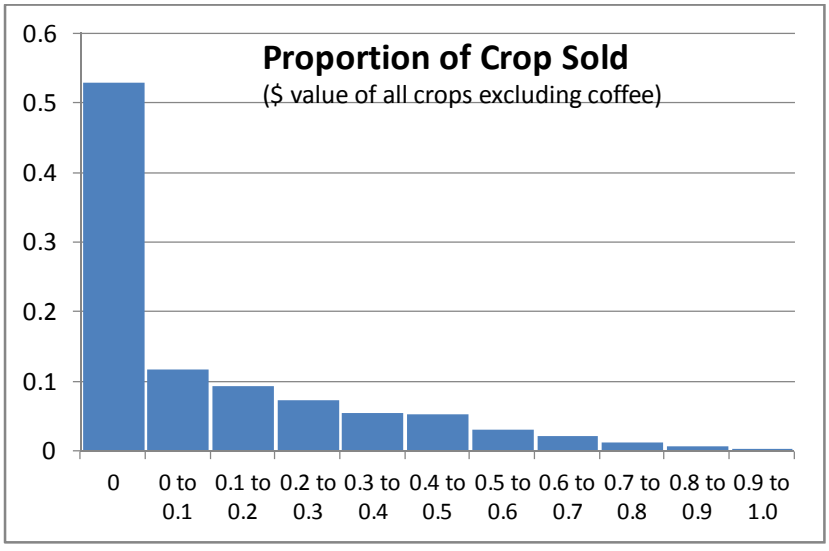
Production Volumes: Typical volumes of production are small. To get a handle on this, it is worthwhile to undertake some simple calculations of the equivalent calorific benefit of these levels of production. Using the recommended nutritional norm of 2100 calories per person per day, and working with 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 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.

Note that there is 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.

Figure 3 provides another window into the market for sale of crops that are harvested by households.

Figure 3: What proportion of their crop does a household sell?



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".

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 = 10,000m

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%

Plot size: 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.

Crop-growing Land: While Timor-Leste is renowned for the very high proportion of hilly terrain, this Table 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.

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.

B. Production of Food Crops, and Consumption of Food: a preliminary analysis

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 that 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]

Table 7: Production and Consumption of Crops, weekly average per household

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%

Focusing on levels of production and consumption, we use cassava as the 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.

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

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 approximate 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 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 (Linh Vu, 2008, Essays of the Economics of Food Production and Consumption in Vietnam), 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.

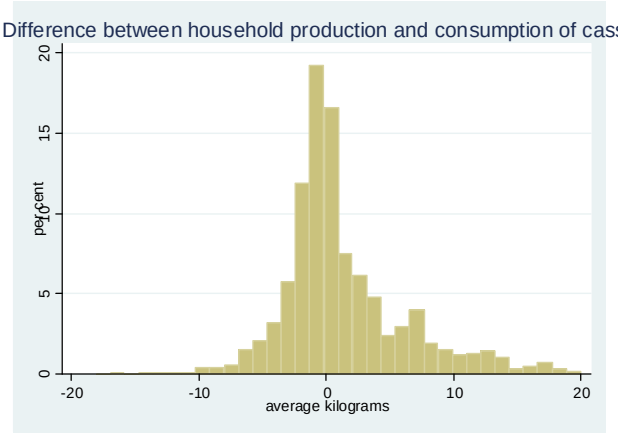
Next we explore another dimension to this puzzle over production and consumption. While Table 7 highlights the mismatch between production and consumption in aggregate, there is further mismatch at the household level which is informative. Continuing with the cassava example, Figure 4 shows distribution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

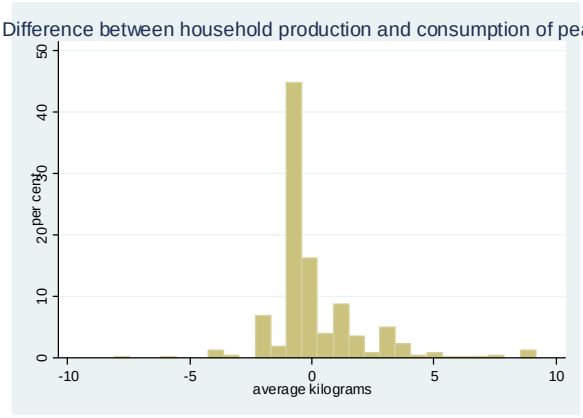
Bearing in mind that average production per household is 5kg per week, these values vary widely around zero. This can presumably be explained by the fact that those who produce more than they are consuming are selling, gifting or bartering to others who consume more than they produce. In other words, 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. So the vast majority of exchange that is apparent from Figure 2 is presumably 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.

Figure 4





C. 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 the indicators of poverty rely on income of one sort or another.

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: Income by Source, all households

	per cent of 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

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. Considering first 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, the coffee-growing sector still contributes relatively little 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.

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.

There have been some broader economic changes between the survey period of 2007 and present, which pose problems for the relevance of data on income from employment and pensions. For example, social assistance packages through various pension schemes have expanded enormously in recent years (WB, 2013), so this income source would likely be far more important for many more households in 2014 than this data suggests. There have also been a number of rural infrastructure development programs in recent years that have injected cash into rural areas. Similarly, 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 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.

D. 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. 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 & cereals vs meat / vegetables / fruit).

The base model involves relating a household's food consumption to their total income. Both variables are defined in monthly per capita terms, and the model contains controls which allow for variation between households in urban or rural areas, across geographic regions, and 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.

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)
How much more consumption in Urban Area compared to Rural 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 much for every extra person in the household	-$1.93	28.2
Increase in Consumption for every extra $1 of Income	$0.23	16.5

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.

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 $6.54 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.

Food Consumption and how it varies by income source

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 address this question, we modify the estimated model to decompose income from various sources. 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 high / above average impacts (MPC=0.53).

Table 10:
How Household **Food Consumption** relates to **Income by Source**
measured as monthly per capita

Independent Variable	Impact (holding other variables fixed)	Statistical Significance (|t-values| >1.96 indicate a significant variable)
How much more consumption in Urban Area compared to Rural 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 much 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 and 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

- 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. Such food is most likely to be used for the household's own consumption needs, with some shared with family and friends. So one extra dollar's worth of such food harvested would be expected to 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.

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, and the higher 50% in the other.

Table 11:

How Household **Food Consumption** relates to **Income by Source**

For the lowest 50% of incomes

Independent Variable	Impact (holding other variables fixed)	Statistical Significance (|t-values| >1.96 indicate a significant variable)
How much more consumption in Urban Area compared to Rural area?	$3.36	7.2
How average consumption for this region varies from Dili:		
Baucau, Lautem, Viqueque	-$3.44	4.7
Ainaro, Manufahi, Manatuto	-$8.13	11.4
Aileu, Ermera	-$3.33	3.0
Bobonaro, Covalima, Liquica	-$2.15	2.8
Oecusse	-$6.70	9.2
Consumption per person changes by this much for every extra person in the household	-$1.58	18.5
Increase in Consumption for every extra $1 of each type of Income		
Crops harvested but not sold	$0.33	2.1
Crops harvested and sold	$0.71	2.0
Coffee	$0.75	2.0
Livestock	$0.36	1.9
Other agricultural activities	$0.24	0.5
Enterprise activity & employment	$2.80	14.5
Cash assistance, pensions, other income	$0.40	1.1

Table 12:

How Household **Food Consumption** relates to **Income by Source**

For the highest 50% of incomes

Independent Variable	Impact (holding other variables fixed)	Statistical Significance (|t-values| >1.96 indicate a significant variable)
How much more consumption in Urban Area compared to Rural area?	$5.61	9.9
How average consumption for this region varies from Dili:		
Baucau, Lautem, Viqueque	-$3.76	3.5
Ainaro, Manufahi, Manatuto	-$8.81	7.9
Aileu, Ermera	-$3.14	2.6
Bobonaro, Covalima, Liquica	-$2.42	2.3
Oeccuse	-$1.67	1.4
Consumption per person changes by this much for every extra person in the household	-$2.28	21.9
Increase in Consumption for every extra $1 of each type of Income		
Crops harvested but not sold	$0.03	1.1
Crops harvested and sold	$0.90	8.4
Coffee	$0.61	6.9
Livestock	$0.17	3.9
Other agricultural activities	$0.11	1.9
Enterprise activity & employment	$0.46	12.1
Cash assistance, pensions, other income	$0.31	8.0

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, 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 found 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 virtually none of the income effects are statistically significant.

- 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 Tables 11 and 12. While the income effects appear much weaker in Table 11, the regional and rural/urban effects are as strong as or stronger than the upper-50% sample. 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.

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 & alcohol).

Table 13, which presents results for consumption of cereals, suggests there is little income effect at all on consumption of these essential foods. This is the 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 Table 13: virtually all regions actually show *greater* consumption of cereal crops than Dili, while previous tables show the opposite effects for overall food consumption.

Table 13:

How Household **Cereal 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)
How much more consumption in Urban Area compared to Rural area?	$0.16	1.3
How average consumption for this region varies from Dili:		
Baucau, Lautem, Viqueque	+$1.19	5.4
Ainaro, Manufahi, Manatuto	-$0.66	3.0
Aileu, Ermera	+$0.66	2.4
Bobonaro, Covalima, Liquica	+$0.86	4.0
Oecusse	+$1.72	7.4
Consumption per person changes by this much for every extra person in the household	-$0.44	18.2
Increase in Consumption for every extra $1 of each type of Income		
Crops harvested but not sold	$0.03	3.5
Crops harvested and sold	$0.15	4.5
Coffee	$0.02	0.8
Livestock	-$0.02	1.3
Other agricultural activities	$0.04	2.1
Enterprise activity & employment	$0.05	4.5
Cash assistance, pensions, other income	$0.03	2.7

Table 14:

How Household Non-Cereal **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)
How much more consumption in Urban Area compared to Rural area?	$4.73	16.0
How average consumption for this region varies from Dili:		
Baucau, Lautem, Viqueque	-$5.22	10.4
Ainaro, Manufahi, Manatuto	-$8.21	16.3
Aileu, Ermera	-$4.48	7.1
Bobonaro, Covalima, Liquica	-$4.17	8.3
Oecusse	-$8.24	15.6
Consumption per person changes by this much for every extra person in the household	-$1.39	24.8
Increase in Consumption for every extra $1 of each type of Income		
Crops harvested but not sold	$0.03	1.5
Crops harvested and sold	$0.66	8.5
Coffee	$0.53	8.2
Livestock	$0.20	6.2
Other agricultural activities	$0.04	1.0
Enterprise activity & employment	$0.43	15.4
Cash assistance, pensions, other income	$0.27	9.4

The estimates in Table 14 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 benefits of increased income for food consumption, which is the most basic of human needs, are realised 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.

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 having a heavy reliance 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.

VIII. Conclusions and Implications

This section has been written at this point as a series of questions for consideration. The questions arise out of the research results reported here. The research is now in a consultative phase, and once feedback has been received, the comments and questions will be transformed into more clear statements about implications for development priorities and programs.

A. Agricultural production and the Rural Sector

1. With evidence of very low levels of agricultural activity in areas like small scale forestry, animal by-products (particularly eggs), livestock, etc, there is obvious potential for some significant improvements in incomes from these sources with minimal investment. What are the impediments to this? Where is best practice occurring and how can this be leveraged up?

2. We need to better understand the apparent disparity between food production and consumption. Is it evidence of large amounts of informal food sharing, etc, and of waste that comes from the lack of market-based information?

3. One interpretation of the empirical analysis in this paper is that local food markets have the potential to substantially increase trade in food, facilitate specialisation, exploit economies of scale, reduce post-harvest loss, etc. In turn this can yield significant direct benefits in reducing hunger, improving nutrition. Does this align with other evidence?

4. How do we get clear evidence about the most pressing impediments to agricultural markets - Eg roads? Financial markets & financial literacy? Entrepeneurship? Lack of demand (cash stimulus)?

5. How would developments programs address these impediments? Where is "best practice" currently taking place?

6. Is there other evidence of significant post-harvest loss in food crops? Apart from improving functioning of markets, are there direct interventions that can help deal with this in the short term?

B. Coffee

As the primary cash crop, coffee plays an important role for many poor, rural households. The evidence suggests that coffee income does yield positive benefits for households, and therefore that improvements in coffee income will improve welfare. Should it be a priority to invest in improving yields and quality of coffee production, in order to improve farmer incomes? How would programs along these lines best function?

C. Nutrition and Poverty

The results in this report suggest some key links between income (including by source) and direct measures of poverty and food consumption. Given the high priority being given to nutritional needs, how can these results add to understanding of keys to improving both the quantity and appropriate diversity of food intake for poor households?

D. Rural-Urban Issues

The agricultural economy fits as part of a bigger picture with development in Timor-Leste. Where does the inevitable trend towards Rural-urban migration impact on priorities in agricultural and rural development? As programs lead to an improvement in agricultural productivity through more reliance on tools and equipment, more specialisation, etc, the problem of surplus labour will only increase in rural areas. How is this best managed? What complementary programs can be added that manage these outcomes?

Appendix: Data Issues

Measuring Production

While the consumption data *are considered robust*, 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 recollection error on the part of the household. Second, the units used for measuring the quantity of crops 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 1 kg units. First, it was not possible to convert the 1 litre, 390 grams and buah crops into 1 kg 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 units 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 form 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 at most 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.