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Improving the Lot of the Farmer: Development Challenges in Timor- Leste during the Second Decade of Independence

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Improving the Lot of the Farmer: Development Challenges in Timor-Leste during the Second Decade of Independence¹

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Abstract

Timor-Leste's first ten years of independence have been turbulent and a large share of the population remains poor. Broad-based improvements in living standards will require improvements in agricultural production since most Timorese are subsistence farmers and since there is no modern sector to absorb a fast-growing population. This paper discusses what determines agricultural development in Timor-Leste and how such development can be achieved. This is done in two steps. The first one takes the production function as its point of departure. Agricultural output is seen as a function of inputs (land, capital and labor) and technology, which in turn are influenced by the infrastructure and institutions of the economy and by external factors which cannot be influenced by policy measures. The second part, in turn, emphasizes the fact that Timor-Leste is a market economy. A model of an agricultural household is constructed. The static optimum of the household is derived and the effects on production, consumption, sales, income and leisure of the household of different price incentives (changes in food prices, cash crop prices and prices of manufactured goods) are investigated.

Keywords: Timor-Leste; Agriculture; Poverty; Development; Rural

JEL codes: O13; Q15; Q18

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1. Introduction

In 2012, Timor-Leste celebrates its tenth anniversary as an independent nation. Economically and socially things have not turned out quite as envisaged at the dawn of independence. It is clear that the country has a long way to go before poverty will be eradicated. Disappointment with the lack of development constitutes a source of political turbulence, most vividly demonstrated by the violence between different groups in 2006 and by the murder attempt on President José Ramos Horta in 2008.

To be fair, the expectations were hardly realistic. The Indonesians left behind a country with an essentially destroyed infrastructure, a country which was far poorer than necessary. It is estimated that real GDP fell with one-third between 1998 and 1999 as a result of the violence and turmoil that accompanied the withdrawal (UNDP, 2002, pp. 57-58).

Another way of measuring the extent of destruction is by looking directly at the social and physical infrastructure. Regardless of which indicator we choose, the result is dismal (UNDP, 2002). On average, peasant families lost 58 percent of their goats, 48 percent of their cattle and 47 percent of their pigs, i.e. half their livestock was gone. All existing banks, including the regional branch office of the central bank were either looted or destroyed, and as a result, all transactions in the economy had to be carried out on a cash or barter basis. One-third of the electricity-generating capacity in the capital was lost, and in the provinces the district capitals lost between 50 and 90 percent. The social infrastructure was more or less wiped out. No less than 80 percent of all schools and medical clinics were destroyed. The transport and communications network, including the markets, collapsed. Most of the fixed telephone lines were damaged and transportation was in extremely short supply. Finally, the entire public administration ceased to function. The civil service at the time consisted of some 28,000 officials. All the top level officials, about one-fourth, were Indonesians, and these left East Timor (UNDP, 2002).

Fortunately, there are signs of positive development during the last five years: incomes have increased, and poverty seems to be declining from its very high level. The improvements are achieved by strong increases in public expenditures made possible by the oil revenues. Timor-Leste is often claimed to be the most oil dependent country in the world, and oil and gas revenues account for around 90 percent of the state revenue. Oil revenues have for instance been spent on funding the return of around 150,000 refugees to their villages, on pensions to war veterans, on cash transfer programs to vulnerable households and on various infrastructure projects (UNDP, 2011, p. 17). In this respect it is a blessing but it also leaves the country at the risk of falling prey to the resource curse of low growth and social turbulence (Lundahl and Sjöholm, 2008a).

Long-term development is likely to require modern sector development. However, for the foreseeable future it is clear that the possibility of moving people out of agriculture so as to increase the average productivity and income is very limited. This puts the poor rural population in a difficult position and leaves little room for per capita income growth other than through increased agricultural output. In other words, living standards will remain very low for the rural population unless there is a substantial increase in farm production. In the short run, and until a modern sector begins to emerge, improvements in agriculture constitute the only way of improving livelihoods in Timor-Leste.

We discuss in this paper what determines agricultural development in Timor-Leste and how such development can be achieved. This is done in two steps. The first one takes the production function as its point of departure. Agricultural output is seen as a function of inputs (land, capital and labor) and technology, which in turn are influenced by the infrastructure and institutions of the economy and by external factors which cannot be influenced by policy measures. The second part, in turn, emphasizes the fact that Timor-Leste is a market economy. A model of an agricultural household is constructed. The static

optimum of the household is derived and the effects on production, consumption, sales, income and leisure of the household of different price incentives (changes in food prices, cash crop prices and prices of manufactured goods) are investigated.

2. A brief look at economic development in independent

Timor-Leste

The rate of economic growth during the first few years of independence was positive but too small to outweigh the high population growth rate. As a result, income per capita was stagnant or declining (*Table 1*). The dramatic political events in 2006, in turn, had a large negative impact on the economy. GDP declined by 5.8 percent which left the population with incomes that were substantially lower than at the time of independence and lower than during the Indonesian occupation. However, the crisis in 2006 was also the beginning of higher economic growth since in the aftermath of the crisis the government increased public expenditures dramatically. Until then, fiscal spending had been prudent, due to administrative constraints and the risk of corruption. After the crisis, the government, however, embarked on large public infrastructure programs and direct cash transfers. The increased spending has been financed by withdrawals from the petroleum fund, set up with the Norwegian oil fund serving as a model, where withdrawals should approximately equal the interest revenue, which has been increased from 300 million US dollars in 2007 to 734 million in 2011. The high public spending resulted in very high growth rates 2007-09 and relatively high 2010-11. As a result, real income per capita today is more than 20 percent higher than in 2002. This progress notwithstanding, Timor-Leste is still a poor country: income per capita is only about 14 percent of that of developing East Asia and the Pacific, or 41 percent of the incomes of developing Sub-Saharan Africa (World Bank: *World Development Indicators*).

--Table 1 about here--

Low incomes go hand in hand with deep poverty. Roughly 50 percent of the population was identified as living below the poverty line in the large Timor-Leste Survey of Living Standards, 2007 (Directorate of National Statistics, 2007).² This was an increase from about 36 percent in 2001. There are, however, indications that the high growth in recent years has had a positive impact on poverty although detailed information is not yet available. On the basis of a health survey carried out in 2009-10 the UNDP (2011) claims that poverty has decreased to around 41 percent. This progress is welcome but it is clear that poverty remains a large problem in Timor-Leste.

Poverty to a large extent is a rural phenomenon. Between 70 and 80 percent of the population is dependent on agriculture for its livelihood and three-quarters of the poor live in rural areas (Lundahl and Sjöholm, 2007; UNDP, 2011). Timor-Leste displays all the characteristics of a labor surplus economy as described by in the classic work of Arthur Lewis (1954). Most people are employed in subsistence farming where the marginal and average productivity of labor, and hence also per capita output, is very low. Few people work in the modern sector. Moreover, the situation may rapidly be getting worse due to the extraordinarily high fertility rate – close to 8 children per woman in child-bearing age in the early years of independence and almost 6 children per woman in recent years (Ministry of Health et al., 2004, p. 6; UNDP, 2011). This means that the population is growing rapidly and that each year about 17,000 young Timorese enter the labor force. As a result, unemployment and underemployment rates seem to be increasing.

² Based on the commonly used measure of the cost of attaining 2,100 calories a day plus meeting basic non-food needs.

The recent Timor-Leste Labour Force Survey (Government of Timor-Leste, 2010) makes an attempt to quantify the problem. For instance, it is claimed that 70 percent of those with employment are defined as vulnerable in the sense that they are own-account workers or contributing family workers. Moreover, it is estimated that there is half a million inactive people – half the total population – defined as neither employed nor unemployed.

One way to increase incomes in a labor surplus economy is to move people out of the surplus sector, agriculture, into an expanding modern sector. In 2006, the UNDP claimed that output per worker was about ten times as high in industry and services as in agriculture in Timor-Leste (UNDP, 2006, p. 3). The figure is difficult to interpret, since there is hardly any industry in the country and because the service sector is very heterogeneous, with public administration and defense as the most important activities. To the extent that it reflects reality, however, any movement of labor from agriculture to a modern sector would have a large positive economic impact on the overall economy. As an additional benefit, the average productivity will eventually start to increase also in agriculture, when the labor surplus declines as labor moves out of agriculture. Increased incomes for farmers will in turn increase the demand for other goods and services and will thereby provide an extra, presumably important, boost to the economy.

Unfortunately, not much of a modern sector is to be seen in Timor-Leste (Lundahl and Sjöholm, 2009a). The only booming industry is oil production which, however, provides very few jobs. There are no signs of an emerging manufacturing industry. The task of absorbing the labor surplus in agriculture is very demanding. Lundahl and Sjöholm (2009a) make a back of the envelope calculation of the annual growth of output required in the modern sector just to keep the share of the labor force in agriculture constant: 21 percent if the public sector is included and a staggering 106 percent if not. It should also be noted that these figures are based on optimistic assumptions with regard to employment elasticities (equal to

1) in the modern sector (the change in modern sector employment when the output of this sector increases). More conservative assumptions make the required growth rates even higher.

The Timorese government seems to be aware of the importance of job creation and has since 2007 tried to increase publicly funded employment. The number of jobs in the public sector is increasing which represents a change from a previous deliberate attempt to keep public employment below 20,000 people. The most visible employment effects have come from the government funded infrastructure projects which have benefited 40,000-60,000 Timorese annually since 2007, often through short term employment for the rural population (UNDP, 2011). Although such policies are welcome, they will, however, at best absorb a fraction of the labor force.

To sum up, poverty alleviation needs to focus on rural areas in general and on agriculture in particular. In the long run, it is necessary that a growing modern sector absorbs the agricultural labor surplus. However, it is not likely that such a development will have any substantial effect on poverty in the medium term. Increased productivity and incomes for the rural population are hence of crucial importance for poverty to decline in Timor Leste during the next ten years.

3. The situation in agriculture

The importance of agricultural development for reducing poverty is by no means a feature which is unique for Timor-Leste. The situation in many other developing countries is similar. For instance, the World Bank (2005, p. 5) estimates that a one percent increase in agricultural yields reduces poverty by about 0.5 percent in East and South Asia. However, there are strong reasons to believe that agriculture is even more important in Timor-Leste than in Asian developing nations in general. Since the country does not have any industrial sector, there are

few alternative ways of earning an income. Anne Booth (2004) argues that Timor-Leste is more similar to African countries than to other Southeast Asian nations, with farming on poor quality land and lack of access to markets for goods and capital. It is hence relevant to note that the estimates by the World Bank (2005) suggest that a one percent increase in yields in Africa reduces poverty by 0.7 percent. Given the similarities, agricultural development is likely to have a large positive impact in terms of poverty reduction in Timor-Leste.

Large segments of the rural Timorese population survive on subsistence farming. Farmers tend to use simple production methods to grow food crops for their own consumption and the surplus sold in the market is small. Whatever cash incomes that are generated are used to buy essential food, kerosene, and salt (Barlow, 2001, p. 110), but also, increasingly, cheap Indonesian consumer goods (Conroy, 2006, p. 21). The importance of subsistence farming differs between regions, however. About 80 percent of the rural households in the Eastern region are classified as subsistence farmers, compared to a mere 11 percent in Central Timor-Leste, and 32 percent in the Western region (Ministry of Agriculture, Forestry and Fisheries, 2004, p. 2).

The main staple crops in Timor-Leste are rice and maize. Some 80 percent of the households grow the former and slightly more than 20 percent the latter (UNDP, 2006, p. 27; UNDP, 2011, p. 79). Almost all maize and about 75 percent of the rice is for own consumption; very little agricultural produce is traded. Moreover, the land area used for maize is about three times as large as the land used for rice. The total area used for rice is actually substantially smaller than the corresponding area around 1975 (a peak period). Rice and maize are supplemented for example by cassava, which is grown by most rural households, often to be used as a reserve when the supply of rice and maize has run out. The same is true for sweet potatoes and taro.

--Figure 1 about here--

The poverty of the farming population is of course caused by low productivity in agriculture. However, there are some indications that productivity may be increasing. Lundahl and Sjöholm (2007) compared agricultural productivity in Timor-Leste with other countries in the region in 2005. Productivity was substantially lower in Timor-Leste than in any other of the included Southeast Asian countries. For instance, it was on average 250 percent higher in rice production in other countries and about 310 percent higher in the production of maize. *Figure 1* shows that productivity, measured as physical output per hectare, for rice and maize remains relatively low in 2010, but not as low as in 2005. The production of rice per hectare is approximately the same as in Cambodia and Thailand and substantially higher than in Papua New Guinea. It, remains substantially lower, however, than in neighboring Indonesia. The progress in maize is smaller and productivity remains lower than in all other countries. It is around half of that of Indonesia and even lower in comparison to two countries at a similar development level – Laos and Papua New Guinea. It should also be noted that the figures reported by the FAO might be exaggerated. Other sources claim that the production of maize is 1.16 tons per hectare, that of rice 1.61 tons, and the production of irrigated rice 3.0 tons (Ministry of Agriculture, Forestry and Fisheries, 2009).

Coffee is the main cash crop in Timor-Leste and it is also the country's main export good. The crop was introduced by Chinese traders and was developed further by the Portuguese. Production is concentrated to the highlands (Fox, 2001, p. 164). Around 67,000 households grew coffee in 2009 (World Bank, 2011a, p. 41). The quality of the Timorese coffee is good, or has high potential. So far, exports have predominantly targeted high-quality niches in foreign markets. The decision by Starbucks to sell coffee from Timor-Leste has

provided a major boost to the reputation of the product and has opened a large potential market.

The main problem with expanding coffee production is that little on-farm investment has been made. Due to poor husbandry of the coffee trees, crops are small, and delivery is irregular. For instance, yields are reported to be a mere 150-200 kilos of green beans per hectare (World Bank, 2011a, p. 41). The irregularity and the small size of the coffee crops is a major obstacle when it comes to attracting foreign purchasers who require a high degree of predictability. Important improvements can also be made in the processing of the coffee.

Maize and rice are the dominant staple crops and coffee dominates cash cropping, but farmers in Timor-Leste grow a number of other crops as well. Fruit trees are common, there has been some success with soy beans, and legumes are important for conserving and increasing soil fertility. Farmers are often deliberately growing different crops to reduce risks and spread harvests across the year. Most of them also have animals, like hens, goats and cattle. Again, production is almost exclusively for subsistence.

4. Determinants of agricultural development

There is no lack of suggestions that aim at agricultural development. Some concern very general factors such as the business climate and the commercialization of agriculture. Other suggestions focus more on practical aspects, such as the introduction of irrigation or new seed varieties. It is therefore difficult to see how different suggestions are related to each other and how they are expected to affect agricultural production. *Figure 2* may be helpful when it comes to understanding the determinants of agricultural output and making policy recommendations.

--Figure 2 about here--

The figure divides the factors affecting agricultural output into different categories. First, there are the external factors, i.e. the factors that are beyond the control of farmers or policy makers but which could have an impact on agricultural output. Such factors could for instance include climate and world market prices of agricultural goods. Second, agricultural production is affected by the amount of inputs used in agriculture. Inputs include a range of factors, from labor and land to capital, like seeds, water, fertilizer and tools. (Presently, we will focus on the factors that complement labor.) Moreover, the better the technology, the more output will be produced with a given bundle of inputs. In practice, it can be difficult to separate inputs and technology in agriculture. New seeds are inputs but their proper use may require technological change, e.g. through extension services, and additional inputs, such as irrigation, to be effective, as in the case of the Green Revolution. Finally, investments in inputs and technology are affected by infrastructural and institutional factors. These include for instance transportation, markets and property (land) rights.

4.1 External Factors

Parts of Southeast Asia are among the most fertile areas on earth. Unfortunately, Timor-Leste is not one of those places. The fertile part of Southeast Asia ends somewhere after Bali, and the eastern part of the archipelago is characterized by a climate which is not ideal for agriculture. The problem is best described as one of too little or too irregular rain and land with steep slopes and low fertility.

The climate in Timor-Leste is a typical monsoon climate with a wet season extending from around December to March and a dry season from around May to October, but with local geographic variations. The annual rainfall ranges between 500 and 1,500 mm in the relatively dry north and over 2,000 mm in the relatively wet south. Local variations in rainfall are common as Timor-Leste is surprisingly ecologically diverse for being a relatively small country (Fox, 2001, p. 155). The rainfall can be very irregular. For example, Dili sometimes receives 30 percent of its annual rainfall in a single day (UNDP, 2006, p. 19).

Moreover, there are regular droughts in Timor-Leste. Such droughts occur approximately every fourth year. Then the rainfall is not only reduced by as much as 50 percent but the drought also delays the wet season by two to three months, which causes further difficulties for agriculture. For example, the drought in 2002/03 reduced output with about 21 percent (UNDP, 2006, p. 21) and in 2007, maize, rice and cassava production (in cereal equivalents) was reported to be 25-30 percent lower than during the previous few years, among other things as a result of late and erratic rainfall (FAO and World Food Programme, 2007, p. 5).

Parts of the Southeast Asian archipelago are very fertile because of a fortunate combination of large rivers and volcanic soil. Timor-Leste, however, has few rivers and, more importantly, the soil is not volcanic but instead consists of limestone and metamorphosed marine clays, a combination which is substantially less fertile (Ministry of Agriculture, Forestry and Fisheries, 2004, p. 1). An additional problem is that the country is very mountainous. Around half of the land has a slope of 40 percent or more, which makes agricultural activities very difficult to pursue.

4.2 Land

The combination of Timor-Leste's particular soil, the steep slope of the land, and the irregular and heavy rainfall makes the land fragile and prone to erode. Natural erosion rates are high. So is the rate of man-made deforestation and soil erosion. This is partly caused by 'slash and burn' cultivation which is still common in the country. Even more important is the effect of logging for firewood. The demand for firewood has increased in recent years, partly as a consequence of the removal of kerosene subsidies. The increased demand has put pressure on the forests and aggravated land erosion, especially in areas close to towns and major villages. There are no recent figures on soil erosion in Timor-Leste, but the forest loss 1972-99 was estimated to about 1.1 percent per year (UNDP, 2006, p. 27), and the Ministry of Agriculture, Forestry and Fisheries (2007, p. 19) reports the same figure for 2000-05.

The reduction of the arable area because of erosion in combination with the high fertility rate means that little agricultural land is available in Timor-Leste, on average only around 0.4 hectares per capita (UNDP, 2006, Table 2.1). The median area is even lower, 0.22 hectares per person and less than 5 percent of the landowning rural population have more than 1 hectare per person (Ministry of Planning and Finance and World Bank, 2003, p. 30). Most people, however, do have access to some land. Hence, there are few landless people in Timor-Leste, in stark contrast to the situation in many other countries in Southeast Asia. The share of irrigated land is only 22 percent of the total (UNDP, 2006, p. 26).

4.3 Capital

Two types of capital are of interest in the discussion of agricultural development. The first is physical capital such as machinery and the second is financial capital, mainly credit. The use of machinery in agriculture, for example tractors, is extremely limited in Timor-Leste, partly because of the inability of poor farmer to pay for fuel. Cultivation is characterized by

production methods that have changed very little for several decades or perhaps even centuries.

Irrigation schemes are difficult to implement in Timor-Leste. Rainfalls are irregular and most rivers are completely dry for large parts of the year. Even in those instances where some type of irrigation exists, it tends to be simple and unreliable. Irrigation systems are often crucially dependent on the water level in the rivers, which has to reach the level of the intake of the irrigation system. There are few instances where a pump can help farmers transferring water from its prime supply to the irrigation systems. As an example on the low quality of irrigation, it was reported that only a few hundred irrigation schemes existed in Timor-Leste around the time of independence and only around 20 of these could store water (Ministry of Agriculture, Forestry and Fisheries, 2004, p. 4). Maintenance is a major problem and irrigation schemes are often ruined by flooding rivers.

Lack of irrigation is hence a major problem when it comes to expanding agricultural output. The lack of water is particularly troublesome in the case of rice production. It should be noted, however, that less than 20 percent of the irrigated land produces a second rice crop (Ministry of Agriculture, Forestry and Fisheries, 2007). In other words, agricultural output is low even when water is not the binding constraint. Hence, there is a range of other problems explaining the low agricultural production level in Timor-Leste. Some of these are discussed below.

There are no up-to-date figures on the amounts of fertilizer and pesticides used in Timorese agriculture but the available indications point to very small amounts. For instance, the Timor-Leste Suco Survey reported that only 3 percent of the households used such inputs in 2001 (Ministry of Planning and Finance and World Bank, 2003, p. ix), and a 2003 survey in five districts revealed that only 29 percent of the farms used chemical fertilizer

and that less than 35 percent used chemical pesticides because of lack of availability and high prices (Care International, 2004, p. 19).

Investments in irrigation, new seeds, a plow or a horse, are expensive and require financial capital. Such capital is in scarce supply since farmer incomes are low, but also because the financial sector is very rudimentary. Banks are few and tend to be located in Dili where they target the international donor community and some service sector operators. No commercial banks are found in rural areas and even if they had existed it is likely that low incomes and ill-defined land rights would provide serious obstacles to borrowing for most farmers. The credit situation in agriculture has been dismal during the entire independence period. Thus, in 2002, JICA (2002) reported that no farmers had access to credits from banks, 50 percent could borrow from traders, and 14 percent from relatives. An FAO-World Food Programme Study from 2007 bluntly stated that credit institutions were non-existent, with minor exceptions (FAO and World Food Programme, 2007, p. 12) and two years later an IFC survey reported that loans were typically not available for purchases of farm inputs or improvements or for trade in farm products, because credit institutions have a problem getting secure information about borrower risk and because land cannot be used as collateral (World Bank, 2011a, pp. 97-98). Micro finance may provide a useful alternative to banks and some initiatives have been taken by international donors, but it is unclear how extensive and successful these efforts have been.

4.4 Technology

Technology in agriculture is related to the use of the inputs described above. The choice of a new input, for example a new variety of seeds, often requires a change in the whole bundle of inputs, such as water and pesticides. Colin Barlow (2001, pp.119-20) describes how maize and rice harvests could increase by as much as 100 percent in Timor-Leste if new and better

varieties were to be planted. However, he notes, such varieties are typically more sensitive to droughts and pests and require more fertilizers and better storage facilities. This change in inputs could be described as a new technology package.

The lack of education is one of the major limitations on this type of broad agricultural changes. The UNDP (2006, p. 28), argues that studies on other countries suggest that such changes in technology require a minimum of four to six years of education of good quality. Unfortunately, the level of education in Timor-Leste is low and the quality is poor (Lundahl and Sjöholm, 2005). The implication is that improvements of the level of education have immediate relevance for the possibilities of introducing a new agricultural technology.

Another area where technology appears to be important is in the processing of crops like rice and coffee. The UNDP (2006, p. 30) claims that rice mills are using outdated technologies. As we have already mentioned, coffee as well seems to be suffering from poor processing, often carried out by the farmers themselves, where lack of water, necessary for the wet fermentation, is a major constraint (Barlow, 2001, p. 120). As it seems, there is plenty of scope for technological improvement both in agriculture and animal husbandry. A major World Bank (2011a, p. 74) study on the scope for expansion of agricultural exports offers the following conclusions:

In summary, Timor-Leste has a wide range of improved crop and livestock production packages which are ready for nationwide adoption, provided the technologies can be extended to farmers and markets developed. For example, if coffee farmers adopt the improved technology recommended by CCT [Cooperativa Café Timor] and Portuguese Aid on 1.0 ha of plantation, gross margins could increase from about \$120/ha to as high as \$800/ha, with an average increase of about \$500/ha; and returns per labor day would increase from about \$3.70 to \$5.90. If a family fattened 2 heads of cattle per year, their net farm income would increase by \$280 per year. The corresponding figures for 0.50

ha of peanuts (or mungbeans) would be an incremental household gross margin of \$340 per year and returns per labor day of \$5.90.

The Indonesian government took a very active part in agricultural production in Timor-Leste. During the occupation, inputs were provided by the government and output was purchased at set prices. The government also provided credits, storage facilities and marketing assistance. Moreover, it developed an extension service which was modestly successful, both when it came to introducing new crops and increasing the productivity of the existing ones (World Bank, 2011a, p. 77). The present government has not yet played any such active role. This is partly caused by an explicit intention to let the market forces and the private sector, including a number of non-governmental organizations, rather than the government, shape agricultural production and development. There are, however, very few agricultural extension workers in Timor-Leste. This is due both to a lack of trained personnel at the time of the Indonesian exodus (Timmer, 2001, p. 105) and to the decision (until recently) to restrict the number of public servants (UNPD, 2006, p. 41).

Hence, extension services are inadequate in Timor-Leste. The World Bank describes the system as 'fledgling but large'. Plenty of people have been hired on various levels, once the government decided to substitute a public extension service for the split private efforts which provided a very uneven coverage both in geographical and qualitative terms, but 'significant technical and organizational constraints' act as obstacles to an efficient service structure (World Bank, 2011a, p. 77). The Ministry of Agriculture, Forestry and Fisheries has assigned one senior extension officer to each of the country's 400 rural *sucos*, but according to the World Bank, this structure 'lacks the skills and experience to service Timor-Leste's 166,000 rural households efficiently and effectively' (World Bank, 2011a, p. 73).

4.5 Infrastructure and Institutions

One of the most important roles of infrastructure and institutions in an economy as undeveloped as that of Timor-Leste is to assist in the development of the market system. Farmers need access to markets if they are to abandon subsistence farming. Markets exist in towns and larger villages but a major problem is lack of transportation to markets. Many observers claim that access to markets is more difficult now than before 1999. Roads were developed reasonably well during the Indonesian occupation, partly to facilitate the movement of troops across the island, but maintenance has been very poor since 1999. ‘The road transport system in Timor-Leste is somewhat unusual in that the distances travelled are short and the loads are small, but travel times are relatively long and costs are high’, remarks a World Bank study from 2011 (World Bank, 2011a, p. 103). Due to the mountainous terrain the roads are narrow and the speed is low, which in turn means that the utilization of the truck fleet is relatively low. The quality of the road network is low and consequently traffic volumes outside Dili are very low. The situation is particularly troublesome during the rainy season when many roads are practically impossible to use (World Bank, 2011b, Annex 10.1).

Walking is the most common way to move about for most people even when roads exist. Other means of transportation are either non-existent, or, more commonly, too expensive. Thus, 80 percent of all farmers have to walk on foot to the nearest market which is located two hours away on average (UNDP, 2006, p.29).

Selling in the market is difficult. It is widely argued that farmers have difficulties in getting access to price information for various crops. Improved communication networks including telephones and radios are necessary to facilitate the information gathering (Timmer, 2001, p. 107). Inadequate or non-existent storage capacity is another problem. A large share of the harvest is regularly destroyed (UNDP, 2006, p. 30). Another result of the

poor access to markets is that many farmers only grow one crop of rice even where a second harvest would be possible.

Most farmers use land without clearly defined title. The attempt of the government to define land rights has been slow and progress has been limited. In the 2012 issue of the World Bank Doing Business report, Timor-Leste ranks 183 out of 183 countries when it comes to registering property (Doing Business, 2012, p. 131). This comes as no surprise considering that several different, partly conflicting, law systems are involved (Fitzpatrick, 2001, 2002, International Crisis Group, 2010). First, there are land claims based on traditional rights, and not by any written laws. The land issue is seen as governed by local custom which makes for potential conflict when groups claim back land taken away from them under the Portuguese and Indonesian administrations. The second type of land claims are based on Portuguese titles, the bulk of which were lost in 1999, at the end of the Indonesian occupation. Third, there are claims based on Indonesian titles, often concerning plantations and transmigration sites. Finally, people claim land based on the occupation of it as a result of displacement of people voluntarily or by force by the Indonesian administration. The situation is further complicated by the displacements that took place following the 1999 disturbances, when an estimated 250,000 people were driven across the border to West Timor, and the disturbances in Dili in 2006, when another 150,000 people were displaced. This means that many landholdings have several claimants. Work has been begun on a cadastral survey and a draft land law exists, but it has not yet been approved by Parliament.

Lack of clear title makes land transactions difficult and makes it impossible to use land as collateral for credit, but not only that. Coffee provides an example of how the lack of clear land rights leads to poor harvests. Low coffee production is to a large extent caused by neglect in pruning the coffee trees. Pruning increases the crops but only after a few years, and yields decline for the first two years after the pruning. Farmers who are not certain that

they will have the right to the crops in the future will therefore behave rationally and avoid pruning the trees.³ The lack of other agricultural investment is also partly caused by the failure of the government to provide land titles. Such failure leads to lower investment both because of the insecurity when it comes to enjoying the fruits of the investment and because of the difficulty of obtaining loans without clearly titled land as collateral.

5. The Role of Market Incentives in Agricultural Development

It is clear that the government has a role to play when it comes to increasing agricultural production. The most obvious example is the provision of the infrastructure that will make it possible for farmers to get their products to the market. Another, much more difficult, task is the allocation of land rights. It is likely that the lack of clearly defined land rights has a detrimental effect on investments in agriculture. A third obvious area for government action is extension services.

Timor-Leste is, however, not a planned economy but a market economy, admittedly an embryonic one, since subsistence activities dominate in agriculture, but still a market economy. The question that then arises is whether market incentives can be employed to make Timorese farmers increase their production and sales and use more and better inputs. Some 80 percent of all Timorese are dependent on agriculture for a living, but productivity is low in the sector. It only accounts for some 30 percent of the non-oil GDP (World Bank, 2011a, p. 34). Increasing productivity and output in agriculture is one of the most important tasks of economic policy in Timor-Leste, since, as we have already dealt with, in the absence

³ Another reason for not pruning the trees is that many farmers are so poor that they cannot afford two years of declining production. A better functioning credit system could help farmers to smooth incomes between years (UNDP, 2006, p. 29).

of other alternatives, the agricultural sector in the foreseeable future will have to serve as a 'sink' for the growing labor force. As John Conroy (2006, p. 21) puts it:

While the transfer of labor from agriculture to industry and services is a necessary structural change, the present imbalance in numbers between the farm and non-farm sectors makes it essential to maintain the capacity of the farm sector to absorb labor. Hence, while it is necessary to strengthen the capacity of the non-farm economy to generate opportunities, the parallel improvement of economic prospects for the young in rural communities is necessary. It is more accurate to describe this as facilitating rural income-generation, rather than as 'job-creation'.

Conroy (2006, p. 20) argues that the discussion of 'private sector development' in Timor-Leste has to take this as its point of departure:

Given these circumstances, it is pertinent to ask the question; what is the meaning of 'private sector development' in Timor-Leste? With such a large subsistence element remaining in the rural economy, it seems most appropriate to commence private sector development there. This would be done by managing the transition of farm households from subsistence to monetized production, and by encouraging them to produce marketable surpluses. Such surpluses would require increasing levels of agricultural productivity, per unit of both land and labor. Fortunately, a self-contained rural economy producing food mainly to the limit of its own subsistence requirements, as in Timor-Leste, will normally have unused resources of labor and land. Given the stimulus of market demand, these can be brought into production to increase output and to diversify into higher value crops. These may be commodities such as coffee, vanilla and high-end coconut products, or ... foodstuffs for domestic consumption. While the former will support export expansion, the latter can help to improve nutritional

standards and consumer welfare more generally, through greater diversity of food supply.

Conroy hence suggests that increased demand for either cash crops or food crops may serve to increase agricultural production, notably production for the market. He also suggests a second mechanism that may serve as a stimulus (Conroy, 2006, p. 21):

Specialized traders underpin the operations of local markets in villages and sub-district centers. Most other market traders in these centers are members of farm households. They come to sell small amounts of seasonal produce, but also buy consumer goods produced in the formal sector. In Timor-Leste they bring produce to the market to gain access to cheap and appropriate Indonesian consumer goods. There is evidence to suggest that in districts where such goods are more readily available the level of informal monetized economic activity is relatively high. The availability of consumer goods, in marketplaces and village 'kiosks', stimulates production and marketing of subsistence foodstuffs and other higher-value, crops. This in turn improves nutritional standards, especially of wage- and salary-earners, most of whom are in urban areas.

Thus, as in many other peasant societies, according to Conroy, peasants will not bother to produce for the market unless they can get access to industrial or other consumer goods which they cannot produce themselves.

Conroy's overall argument implies that the subsistence sector resembles the vent-for-surplus economy portrayed by Hla Myint (1958), where both labor and land are unemployed for lack of demand. The economy is producing at some point inside its production possibility curve, to use a textbook term, and if and when the demand for its goods increases, combining land and labor in the prevailing fixed proportions may serve to bring it

quickly to the curve, where production becomes efficient in the sense that it will no longer be possible to increase the output of any given commodity without simultaneously reducing that of some other good. There are no longer any unused resources in the sector.

Whether such a process will materialize is, however, doubtful. In the first place the land frontier that exists in the economy must be put under the plow, as it were. The frontier must be ‘cleared’ before it can be used for production and this is costly in itself (Findlay and Lundahl, 1994). Second, in practice it is unlikely that a hand-in-hand expansion of labor and land can take place. The confused situation with respect to property rights makes it probable that when the agricultural labor force grows, most of the absorption of this growth will take place on land already under cultivation. Then, labor absorption in agriculture will be subject to diminishing returns, i.e. to falling income per head. Third, even if land and labor can be combined in fixed proportions, diminishing returns to labor are likely to set in, since the land added to cultivation is likely to be either of lower and lower productivity or of more and more distant location, in the Ricardian fashion.

6. A Model of the Agricultural Household in Timor-Leste

With the above proviso, we may shed some light on the question whether agricultural ‘entrepreneurs’ will seize the opportunities offered by the market with the aid of a simple model of farm household behavior (Lundahl and Ndulu, 1990). In this model, the utility function of rural households contains three elements: consumption of food and purchased commodities, respectively, and leisure. Households produce food and a cash crop (which they do not consume themselves) on a given land area. The consumption and production decisions are hence interdependent. The households maximize their utility⁴ given the relative prices of

⁴ An alternative formulation would be to assume that the household maximizes expected utility subject to a survival constraint. The present formulation does not take uncertainty into account.

cash crops, food crops and purchased goods. (The price of purchased goods may be used as *numéraire*, i.e. the prices of other goods can be measured in terms of the number of units of purchased goods they can buy.) Utility maximization yields an equilibrium where the households distribute the available time between production and leisure, the time devoted to production between cash crops and food production and the resulting income between the consumption of food and purchased goods, all according to their preferences and the prevailing relative prices. It also determines how much food is sold on the market.

The utility function of the agricultural household is

$$(1) \quad U = U(F, M, L_e)$$

where F denotes food, M purchased goods and L_e leisure.⁵ Utility is positive and diminishing for all arguments of the function.

Households produce two crops, food and cash crops, with the aid of labor and a fixed quantity of land. The cash crop is not consumed at all by the households themselves, but the entire output is sold outside the agricultural sector:

$$(2) \quad q_f = q_f(L_f)$$

$$(3) \quad q_c = q_c(L_c)$$

These production functions display diminishing returns to labor. The total quantity of labor (time) is divided between leisure, food and cash crop production:

⁵ Possibly, the household is not interested in leisure. This simplifies the utility maximization to a choice between the consumption of food and manufactured goods.

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$$(4) \quad L = L_e + L_f + L_c$$

Households maximize their utility subject to (4) and to

$$(5) \quad p_m M = p_f [q_f(L_f) - F] + p_c q_c(L_c)$$

where the p 's denote prices. What is available for spending on purchased goods is the sum of the value of food production minus what is consumed by the household itself and the value of cash crop production.

Utility maximization yields the following first-order conditions:

$$(6) \quad U^M(p_f/p_m) = U^F$$

$$(7) \quad U^{L_e} = U^M(p_f/p_m)q_f^L = U^M(p_c/p_m)q_c^L$$

where the superscripts denote first derivatives. In equilibrium, the valuation of a unit of food must be the same at the margin regardless of whether the household chooses to sell it in order to buy purchased goods or consumes it in the household. Also, at the margin the household must obtain the same satisfaction of a unit of time regardless of whether it is dedicated to leisure, food production or cash crop production.

The situation is illustrated in *Figure 3*. Beginning with the OA curve, this shows the income-leisure tradeoff for the household. The number of hours available is OB. Work (as opposed to leisure) is measured leftwards in the diagram, and income downwards. The more hours the household works, the higher is its income, which increases at a decreasing rate.

Given the preferences of the household for income and leisure, respectively, it chooses point C on the tradeoff, working OD hours and taking out DB hours of free time. This yields a total income of OK, measured in terms of purchased goods.

--Figure 3 about here--

The OD hours worked must be distributed between food and cash crop production. If only the latter is chosen, the maximum output will be OE, one of the two endpoints on the household's production possibility curve. If the household specializes on food production instead, the maximum output is given by the other endpoint of the curve, as OF. The production possibility curve is drawn on the assumption of a given factor (work) endowment, and shows the different possible combinations of food and cash crops that can be obtained with the aid of this endowment. The actual choice of production point is determined by the relative price of the two crops, as given by the price line IJ. This line is tangent to the production possibility curve at G, which is where the value of output is maximized at the given prices.

The output combination given by G gives a farm household income of OI, measured in terms of cash crops, or OJ, if we choose to measure in terms of food instead. Given the relative price prevailing between food and purchased goods, this translates into an income of OK, in terms of the latter, our *numéraire*. The only thing that remains to determine is the consumption of the household, given this income, represented by the budget line JK. Given the preferences of the household for the two goods, the consumption point is L, where ML units of the purchased goods are consumed and OM units of food. This, in turn, leaves a food surplus of MH, which is sold in the market.

6.1 Farm Household Response to Market Incentives

Next, we will use our model to examine the proposition offered by John Conroy (2006, p. 20): that Timorese farmers may be expected to increase production for any of the following three reasons:

1. Increased prices on cash crops
2. Increased prices on food crops
3. Reduced prices (increased availability) on goods not manufactured by the farmers but purchased from outside

In the present essay, we do not make any assumptions as to where the price changes come from, but they are likely to be intimately connected with, for example, infrastructural development. For example, better roads are likely to increase the net price fetched by the farmers both for cash and food crops while at the same time they should have to pay less for what they buy from the outside.

We will next examine the probable effects of each one of these price changes with the aid of our model.

6.2 Increased Prices of Cash or Food Crops

Let us begin with what happens when the price of cash crops increases ($dp_c > 0$) while the other two prices are kept constant. The price increase serves to rotate the income-leisure tradeoff in *Figure 3* anti-clockwise, since the value of marginal product of labor in the production of cash crops increases. For any given labor effort in agriculture, the household income will increase. At the same time, leisure will become more expensive in terms of income forgone. We have an income effect and a substitution effect, and it will not be

possible to reach an general conclusion of whether more hours will be devoted to agriculture than before, or the number of leisure hours will increase. However, if leisure is an inferior good, as hinted by Conroy, the number of hours worked will increase. This is a quite realistic case in a poor economy. Households have plenty of idle time. Should income possibilities improve, it is quite likely that the farm household prefers to work more and not less. Leisure does not even have to be inferior. It is enough that the substitution effect is strong enough to swamp the increased demand for leisure at given prices.

What will happen to the production of the two goods? The first-order condition (7) may be rewritten as:

$$(8) \quad (p_f/p_m)q_f^L = (p_c/p_m)q_c^L$$

Differentiating (4) yields:

$$(9) \quad dL_f = -(dL_c + dL_e)$$

and from (8), allowing p_c to change and keeping p_m and p_f constant (normalizing all three prices = 1, at the outset), we obtain

$$(10) \quad q_f^{LL}dL_f = q_c^{LL}dL_c + q_c^L dp_c$$

Combining (9) and (10) gives us

$$(11) \quad -(q_f^{LL} + q_c^{LL})dL_c = q_c^L dp_c + q_f^{LL}dL_e > 0$$

provided that $dL_e < 0$, since $dp_c > 0$ and the second derivatives of the production functions are negative. By the same token we must have that $dL_c > 0$. If the rise of the price of cash crops leads to a reduction of leisure, the production of these crops must increase. Even if dL_e is positive, the production of cash crops may increase, if the price rise is large. The production of food crops may increase as well, in the case where the reduction of the hours devoted to leisure exceeds the increase in the number of hours devoted to cash crop production. Finally, what will happen to the marketed surplus of food crops is uncertain. The on-farm demand for food will increase if the production of cash crops, and hence income, increases, since the relative price of food and purchased goods remains constant, but food production may also increase.

In the same way as above it may be demonstrated that an increase in the price of food will lead to increased food production, provided that leisure is reduced or provided that the increase in the price of food is large. What will happen to on-farm consumption and the marketed surplus of food is not clear. When incomes rise in terms of the purchased goods the farm households will demand more of both these goods and food at given relative prices. However, there is also a substitution effect due to the increase of the relative price of food. This serves to reduce the consumption of food and increase that of purchased goods. The net outcome of this is not given. Very much depends on the income elasticity of demand for food products among the farm households themselves.

Normally, we should expect Engel's Law to operate, i.e. when incomes rise, less and less of the income increase will be devoted to food consumption, so that the share of the household budget spent on food will decrease as income increases. In Timor-Leste, however, this is not necessarily the case. Various empirical investigations have shown that households experience a shortage of food between November and April, i.e. for some four months every year (Lundahl and Sjöholm 2005, pp. 15-16; 2008b, p. 20). Hence, given the low income level

and the large share of the population living in poverty, it is far from certain that Engel's Law is operative. It is not possible to rule out the possibility that an increase in the price of food will lead to a reduction of the marketed surplus.

6.3 Cheaper Purchased Goods

Finally, we have to investigate whether a cheapening of the goods which the farm households purchase from the outside will serve as a stimulus to increased production and sales (in the case of food). Again, we differentiate (8), but this time holding p_f and p_c constant, while allowing p_m to fall. This yields

$$(12) \quad q_f^{LL} dL_f - q_f^L dp_m = q_c^{LL} dL_c - q_c^L dp_m$$

In the initial equilibrium the value of the marginal product of labor in food production must equal that in cash crop production (remembering that we have normalized all prices = 1 at the outset). Hence the second terms on both sides of the equality sign in (12) are equal. What remains is

$$(13) \quad q_f^{LL} dL_f = q_c^{LL} dL_c$$

Either the production of food and cash crops will both increase, or both decrease. Rewriting (9) as

$$(14) \quad dL_e = -(dL_f + dL_c)$$

shows that the crucial determinant here is what happens to leisure as purchased goods become cheaper. Since we have chosen the price of purchased goods as our *numéraire*, making these goods cheaper amounts to increasing farm household income. The income-leisure tradeoff in *Figure 3* will rotate anti-clockwise, exactly as when the price of cash crops or food increased. Once more, we have an income effect and a substitution effect, and if the net outcome of these is to reduce leisure (presumably the most likely case) the production possibility curve will shift outwards and the production of both cash and food crops will increase. In the opposite case, it will fall. Again, what will happen to the marketed surplus of food crops is not certain. The same considerations as before apply.

6.4 The Importance of Outside Alternatives

So far, we have considered farm households with no options work outside of agriculture. The Household Survey carried out in 2001 (see Lundahl and Sjöholm, 2005, p. 14) reported two very significant findings: (1) Among those individuals that were in the labor force, those belonging to households whose heads were limited to farm employment were considerably poorer than when the heads worked in wage employment, household business or other outside ventures; (2) Almost 70 percent of all Timorese belonged to families with no or only small possibilities of obtaining income from outside agriculture.

--Figure 4 about here--

This clearly points to desirability of creating employment outside the agricultural sector. In the short run, this could for example take the form of public works during the off-peak season in agriculture. In the longer run, a private sector will develop.

Smallholders in the Third World often derive their income from a variety of sources, and this serves to increase their standard of living. This finding can easily be incorporated into our model. In *Figure 4*, the possibility of earning a given outside wage equal to w/p_m , when measured in terms of purchased goods, has been incorporated. The household keeps working in agriculture until the value of the marginal product of labor there falls to the level given by the constant outside wage. At this point (B), the income-leisure curve becomes a straight line. Thereafter the remaining hours worked are spent in wage employment, up to point C. The income from this must be added to that from farm work. Hence, the total income line will lie outside IJ, and outside the budget line JK. The incorporation of outside employment changes our conclusions. Let us begin with the case of increased prices of cash crops. When p_c increases, as before, the income-leisure tradeoff rotates anti-clockwise, from OA to OA_1 . The value of the marginal product increases in agriculture, and more hours will be worked there. Outside work will no longer begin at B (or D), but at B_1 or (D_1). The total number of hours worked will, however, decrease. Provided that leisure is not an inferior good, points C_1 and E_1 lie to the right of C and E, respectively, as long as some outside work takes place both before and after the price increase. The reason is that the substitution effect disappears. Leisure is no more expensive at the margin after the price increase than before, since the marginal valuation is given by the wage rate and not by the price of cash crops, and the wage rate does not change. All that remains is the income effect, and this makes for increased leisure. Income increases as well, but as a result of the reallocation of work hours between wage labor and farm work. Should leisure on the other hand be inferior, C_1 will be to the left of C and E_1 to the left of E. Work will increase both inside and outside of agriculture at the expense of leisure.

Turning to the allocation of work hours between cash and food crop production, (12) may now be rewritten as

$$(15) \quad (p_f/p_m)q_f^L = (p_c/p_m)q_c^L = w/p_m$$

where the wage rate is given in terms of purchased goods. Also, the available labor time has to be distributed among leisure, crop production and outside work. This changes (4) to

$$(16) \quad L = L_e + L_f + L_c + L_w$$

Differentiating (15) when p_c changes and the other two prices and the wage rate in terms of purchased goods (w/p_m) are held constant (with $p_f = p_c = p_m = 1$ at the outset) yields

$$(17) \quad q_f^{LL}dL_f = q_c^{LL}dL_c + q_c^L dp_c = 0$$

or

$$(18) \quad dL_c = - (q_c^L/q_c^{LL})dp_c > 0$$

and

$$(19) \quad dL_f = 0$$

The output of cash crops increases while that of food remains constant. Here, price incentives work unequivocally, and since all cash crops are sold in the market, outside sales will increase as well. The marketed surplus of foodstuffs, on the other hand, will be reduced. Farm

household income has increased, and both food prices and the price of purchased goods remain constant. Hence, there is only the income effect, and no substitution effect. The demand for both food and purchased goods among farm households will increase, but food output remains constant. The marketed surplus of food must therefore shrink.

The analysis is analogous for the case of increased food prices. There will be more leisure and larger food production while cash crop production will remain constant. In this case, however, we don't know with certainty what will happen to the marketed surplus of food. The price of the latter good increases and the substitution effect will be reintroduced. Possibly, on-farm consumption will be reduced and more food will be sold outside.

The conclusions will change also when the price of purchased goods is reduced (but w/p_m remains constant). The income-leisure tradeoff again rotates anti-clockwise, more leisure is enjoyed, less work takes place outside the farm and more inside. (12), in turn, becomes

$$(20) \quad q_f^{LL}dL_f - q_f^L dp_m = q_c^{LL}dL_c - q_c^L dp_m = 0$$

and

$$(21) \quad dL_c = (q_c^L/q_c^{LL})dp_m > 0$$

$$(22) \quad dL_f = (q_f^L/q_f^{LL})dp_m > 0$$

$dp_m < 0$, so the production of both cash crops and food will increase. The farm households will increase their consumption of purchased goods, and possibly, but not with certainty, that of food as well, since food becomes more expensive in terms of purchased goods. However,

since the production of foodstuffs increases as well, the net result of the cheapening of purchased goods may be both increased leisure, at the expense of outside work (provided that leisure is a superior good), increased on-farm consumption of food, and increased sales not only of cash crops but also of food.

6.5 Policy Implications

The model analysis has some policy implications. The first one is that we cannot be certain that price incentives will necessarily work for farm households that have no outside opportunities. The increased income opportunities may be converted to more leisure instead of increased output. On the other, hand, given the widespread poverty in the countryside, this is perhaps less likely. Then, in the case of higher cash crop prices, more output will be put on the market. The case of food crops is different, since these are consumed also by the farmers themselves, and given the regular periodic food scarcity, an increased output is likely to be absorbed to a certain (unknown) extent by increased on-farm consumption. Access to cheaper purchased goods will increase the production of both types of crops, provided that it reduces leisure, but we don't not know with certainty whether this will result in more food in the marketplace or not.

The second policy implication is that once farm households get access to outside income opportunities, agricultural production is likely to increase as a result of price incentives. As long as leisure is not an inferior good, all three price changes will result in more leisure, but at the expense of outside work. The increases of the value of the marginal product of labor in agriculture that are due to the price changes will ensure that the output of the crop whose price increases will increase as well, and when purchased goods become cheaper, the production of both types of crops will expand. The marketed surplus of food will shrink when the price of cash crops increases, but not necessarily in the other two cases,

where not only the on-farm consumption but also the production of food increases. (If leisure is inferior, both outside work and work in agriculture will increase. The effects on agricultural production will be the same.)

Thus, altogether, it appears likely that price incentives stand a better chance to work once the farmers have access to outside income earning opportunities as well. Also, in that case, improved access to purchased consumer goods may serve as an important stimulus to agricultural production. This, in turn, may be important for non-agricultural enterprises, which often perceive that their operations are constrained by insufficient demand. However, the situation to a certain extent resembles that of the hen and the egg. If outside goods are available, farmers may produce more, and this may provide a market for domestic modern enterprises, but unless the latter provide outside goods in the first place, there may be no response from the farmers. The analogy is not perfect, however. The initial stimulus could come from imported goods, and once domestic entrepreneurs see this, they may develop substitutes for imports. But then, on the other hand, a business environment conducive to entrepreneurship must be created, and here, Timor has some way to go (Lundahl and Sjöholm, 2009b).

7. Conclusions

This paper has dealt with the problem of how to achieve a higher future income and living standard in Timor-Leste. In the longer run, this will presumably be the task mainly of a modern industry or service sector, but at the present time four-fifths of all Timorese are subsistence peasant farmers, and in the absence of a modern sector, in the short and medium term, agriculture will have to continue to act as a sink in terms of employment.

This fact makes it natural to focus on what determines production and incomes in agriculture. In the first part of our discussion we used a ‘production function approach’

which allowed us to focus on the inputs employed in agriculture. Land is a scarce production factor and little capital is employed, among other things due to a generalized lack of credit. The technological level is low, not only because of the lack of capital, but also because of the low educational standard of the farmers and the lack of government support in such areas as extension and transportation.

The agricultural sector in Timor-Leste is to a large extent a subsistence sector, where the agricultural households consume most of what they produce. In the future, however, the market orientation of the sector is likely to increase. Timor-Leste will presumably undergo the same process of rural-urban migration and urbanization as the rest of the Third World. This, in turn, means that change, for better or for worse, will presumably have to come via the market mechanism.

In the second part of our analysis we hence developed a model of an agricultural household which allowed us to find out the likely effects on agricultural production and incomes, crop mix, leisure, farm household consumption of food and industrial goods as well as sales of food crops and cash crops not consumed by the farm households, as prices of these two crops and of industrial goods change. Incentives may come from increased prices of farm products and reduced prices of industrial goods. The effects of these changes are not altogether clear-cut. Much depends on how the farmers value leisure and on whether the farm household has access to outside earning opportunities as well. Introducing wage-earning opportunities may be important, since in this case, whatever increased leisure that the farm households may want to enjoy will take place through a reduction of outside work rather than of farm production. The production of at least one agricultural commodity will increase (both in the case of a cheapening of manufactured goods). Thus, even if the objective is to increase the living standard of the Timorese farmers, the road may go partly via increased earning opportunities outside agriculture.

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Table 1. Economic indicators of Timor-Leste, 2002-2011.

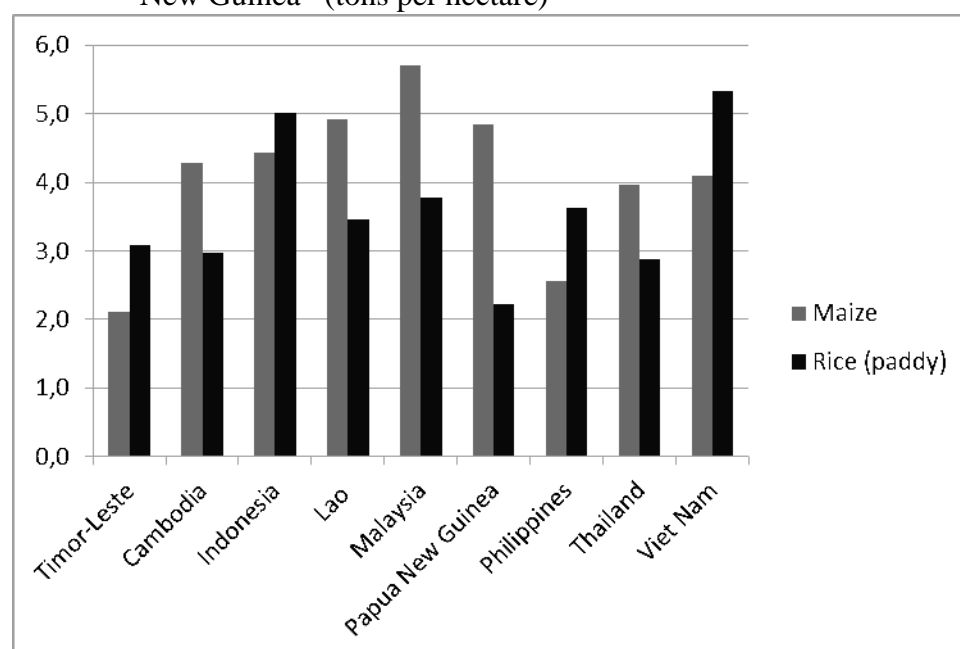
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Growth rate of GDP	2.4	0.1	4.2	6.2	-5.8	9.1	11.0	12.9	6.1	7.3
GDP per capita	719	687	684	700	642	677	753	792	832	n.a.
Petroleum fund withdrawals	n.a.	n.a.	n.a.	0	0	300	396	512	636	734

Note: Growth – real non-oil GDP growth (percentage change); GDP per capita – non-oil PPP constant 2005 US dollars; petroleum fund withdrawals – millions of current US dollars.

Source: IMF (2008, 2011), *World Development Indicators* available from <http://data.worldbank.org/data-catalog/world-development-indicators>.

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Figure 1. Productivity in agriculture in 2010 in selected East Asian countries and Papua New Guinea (tons per hectare)



Source: FAO Statistics Division, available at

<http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567>.

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Figure 2. The determinants of agricultural output

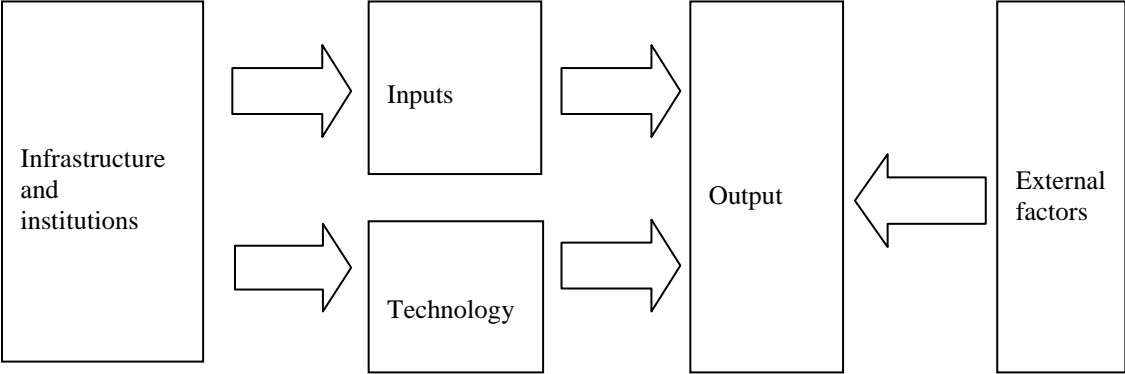


Figure 3. The Equilibrium of the Farm Household

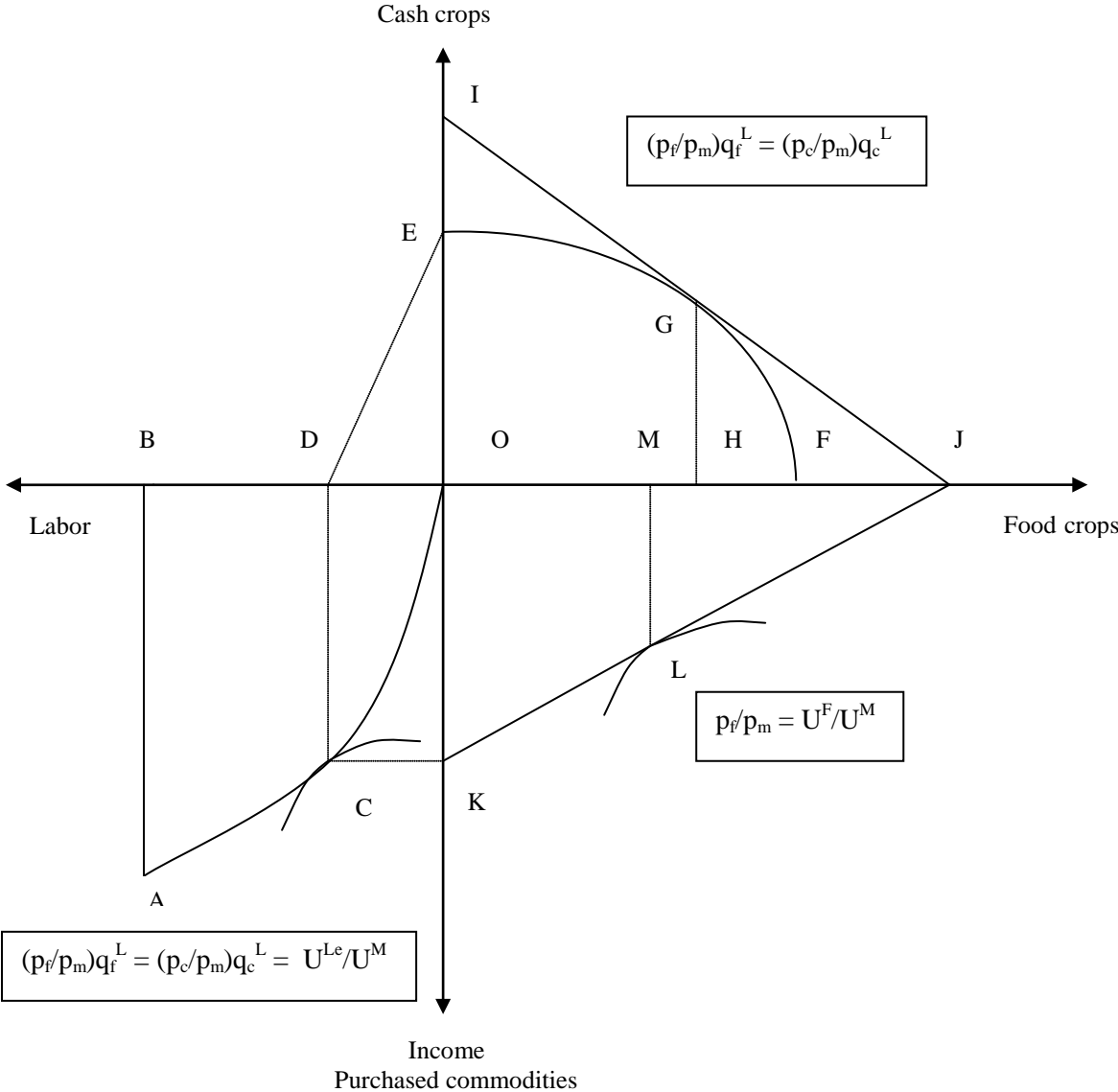


Figure 4. An Increase in the Relative Price of Cash Crops

