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Liquidity and Credit as Constraints to Small Coffee Farmers in the Highlands of Papua New Guinea

A thesis
submitted in partial fulfilment of the requirements for the Degree of
Master of Commerce (Agricultural)

at

Lincoln University

by

J. J. Mauro

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Abstract

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Coffee is Papua New Guinea's (PNG's) second largest export crop and the main source of income for over 50 per cent of the country's households. It is estimated that PNG has more than 2.5 million small coffee growers. However, small grower coffee sales have been declining since 1998. This research examined the importance of cash flow (liquidity) problems relative to other constraints confronting small coffee farmers in the Highlands region, which accounts for more than 90 per cent of PNG's coffee production. The purpose of the research was to offer policy recommendations that would alleviate the most binding of these constraints.

Data gathered in a multistage sample of 150 small coffee growers in two council wards of Daulo District in the Eastern Highlands Province were used to estimate a logit model of investment in seasonal inputs applied to coffee. Liquidity was found to be the most important determinant of investment, followed by family farm labour, transaction costs, formal education and informal taxes imposed by the *wantok* system. Agricultural extension did not have a significant impact on investment. It was concluded that small coffee growers in the study area were unable to finance farm inputs purchased in formal markets because they could not access formal credit. Although almost a quarter of the sample

farmers had bank accounts, only two had used formal credit. Descriptive statistics suggested that access to formal loans was constrained by inadequate supply of development finance and stringent lending criteria stipulated by formal lenders, including development finance institutions (DFI's). It was recommended that government should improve the physical and legal infrastructure in rural PNG in order to reduce high transaction costs that constrain markets, including the rural finance market. In addition, the government should improve education, health and social protection programmes to encourage farmer investment in new technology.

Keywords: Developing country, rural finance, small farms, cash flow problem, agricultural credit, transaction costs, farmer education, extension, family labour, tenure security

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Acronyms

ACIAR	Australian Centre for International Agriculture Research
ADB	Asian Development Bank
CCGS	Coffee Credit Guarantee Scheme
CIC	Coffee Industry Corporation Limited
DFI's.	Development Finance Institutions
EHP	Eastern Highlands Province
EU	European Union
FPDA	Fresh Produce Development Agency
IFAD	International Fund for Agriculture Development
IMF	International Monetary Fund
K	Kina (PNG currency)
m.a.s.l	metres above sea level
MTDS	Medium Term Development Strategy
NADP	National Agriculture Development Plan
NGO's	Non-government Organisations
PDAL	Provincial Division of Agriculture and Livestock
PNG	Papua New Guinea
ROSCAs	Rotating Savings and Credit Associations
SSSPP	Smallholder Support Services Pilot Project
WDR	World Development Report

Chapter 1

Introduction

1.1 Nature and scope of this study

This research examines the importance of liquidity (i.e. cash flow) problems faced by small coffee farmers in the Highlands of Papua New Guinea (PNG) relative to other problems thought to constrain them. The purpose is to identify and rank significant constraints to small grower coffee production and to offer policy recommendations aimed at alleviating these constraints.

Coffee production has been declining in PNG since 1998 (CIC, 2004 & 2008). Much of this decline can be attributed to the collapse of large, foreign-owned coffee plantations following land invasions and to declining world coffee prices (CIC, 2004 & 2008). This research does not attempt to explain changes in coffee production over time. Rather, it is a cross-sectional study that seeks to explain why some small growers invested so much more in their coffee crop than did others during the 2008/9 growing season. Although the study is based on coffee, it was anticipated that many of the problems constraining coffee production would also constrain other commercial crops, and that recommendations emanating from the study would promote commercial agriculture on small farms throughout PNG.

1.2 Rationale for the study

Coffee is the main source of income for over 50 per cent of PNG's households and is the second largest export crop; generating 3.4 per cent of the country's foreign exchange in 2006 and accounting for 17.8 per cent of its non-mineral exports (see IMF Country Report, 2008, p.93, Table 17). It is estimated that PNG has more than 2.5 million growers (CIC, 2008, p.3). Fifteen of the country's twenty provinces grow coffee, but the Highlands (and especially the provinces of Morobe, Simbu, Western Highlands and Eastern Highlands) account for more than 90 per cent of overall production. Arabica coffee is grown in the temperate climate of the Highlands while Robusta coffee does better in the coastal regions. The coffee industry generates more than K350¹ million annually, of which 60-70 per cent directly benefits coffee farming households (CIC, 2009; CIC, 2008, Gimbol, 2001).

Coffee's substantial contribution to livelihoods and foreign exchange earnings encouraged PNG's national government to support the industry. Much of this support is channeled through the Coffee Industry Corporation (CIC) which is mandated to provide leadership and support services to the coffee industry (CIC, 2008, p.vi). The CIC works in collaboration with the Secretariat of the National Agriculture Development Plan (NADP) and the Smallholder Support Services Pilot Project (SSSPP) (both of which report to the National Department of Agriculture and Livestock (NDAL)), the National Development Bank (NDB), donor agencies (primarily the Australian Centre for International Agricultural Research (ACIAR), the European Union (EU), Asian Development Bank (ADB), The World Bank and the International Monetary Fund (IMF)), processors,

¹ 1 Kina =US\$0.3415 in January 2009

exporters, plantation owners, block-holders, coffee production and marketing co-operatives, farmers and other associated stakeholders (CIC, 2004 & 2008; NADP, 2007).

In 1996, the government approved K20 million to fund a Coffee Credit Guarantee Scheme (CCGS) administered by the CIC. An initial K10 million of the approved K20 million was channeled to the CIC via the National Department of Agriculture and Livestock (NDAL) to implement the scheme (CIC, 2004 & 2008). The CCGS lends to smallholders with viable coffee enterprises who do not satisfy the lending requirements of commercial banks. It also subsidises interest charges. Whereas annual interest rates charged by commercial banks in 2004 ranged between 18 per cent and 24 per cent, the CCGS charged only five per cent (CIC, 2004 & 2008).

Despite efforts made by the CIC to increase coffee production, there has been a downward trend in sales since 1998. Figure 1.1 shows that exports peaked at 1.348 million bags in 1998 but then declined to 1.298 million bags in 1999 and 1.043 million bags in 2000 (Gimbol, 2001). The recent production for 2006 and 2007 has declined to 0.803 and 0.800 million bags of green-bean coffee respectively (CIC, 2008). The Chief Executive Officer of CIC conceded that coffee income had declined and he blamed farmers for neglecting coffee (The National, 2008). The decline has also been attributed to low coffee prices, law and order problems, adverse weather conditions, aging tree stocks, inappropriate research and extension delivery mechanisms, deteriorating rural infrastructure and services, high transport costs, and shortages of land and labour (CIC, 2004 & 2008, p.6, Gimbol, 2001, pp.9-11; ADB, 2006, pp.1-8; ARD Workshop, 2002; Eko, 2002 & Taru, 1997 cited in Sengere, 2007; Gwaiseuk, 2001; Overfield, 1998). In 2005, the World Bank highlighted similar problems and stated that, unless they were addressed, there would be little pro-poor

development growth in PNG (World Bank, 2005, p.6). More recently, the IMF repeated this call, stressing that these (persistent) problems need to be resolved in order to promote PNG's competitiveness and economic growth (IMF, 2008, pp.42-44). Murray-Prior and Batt (2007, pp.378-381) and Murray-Prior *et al.* (2008, p.247) also identify 'complex social networks' as hindering the development of coffee value chains in PNG.

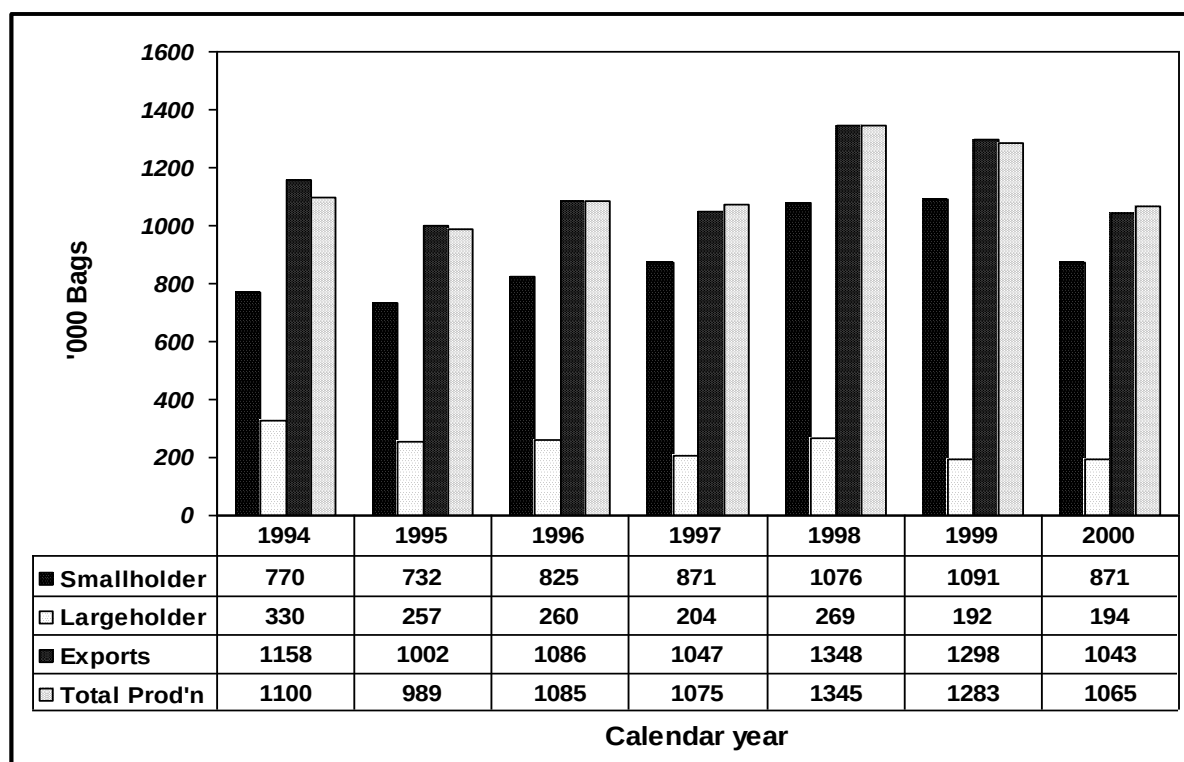


Figure 1.1: Total Coffee Production, by Sector and Exports; 1994-2000

Source: Gimbol, 2001, p.3

By 2004, the CCGS had disbursed K3.9 million to borrowers, leaving a balance of K1.2 million in funds for further lending (CIC, 2004 & 2008). It appears that K5 million of the initial disbursement of K10 million paid for implementation and administration expenses incurred by the CCGS. The CIC estimated that K1.2 million would finance about 180 of the 277,000 registered small growers in the country. Considering that most of PNG's small coffee farmers are not registered, it is clear that this source of credit would have done little to alleviate widespread liquidity problems on small coffee farms. The CIC's Research & Grower Services Division (R&GSD) reported that loan enquiries from small coffee

farmers were increasing at an alarming rate, and claimed that the CIC did not have sufficient resources to administer the CCGS (CIC, 2004 & 2008). It also reported that farmers had defaulted on loans made by the CCGS and attributed this to both internal and external factors such as poor assessment and monitoring of clients, high transport costs, low returns to coffee, disregard for law and order, and poorly educated farmers (CIC, 2004, p.76)

The previous paragraphs suggest that small coffee growers face many constraints, including liquidity problems. The main objective of this study is to establish the importance of cash flow (liquidity) problems relative to other constraints confronting small coffee farmers in the Highlands region. If small coffee growers are indeed constrained by liquidity problems, a second objective of the study is to assess their use of formal agricultural credit - including loans made by commercial banks and DFIs (like the CCGS) and credit extended by input suppliers.

Liquidity refers to the ability to generate cash in order to meet anticipated cash demands and to provide for unanticipated shocks and investment opportunities or events. Liquidity is generally provided by holding cash and assets that can be easily sold if the need arises, or by having the capacity to borrow (Barry *et al.* 1979, pp.129-130). This study focuses on small-farmer access to formal credit because sources of informal credit (such as local money lenders, friends and family) typically found in the rural areas of developing countries are susceptible to both systemic and covariant risk, and usually provide only very small, short-term loans (Meyer & Nagarajan, 2000, pp.23-30). The establishment and inadequacy of the CCGS lends support to the view that access to formal credit is constrained.

Both study objectives help to inform policy aimed at developing PNG's small coffee farmers. In addition, information about sources and levels of formal credit used by small coffee farmers will be helpful to the CIC, commercial banks, agricultural cooperatives and farmers. The conclusions and policy recommendations are also expected to have relevance for other agricultural industries in PNG such as oil palm, cocoa, coconut, vegetables and spices.

1.3 Research objectives and hypothesis of the study

The main objective of this research was to investigate and assess the importance of liquidity problems relative to other constraints faced by small coffee farmers in the Highlands of Papua New Guinea (PNG). The second objective was to assess their use of formal agricultural credit. The purpose of these objectives was to offer policy recommendations aimed at alleviating the most binding of these constraints.

The study tested the hypothesis that small-scale coffee farmers in PNG were constrained by liquidity (cash-flow) problems because they had poor access to formal credit to finance farm inputs.

1.4 Structure of the thesis

The next chapter reviews relevant literature on factors that inhibit the growth of smallholders, with particular attention given to PNG. This discussion draws on theoretical propositions and past empirical studies. Chapter 3 describes the sampling method and field work used to collect household and farm-level data from 150 small coffee growers in the Daulo District of the Eastern Highlands Province. Descriptive statistics computed for the sample farmers are presented in Chapter 4. Chapter 5 presents and discusses a logit analysis of factors influencing the level of investment that sample farmers made in seasonal inputs used to produce coffee during the 2008/9 season. Chapter 6 summarises the main findings and offers conclusions and recommendations based on these findings. It also highlights some limitations of the study and proposes areas for future research.

Chapter 2

Literature Review

The literature reviewed in this section has two distinct themes. First it explores the question of farming constraints faced by smallholders. Second, it examines the question of smallholder access to, and use of, credit markets. Some of the literature is rooted in theory and some in empirical studies.

2.1 Farming constraints

Smallholders in developing countries encounter many constraints that prevent them from improving their income and living conditions. The following problems are frequently mentioned in the literature, and are relevant in PNG:

- poor road, transport and communication infrastructure (ACIAR, 2007, p.49; ADB, 2004 & 2008ab; IMF, 2007; World Bank, 2006 & 2008; Gwaiseuk, 2001, pp.35-36) drives up the cost of market transactions reducing the appeal and efficiency of markets, including credit markets. (ACIAR, 2007, p.49; World Bank, 2006; Kavanamur, 1997, p.3; Delgado, 1996 cited in Fenwick & Lyne, 1999; Manning, 2001, p.10-21)
- weak law enforcement compromises contracts and personal security (ACIAR, 2007, p.49; ADB, 2004 & 2008ab; IMF, 2007; World Bank, 2006; Nita, 2006, p.xiii; Gwaiseuk, 2001; Manning, 2001)

- insecure property rights undermine incentives to invest and the ability to finance investments (ACIAR, 2007, p.49; IMF, 2007; ADB, 2008ab; World Bank, 2006; Gwaiseuk, 2001, pp.35-36; Kille & Lyne, 1993; Lyne, *et al.*, 1997)
- inappropriate policy, weak governance and corruption within organisations create uncertainty for investors (ADB, 2008ab; IMF, 2007; World Bank, 2006; ACIAR, 2007; Nita, 2006, p.xiii; Yaron *et al.*, 1997, p.100)
- low levels of social trust (ACIAR, 2007, p.49; World Bank, 2006; IMF, 2007; Gwaiseuk, 2001, pp.35-36) and high transaction costs render markets for rural credit, insurance and land imperfect or missing altogether (ADB, 2008ab; Fernando, 2007; Udry, 1995 cited in Fenwick & Lyne, 1999; Christensen, 1993; Thomson & Lyne, 1993; Von Pischke, 1991 cited in Fernando, 2007, p.14)
- health problems, especially HIV/AIDS, tuberculosis (TB) and malaria, that reduce the supply of quality labour (ACIAR, 2007, p.49; IMF, 2007; World Bank, 2006; Nita, 2006, p.xiii, MDG's, 2007)
- poor education, extension and farmer training (NADP, 2007; CIC, 2004 & 2008; Gwaiseuk, 2001)

2.1.1 Poor physical infrastructure

Agriculture is the most important livelihood for the vast majority (>85%) of rural people in Papua New Guinea. Rural households rely heavily on subsistence crops and earnings from

coffee and vegetables to meet cash expenses for education, health and other basic services (Gwaiseuk, 2001). Inadequate maintenance of roads is a major constraint to increasing agricultural production and cash income for villagers (AusAID, 2004, p.xv). Road transport services are unreliable and expensive, making it difficult for farmers to access urban markets. While recognising that improving and maintaining road networks requires more capital, there are concerns that government is not making efficient use of existing resources to maintain roads.

Maritime transport services are also of poor quality and relatively expensive, significantly reducing export parity prices for coffee, cocoa, copra, oil palm and timber. Policy recommendations include the privatisation of PNG Harbours Limited and increased competition in port management and coastal shipping (AusAID, 2004; NADP, 2007; ADB, 2004 & 2006). In aviation, current levels of domestic and international service are considered adequate, but government-owned and managed Air Niugini is financially stressed (AusAID, 2004). A private equity partner is seen as the most promising means of improving its operational and financial performance (IMF, 2008).

The requirements for better transportation in Papua New Guinea include clear and consistent policy at the national level; reliable, transparent and accountable resource allocation to the core institutions responsible for each sub-sector, and - where applicable - the introduction of private capital and management. Legal and regulatory institutions need to be strengthened to ensure security for private investment in transportation and competitive prices for consumers (AusAID, 2004).

Coffee, cocoa and coconut (copra) are severely affected by inefficient port and coastal shipping services. For coffee, the deteriorating condition of the Highlands Highway and district feeder roads has become an even more serious problem (ACIAR, 2007: NADP, 2007; ADB, 2004 & 2006; IMF, 2008; World Bank, 2006; Gwiseuk, 2001). Many of the feeder roads servicing the highlands have become impassable, and roads which are passable impose high wear and tear on vehicles. Coffee beans are usually carried on foot to collection points along the main highway (ACIAR, 2007). Regular newspaper reports, such as a recent one entitled “Highlands Highway severed again” (The National, 2009, p.1), attest to the poor condition of the national road. The highway links the Eastern, Western and Southern Highlands, Simbu and Enga provinces with Madang and Morobe provinces on the coast. The port of Lae in Morobe province handles all mineral and agricultural commodities exported from the Highlands.

High road transport costs add significantly to the price of imported inputs and discourage coffee growers from adopting new plant varieties and production techniques that require intensive application of such inputs. Conversely, they depress coffee prices at the farm gate. When prices are low, coffee grown some distance from the highway is not harvested and farmers turn to other crops or nonfarm activities (ACIAR, 2007). While the poor state of transport infrastructure is a proximate cause of serious problems impacting export crops, the underlying determinant is the performance of central, provincial and local governments in planning, prioritising, funding and executing public works. The variable quality of public expenditure management has, in the past, also led to periods of macroeconomic instability which have also impacted negatively on the tree crop sector (ACIAR, 2007).

Effective communication mechanisms are important ingredients for economic growth and development. PNG's national agriculture development plan (NADP) recognises that buyers and sellers require good communication systems to provide timely and accurate two-way information flows (NADP, 2007). The reliability of effective communication systems such as the internet, cell-phones and telephones depends largely on the quality of its supporting infrastructure (e.g. cabling), much of which is maintained by government agencies. Confidence in these services is low in PNG as they are frequently interrupted by natural disasters, vandalism and theft, and repairs to infrastructure are slow (NADP, 2007). In addition, the coverage of telecommunication services is restricted to PNG's main cities and towns, notably Port Moresby, Lae, Goroka, Madang, Mt Hagen and Wewak (NADP, 2007).

User charges for cell-phones, telephone and internet services are amongst the highest in the Pacific region. This has been attributed, in part, to monopoly ownership by Telikom PNG and its subsidiary, Pacific Mobile Communications (NADP, 2007). The recent entry of Digicel, a new international telecommunication company, has been welcomed by consumers and business houses (AusAID, 2008). Poor coverage also means that people have to travel considerable distances to access these services. Farmers, for example, would have to incur substantial travel and time costs to access information by phone or internet.

The state-owned, provincial radio stations which deliver news, weather, market and extension reports are under-funded and broadcast only when they have cash flow. PNG has just two daily newspapers (Post Courier & The National) and one privately-owned commercial television station (with limited rural cover). Transport problems mean that newspapers are often delivered late in the day or the next day. Two private companies (i.e.

Datec & Daltron) provide internet services. While useful, these services are not accessible to small coffee farmers in remote rural areas.

2.1.2 Law and order

Papua New Guinea's law and order problems and related security costs also have an adverse impact on investment decisions, economic growth and development. Security concerns have been echoed by many commentators and foreign investment partners (IMF, 2008, NADP, 2007; Murray-Prior & Batt, 2007; ADB, 2006; Gwaiseuk, 2001; Nita, 2006, p.xiii). Industry representatives have singled out theft and crime as serious problems that substantially increase the costs of doing business (NADP, 2007; ADB, 2008ab).

In addition to the direct cost of providing private security, which is estimated at three per cent of total business costs on average (IMF, 2008), there are many indirect costs associated with insecurity. For example, physical insecurity constrains the geographical area and time of day in which a company can safely operate. As a result, plant and equipment tends to be underutilised. Labour costs are increased to compensate employees for personal safety risks, especially in the case of foreigners. The IMF (2008) reported that security issues occupy management's time, thereby reducing overall productivity. In the national assessment report of PNG, Nita (2006) stressed that law and order problems are undermining the social, economic, political and cultural fabric of society. He describes criminals as 'internal terrorists' that have no respect for life or property.

Farmers are particularly prone to losses stemming from clashes between tribal groups, and theft of farming inputs, equipment and even crops. Land disputes within the clan or family

are an important source of physical insecurity (CIC, 2004 & 2008, p.8; Gimbol, 2001; NADP, 2007; Gwaiseuk, 2001). Farmers are sometimes forced to default on payments or even to abandon their land with dire consequences for food security and poverty. Most farmers are risk averse and under-invest in agriculture when the odds of suffering a significant loss are high. This generates negative externalities as employment opportunities are lost throughout the value chain. Personal safety and certainty that contracts are legally enforceable are public goods for which the government must take responsibility.

2.1.3 Land tenure

Land ownership and tenure issues have been reported widely by key investment partners and commentators as one of the main barriers to PNG's development (ADB, 2004, pp.8-9; IMF, 2008; NADP, 2007; ACIAR, 2007; Murray-Prior and Bart, 2007; Gwaiseuk, 2001). About 97 per cent of the land is farmed under customary forms of land tenure (NADP, 2007) that are not secure in the economic sense (ACIAR, 2007; IMF, 2008; Murray-Prior & Batt, 2007; ADB, 2004; NADP, 2007, pp.16-21). Secure tenure, i.e. property rights that are exclusive, transferable, durable and assured (Lyne & Graham, 2001), promote allocative efficiency and investment that raise the productivity of land and labour (Kille & Lyne, 1993). The ACIAR (2007, p.38), when referring to insecure tenure in PNG, emphasise the need for a broader bundle of property rights to land, including "...the right to exclude others from its use and enjoyment; the right to transfer it by sale, lease or gift; and, perhaps most notably, the right to receive income from the property independent of use".

In its 2008 report, the IMF called for land tenure reform in PNG, arguing that the customary tenure system: (a) reduces the incentive for landholders to improve their farmland as they cannot internalise the benefits of their investment; (b) reduces the ability of landholders to finance investments in agriculture because land has no collateral value when it cannot be repossessed and sold in an active land market; and (c) diverts resources into rent-seeking activities rather than wealth creation because property rights are poorly defined. Efforts to establish a national land registry system have been resisted by local village leaders and NGOs, although there have been some successes. For example, tangible benefits in the form of royalties, jobs and social services generated by some oil palm estates have encouraged coastal village tribes in West New Britain, Milne Bay, New Ireland and Oro provinces to recognise leases, leading to a significant increase in exports of palm oil (IMF, 2008).

However, only the State is permitted to purchase tribal land, and it is unlikely that rental markets for tribal land are efficient because insecure tenure increases transaction costs (Lyne *et al.*, 1997). This may explain why intense demand for cropland in the Highlands region often triggers tribal fights that destroy property, including coffee plantations, food gardens, livestock and villages. Such conflict further reduces the predictability of returns to investment and discourages farmers from making improvements and planting perennial crops. Commercial Banks also tend to redline areas known for land disputes and tribal fights. Even the small share (3%) of PNG's land that has been alienated by the State, and which can be formally leased (NADP, 2007), is subject to claims from customary landowners. One of the worst cases in PNG's history was the Bougainville crisis, which precipitated a decade (i.e. 1989-1999) of civil war that claimed some twenty thousand lives

and destroyed foreign and national investments worth millions of dollars (Post Courier, 2001; UNDP, 2004, p.6; AusAID, 2003).

Against this background, it is perhaps surprising that small farmers in PNG have invested in perennial crops to produce coffee and palm oil. This apparent anomaly (frequently observed in African countries) has been attributed to a perception that a perennial crop strengthens the investor's claim to the land (Place *et al.*, 1994). The implication is that coffee farmers might feel less vulnerable to land claims than do farmers who have not planted perennial crops. Even so, incentives to invest are diluted by the inability to realise capital gains by selling the property (Kille & Lyne, 1993).

2.1.4 Governance

Corruption is widely regarded as a key factor undermining efficient use of public resources and service provision in PNG. According to Cammack (2009), 15 per cent of teachers employed at public schools are ghost employees (i.e. fictitious workers receiving salaries that are pocketed by corrupt officials) and over 16 per cent of school subsidies are being leaked. Nita (2006) claims that corruption occurs at all levels of government and that it is deeply-rooted. Efforts by the Ombudsman Commission, Auditor General's Office, Police Fraud squad and NGOs to curb corruption have failed. This suggests that corruption and poor governance are difficult to address using PNG's existing legal and justice systems. Many commentators blame the chronic *wantok* system, in which self-serving bureaucrats and politicians collude to siphon off public funds (Nita, 2006; INA, 2003). The National (2009b, p.1) quoted Dr Allan Marat, PNG's Attorney-General and Minister of Justice as saying to his parliamentary colleagues "*You have to be serious about corruption in your*

districts, in your provinces; some of us leaders here are guilty of corruption, and we have set up our own personal companies in our districts and provinces to eat up all the funds that are meant for development purposes. This is a clear example of what we leaders sitting here in this very parliament have been doing”.

Cammack (2009) draws attention to high-level corruption in PNG’s forestry sector. Recent press reports claim that NADP funds were fully drawn by mostly ‘ghost farmers’ in Port Moresby while farmers that applied for support to finance viable projects missed out. There are also concerns that corrupt loan officers employ delaying tactics when dealing with legitimate loan applications from creditworthy clients, and divert loans to inferior applications from friends and borrowers willing to pay bribes (Kavanamur, 1997; Nita, 2006).

2.1.5 Transaction costs and access to formal credit

Transaction costs can be broadly defined as the costs of transferring or exchanging resources in the markets (Fenwick, 1999, pp.16-19). Zeller *et al.* (1997) define transaction costs as the costs involved in an exchange of goods or services apart from the price of the goods or services. These costs are influenced by farm and farmer characteristics and by the physical and institutional environment within which prospective buyers and sellers operate.

Transaction costs can be broadly classified as *ex-ante* or *ex-post* costs. In agricultural production and marketing, transaction costs are heavily influenced by distances between farms and markets and the state of physical infrastructure (Martin & Jagadish, 2006, Schreiner, 2001). Searching for better markets and negotiating good terms are examples of

ex-ante transaction costs. These costs would tend to be lower for farmers who have affordable access to telephones or who are located close to input and product markets. They would also be lower for farmers who are literate and who speak the same language as their trading partners (IFAD, 1985, p.32). Most *ex-ante* transaction costs are fixed costs that do not vary with the volume transacted (Poulton & Lyne, 2008, p.115). For small farmers, unit transaction costs may be prohibitively high, and group action may be required to access markets (Lyne & Martin, 2008).

Ex-post transaction costs include the costs of monitoring and enforcing contracts, and the losses incurred if a contract is breached. Risk is therefore an important *ex-post* transaction costs, and one which increases with the volume transacted (Poulton & Lyne, 2008). Farmers who trust their trading partners or who can rely on the legal system to uphold their contracts tend to face lower transaction costs than those operating in environments where there is little social trust or where the legal system is uncertain. Of course, the same arguments apply to the trading partners; high unit transaction costs (Zeller, 2003; de la Tore *et al.*;2006) discourage input suppliers and processors from dealing with small farmers.

It follows that (a) high transaction costs constrain or even prohibit market activity, and (b) that transaction costs are idiosyncratic (Gonzalez-Vega, 2003), varying between producers in the same geographic area. For example, it has been argued that rural women in developing countries often confront higher transaction costs than do men as they face greater legal uncertainty and tend to be less literate (Fenwick & Lyne, 1999).

With respect to rural finance markets in developing countries, Zeller (2003, p.14) and the World Bank (2005b, p.69) propose the following reasons for high transaction costs:

- low rural population density in rural areas
- considerable dispersion of rural households, markets and institutions
- weak or deteriorating physical infrastructure
- poor access to information, education and business training
- small loans and small volumes of loan transactions
- lack of marketable collateral – a substitute for information about a borrower's capacity and intention to repay a loan
- a legal system that cannot be relied on to uphold property rights and contracts.

Credit markets are particularly sensitive to transaction costs because credit transactions take time to conclude. This exposes the lender to problems of adverse selection and moral hazard (Besley, 1994; Lyne, 1996). Adverse selection occurs when loans are granted to risky borrowers instead of low risk borrowers. Moral hazard occurs when the borrower breaches the contract and defaults on the loan (Fenwick & Lyne, 1999). To address the adverse selection and moral hazard problems, lenders require accurate information about prospective borrowers (Jabbar, *et al.*, 2008; Atieno, 2001; Lyne, 1996; Zeller, *et al.*, 1997, p.9; Kavanamur, 1997, Norton, 2004; Seibel, 2004). However the cost of acquiring this information about small clients in remote rural areas usually results in prohibitively high unit transaction costs for formal lenders (ADB, 2008ab; Meyer & Nagarajan, 2000, pp.26-33; Kavanamur, 1997; World Bank, 2005ab; Gonzalez-Vega, 2003; Sharma & Zeller, 2000; Oluwasola, *et al.*, 2008). For this reason, rural credit markets tend to be poorly developed in areas characterised by small farms, and are dominated by informal lenders and publically subsidised development finance institutions (DFIs) (Zeller *et al.*, 1997).

Meyer and Nagarajan (2000, pp.45-55) describe a changing paradigm for developing rural financial markets. While many developing countries continue to use the old policy approach of providing directed credit to farmers, there has been a significant shift in some developing countries to a new policy approach that seeks to promote efficient and sustainable financial markets in rural areas by addressing problems that prevent financial intermediaries from accepting deposits and offering credit to poor clients at reasonable cost. Reducing transaction costs is an important part of this approach. In the new paradigm, the State must provide high-quality physical and legal infrastructure, positive real interest rates and a regulatory framework that promotes good governance and good lending and deposit-taking practices. Similarly, Claessens (2006, p.221) blames the persistence of institutional barriers to access (credit markets), such as weak legal system, weak information infrastructure, and lack of competitiveness in the banking system. Subsidies could be used to help finance start-up and training costs for financial intermediaries and credit bureaus, but should not be used to reduce interest rates on loans made by DFIs.

Farmers benefit from a wider range of financial services and more competitive interest rates when large intermediaries like commercial banks enter the rural market, and large intermediaries are less prone to the effects of covariant and systemic risk than are small, local lenders who cannot diversify their lending portfolios. Importantly, farmers who establish a successful credit history can access larger loans from large intermediaries. This is seldom possible when dealing with small, informal lenders like ROSCA's. For this reason, this study focuses on access to credit provided by formal lenders and input suppliers (like trading stores) as a likely contributor to liquidity problems experienced by small coffee farmers in PNG. Section 1.1 of this thesis described a widening gap between

growing demands for development finance administered by the CCGS and its depleted capital reserves. Several PNG studies have identified cash flow problems as a major constraint as incomes earned by farm households are small and unreliable (ADB, 2008b; Fernando, 2007; Kavanamur, 1997; Nita, 2007).

Of course, the entry of new intermediaries is largely dependent upon the State's ability to reduce transaction costs and risks in all markets, including markets for land and other assets that can serve as collateral for loans. Unfortunately, PNG is characterised by conditions that lead to high transaction costs (as discussed in 2.1.1-2.1.4). Reporting on the results of two recent surveys conducted jointly by the ADB and PNG's Institute of National Affairs (INA), the ADB (2008b, p.35) concluded that government was not supplying essential public goods and services needed to support private sector development. Well-functioning states provide secure property rights and adequate public infrastructure and services (such as health, education and law enforcement), keep the costs of doing business low, promote competition and encourage access to finance - but do not own substantial productive assets.

2.1.6 HIV/AIDS

The impacts of Human Immune-deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) on agricultural development and sustainability of livelihoods by households have been widely reported. The 2008 World Development Report (WDR), citing 2006 data, estimates that 39.5 million people were living with HIV, and that 2.9 million people had died from AIDS (World Bank, 2008, p.225). Most of the people affected by HIV and AIDS rely on agriculture for their livelihoods, and live in sub-Saharan Africa (SSA) and other developing countries.

The WDR further points out that illnesses and death from HIV/AIDS are reducing agricultural earnings and productivity. A Kenyan study conducted in 1997 showed that average daily output of farm workers suffering from HIV/AIDS was 23 per cent lower than that of healthy workers. A study in Mozambique revealed that household food production was significantly lower in households with HIV positive males. (World Bank, 2008). Similar findings have been reported in many other developing countries. Evidence from PNG suggests that more than 50,000 of its people are HIV positive. Some 70 per cent of detected cases come from Port Moresby, but this may understate the scale of the problem in rural areas where there is little or no HIV testing (World Bank, 2005b). It is predicted that 10 per cent of the population could be infected by 2010, and that 37 per cent of PNG's labour force could be infected by 2020. (Cammack, 2009; Nita, 2006: xiii; World Bank, 2004, p.11). These assertions are consistent with claims made by other local and international agencies (AusAID, 2002 & 2008; IMF, 2007; World Bank, 2004)

There is concern that declining agricultural earnings and productivity may increase the risk of contracting HIV by encouraging urban migration and prostitution. A study of young unemployed urban women found that almost half resorted to sex work to support themselves and their relatives (World Bank, 2004; ADB, 2002:10). This trend is evident in PNG, and the government is concerned that its investment in HIV/AIDS awareness programmes is having no impact on patterns of sexual behaviour (AusAID, 2002 cited in World Bank, 2004, p.39; ADB, 2002, p.10). Farming households in PNG are beginning to experience AIDS-related deaths which impact negatively on their labour supply for farming and other income-generating activities (Nita, 2006, p.xiii; World Bank, 2004). In addition, rural people are dying from preventable diseases - especially malaria,

tuberculosis, typhoid and pneumonia - simply because they cannot afford the distant medical services.

2.1.7 Education, training and extension

Educated farmers tend to face lower transaction costs than do illiterate farmers, and are better able to assemble and interpret technical information. Education also promotes awareness and experiential learning. Empirical studies have shown that better educated farmers tend to allocate resources more efficiently and adopt new technology more readily than do their less educated counterparts (Bizoza, *et al.*, 2007; Wynne & Lyne, 2003).

Low levels of education in rural PNG (Claessens, 2006, p.222; IMF, 2006, p.17; ADB, 2002, p.6) may well constrain the growth of small farm enterprises. Education and training have elements of public goods and require government funding. The IMF (2006) argues that access to, and quality of, education are major factors impeding productivity growth and development in PNG. According to IMF (2006) estimates, PNG's gross enrolment at primary and secondary school levels are 69 per cent and 11 per cent respectively and fewer than 60 per cent of children complete year six (Grade 6). These levels have not increased since independence in 1975. The IMF (2006) attributes low enrolment and retention rates, in large part, to long distances to school, a shortage of teachers in remote areas and the significant cost of education, especially at secondary and tertiary levels. These conditions have not improved despite impressive targets set by the government in its medium-term development strategy (MTDS) to increase the quantity and quality of education and basic health care (MTDS, 2004).

Following their study of smallholder access to specialty coffee markets in PNG, Murray-Prior and Batt (2007) emphasise the importance of appropriate training, skills and information to help farmers understand and achieve required quality standards. In their view, quality begins with farmer training. However, there is general consensus that PNG's extension service is failing small farmers (Gwaiseuk, 2001; Overfield, 1998). Both farmers and their extension agencies blame unpredictable budgetary support, poor governance, corruption, and misappropriation of funds for the poor state of extension services. For instance, the CIC (2004 & 2008) stated that it is unable to provide adequate training and visit to farmers owing to inadequate funding and poor road infrastructure. For the same reasons, it cannot communicate research findings or demonstrate new technology to the vast majority of farmers. While higher levels of contact may well encourage small farmers to innovate (Kagen, 2001 cited in World Bank, 2004, pp.31-32; Gwaiseuk, 2001; CIC, 2004 & 2008) questions still remain about the quality of information and advice provided by poorly funded government agencies.

2.1.8 The *wantok* culture

Another possible constraint to farming, business development and entrepreneurship in PNG (and other Pacific Island Countries) is the *wantok* system of reciprocity whereby households experiencing relatively good times share (money, livestock, land, tools, etc.) with less fortunate members of their extended family or kin group on the understanding that the recipients will reciprocate should their fortunes change in the future (see Brigg, 2009, p.153). Such reciprocity or informal insurance is common in many developing countries and is deeply rooted in PNG. As highlighted by Tweeten (2007, pp.63-65), the downside of this tradition is the creation of unreasonable expectations. For example, wage

employees and entrepreneurs are expected to contribute towards their relatives costs of education, healthcare and funeral expenses. These high implicit taxes have been observed to discourage labour effort (Tweeten, 2007) and could well discourage entrepreneurial farmers whose 'good fortune' is so visible to needy neighbours. More than 90 per cent of the small farmers interviewed by Overfield (1991, p.10) in his study of social and cultural factors affecting coffee production in PNG stated that cultural cash demands had a major influence on their production.

2.2 Past empirical studies

Empirical studies show that farmers in developing countries face similar constraints in their pursuit to increase production and income. For instance, Fenwick and Lyne (1999) reported that smallholders in KwaZulu-Natal (South Africa) were constrained by low levels of liquidity, poor access to land, poor access to information and high transaction costs - in decreasing order of importance. These constraints were identified using Logit regression to distinguish between smallholders who invested substantially in farming and those who did not. Transaction costs were measured using an index computed from proxy variables such as education and car ownership. Fenwick and Lyne (1998) then used Heckman regression to identify factors influencing the level of credit used by the subset of smallholders that had borrowed. They found that transaction costs and savings were important determinants of a household's decision to borrow, and that the level of credit used was determined primarily by household income (debt servicing capacity).

Matungul *et al.* (2001) found that transaction costs (proxied by vehicle ownership and distance from telephones and district roads) were significant determinants of the number of

market channels used by 240 small crop farmers sampled in KwaZulu-Natal (KZN). Farm size, liquidity and the number of marketing channels used were - in turn - the most important determinants of crop income. The first equation of their recursive regression model was estimated using OLS regression, and the second using Two-Stage Least Squares (2SLS) regression. Similarly, Wynne and Lyne (2003) used a recursive regression model to identify factors influencing levels of credit used by 123 small poultry producers in KZN, and also the size of their poultry enterprises. In the first equation, estimated using OLS regression, liquidity, wealth (assets) and well-defined property rights were all positive determinants of the level of credit used. In the second equation, estimated using 2SLS regression, credit and transaction costs were significant determinants of enterprise size. Transaction costs were measured using a principal component index of distance to market, vehicle ownership, education and access to a telephone.

A study by Bizoza, *et al.* (2007) to identify factors influencing potato yields achieved by a sample of 143 small farmers in Gikongoro province, Rwanda, regressed levels of investment in seasonal inputs (fertiliser and seed) on various farm and household characteristics. Farm size, household income (liquidity) and family size were all significant and positive determinants of investment in seasonal inputs. Larger families, it was argued, mean more family labour and greater subsistence consumption needs.

Chapter 3

Data Collection

This chapter consists of five sections. It describes the study areas, sample survey design and field work undertaken to train enumerators, pilot the questionnaire and gather data from sample households.

3.1 Location of research (study area)

Data for this research were gathered in two council wards [Yamayo (Ward 7) & Korepa (Ward 8)] of Daulo District in the Eastern Highlands Province (EHP) of Papua New Guinea (see Figures 3.1 & 3.2). EHP is made up of eight districts covering an area of 11,200 square kilometres. The province is the second largest producer of Arabica coffee in PNG and it has a population in excess of 432,000 people (Wikipedia, 2009). Daulo district has an estimated population of over 30,000 people (Wikipedia, 2009). The study area lies about 30km west of Goroka township. Although Ward 7 (Yamayo) is closer to the main highway than Ward 8 (Korepa), farmers in both wards encounter similar deficiencies in physical infrastructure that constrain access to information, services and markets.. For example, the 30km trip from Goroka to Ward 7 takes about one hour. The wards are typical of coffee growing areas as elsewhere in EHP. Both have high potential for agricultural production (Sengere, *et al.*, 2007), but Korepa lies at higher altitude (>1750 m.a.s.l) and this tends to reduce coffee yield (Sengere, *et al.*, 2007; Lutulele, 2001, p.684). Each has an estimated total population of 5000 people, or approximately 1000 small farm families – most of whom depend heavily on coffee and vegetables as their main source of

income (Wikipedia, 2009). A sample of 150 small coffee farmers was selected and interviewed by the researcher and two enumerators.

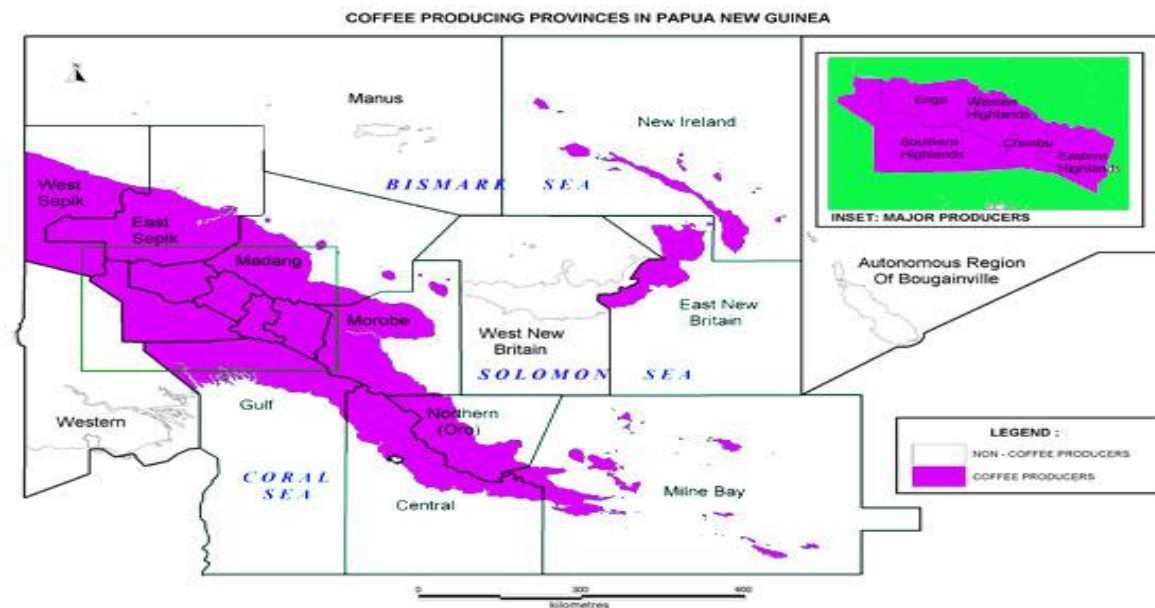


Figure 3.1: Coffee growing areas of PNG
Source: www.coffeecorp.org.pg/pngmap.html

3.2 Sample design

A stratified, multi-stage sampling technique was used to draw a representative sample of small coffee growers from Yamayo and Korepa wards (Figure 3.2). The wards were treated as strata, and a sample of 75 small coffee farmers was selected from each stratum using a multi-stage sampling design (Davidson & Tolich, 2003, pp.111-120) as there were no lists (sampling frames) of small coffee growers operating in these wards. At the first stage of sampling, two villages were selected from the population of (8-9) villages in each stratum (ward). These sample villages were selected with probability proportionate to an estimate of their size (PPS). PPS selection helps to reduce sampling variance (Hansen *et al.*, 1953). Estimates of village size were based on prior information about village populations gathered from village leaders. A list of small coffee growers was then constructed for each selected village in consultation with village elders, and a random

sample of coffee growers was drawn from each list. A constant sampling rate was applied to each list within a stratum, and the sampling rate was high enough to generate a sample of 75 small coffee growers for the stratum. This process yielded a valid sample of small coffee growers in each ward, and also meant that sample statistics could be computed for each ward without weights to account for differences in village size and sampling rates.

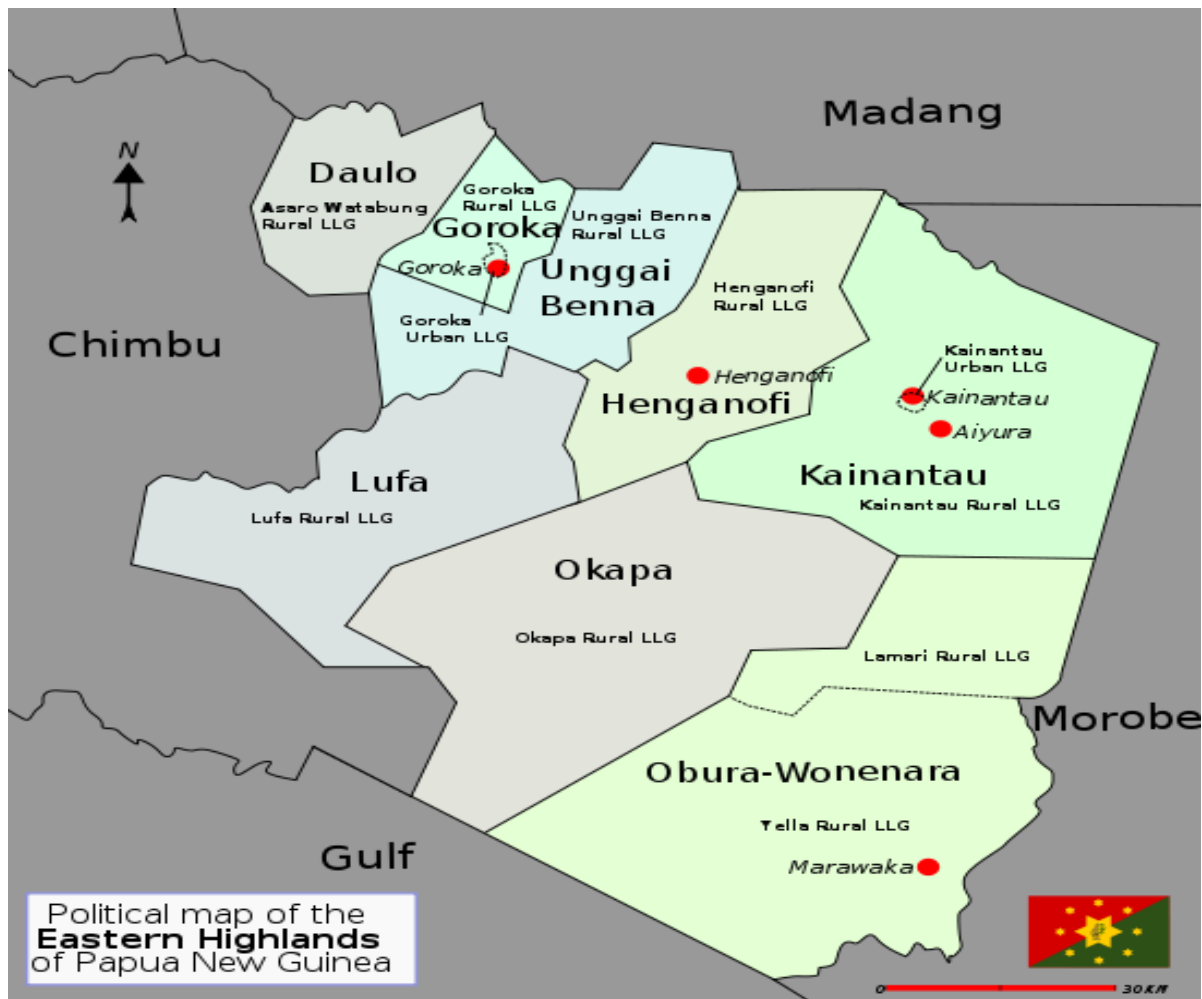


Figure 3.2: Map of Eastern Highlands Province

Source: Wikipedia at <http://www.easternhighlands.com.pg/facts.htm>

Fieldwork ran from mid July to early September 2009. Two enumerators were recruited from Yamayo (Ward 7) to interview sample farmers in both wards. A tribal leader or councillor helped the researcher and enumerators to locate each sample farmer and introduced them to the household. In cases where a sample farmer was unavailable, the

enumerators were instructed to substitute him or her with the next closest farmer (Hendriks, 2002). The researcher circulated between enumerators, checked completed questionnaires and revisited respondents to correct any omissions or errors.

3.3 Enumerator training and pilot survey

The two enumerators were briefed on the terms and conditions of their engagement. Both had completed at least ten years of formal schooling. They were instructed on appropriate ways of approaching households, phrasing questions and recording information on the interview schedules. The questionnaire was tested after the training sessions. Two non-sample farmers were selected from each village and interviewed to identify flaws in the questionnaire and to determine interview duration. Post-interview evaluations were conducted to appraise not only the questionnaire but also the performance of the enumerators. Copies of the final questionnaire were produced in Goroka, the capital of Eastern Highlands Province. Although the questionnaires were expressed in English, interviews were conducted in *Pidgin* or the local dialect. The village councillors or leaders who introduced enumerators to respondents were excused from attending the interviews in case their presence constrained respondents' answers.

3.4 Questionnaire and data capture

The questionnaire (Appendix A) elicited information on: household size, composition, education and occupations; total area cropped, area under coffee, expenditure on seasonal inputs, and investment in fixed improvements, farming equipment, livestock and household assets; use and sources of credit to finance inputs and investments; household

income and cash savings; access to information and opinions on farming constraints including the *wantok* system. Data recorded in the questionnaires were captured in spreadsheet format and analysed using the Statistical Package for Social Sciences (SPSS 17, 2009). Descriptive statistics were computed at ward level. These are presented in Chapter 4. Multivariate analysis of factors constraining investment in coffee farming was conducted on the pooled data using Logistic regression. This model and its estimated parameters are presented in Chapter 5.

3.5 Ethical issues

No application was made to Lincoln University for ethics clearance because (a) the questions related primarily to the respondent's farming decisions and (b) the researcher and enumerators came from the study area so there was little risk of cultural or moral offence. Respondents were informed that participation was voluntary, confidential and anonymous. Family names were not recorded on the questionnaires and the interviews were not recorded. Respondents were also informed that they were not required to answer all questions and could withdraw information at any time (Snook, 2003, pp.73-83).

Chapter 4

Descriptive Statistics

This chapter presents sample statistics describing household demographics, farm and farmer characteristics, expenditure on seasonal farm inputs, ownership of assets, use and sources of credit to finance inputs and assets, and access to agricultural extension and information.

4.1 Household demographics

Table 4.1 summarises information relating to household demographics. On average, sample households had approximately 3.5 members, of whom roughly 40 per cent were children. Dependency ratios (calculated as the number of children/number of working adults in the household) were less unity in both wards. On average, sample households in Korepa had lived in the ward for 34 years, and those in Yamayo for almost 40 years.

Table 4.1: Household demographics

Variables	Yamayo (n=75)	Korepa (n=75)	t-value
Household size (members)	3.57	3.40	0.53
Dependency ratio (children/adult workers)	0.68	0.70	0.15
Time household had resided in the ward (years)	38.51	34.41	2.08**
Proportion of <i>de facto</i> heads that are male (%)	99	100	-
Formal education of household head (years)	5.76	6.67	2.00**
Farm income in previous 12 months (Kina)	3330	2957	0.50
Non-farm income in previous 12 months (Kina)	2021	686	1.42 ⁺
Proportion household members too sick to work (%)	29	24	0.63

Notes: ⁺ and ** signify statistical significance at the 20% and 5% level of probability respectively

1 Kina = 0.35 US\$ in September 2009

Source: Survey data, 2009

Low levels of education may have contributed to the immobility of these rural households. Almost all household heads were males, and the average *de facto* household head had completed only six years of formal education.

Cash income from sales of coffee, other cash crops and livestock (goats, pigs and chickens) over the previous 12 months averaged approximately K3000 in both wards. However, mean income from non-farm activities differed between the wards (at the 16% level of probability) with sample households in Yamayo earning about three times more than those in Korepa. This difference reinforces personal observations that people in Yamayo were more heavily engaged in trading and processing activities, selling fruits and nuts, meals, craftwork and woven walls to travellers on the national highway. It would seem that diversion of household labour into non-farm activities was not impacting adversely on farm incomes – even though 25-30 per cent of household members were considered to be too sick to work.

4.2 Farm characteristics

The mean farm size of sample households was less than two hectares in both wards (Table 4.2). None of the Yamayo households, and only three per cent of Korepa households, cultivated all of their land. Despite this, eight per cent of the sample households in Korepa hired in additional cropland suggesting that some of these households owned land that they could not cultivate. Reasons given by respondents for not making full use of their land are summarised in Table 4.3.

Table 4.2: Area and utilisation of household cropland

Variables	Yamayo (n=75)	Korepa (n=75)	t-value
Cropland area (ha)	1.53	1.34	1.69*
Households that used all of their cropland (%)	0.00	3.00	1.42
Households that rent in additional land (%)	0.00	8.00	2.54**
Area hired in (ha)	-	(n=6) 0.42	-

Note: * and ** signify statistical significance at the 10% and 5% levels of probability respectively.

Source: Survey data, 2009

Table 4.3: Reasons for not cultivating all of the household's cropland

Variables	Yamayo (n=75)	Korepa (n=75)	t-value
Cash flow problems (%)	87	100	3.37***
Crops susceptible to damage by pigs (%)	87	97	2.44***
Labour shortage (%)	69	84	2.14**
Lack of ploughing service (%)	72	53	2.39***
Threat of land or tribal disputes (%)	5	23	3.14***
Threat of drought (%)	8	7	0.31
Susceptible to soil erosion (%)	8	5	0.65
Land too steep (%)	8	4	1.03
Land infertile (%)	8	4	1.03
High cost of inputs (%)	1	0	1.00

Note: ** and *** signify statistical significance at the 5% and 1% levels of probability respectively.

Source: Survey data, 2009

All of the sample households in Korepa, and 87 per cent of those in Yamayo, claimed that cash flow problems prevented them from cropping all of their land. The second most popular reason was the threat of damage to crops caused by free-ranging pigs. This was followed by seasonal labour shortages, lack of ploughing services and the threat of land or tribal disputes. Respondents in Korepa were generally more concerned about these problems than were respondents in Yamayo. Interestingly, only one respondent stated that inputs were too expensive. Apparently liquidity was the more binding constraint.

Table 4.4 shows that the vast majority (>90%) of the coffee growers sampled in Yamayo and Korepa grew other cash crops - mainly root crops and green vegetables - and raised pigs. Mean coffee sales over the previous 12 months fell short of K1000. Revenue earned from sales of all other crops averaged K1500 in Korepa and K1800 in Yamayo. However, these estimates were not statistically different. Revenue earned from selling pigs approximated earnings from coffee sales, but a significant number of sample households did not sell pigs. The average coffee grower tended to diversify into other crops and generated a per capita cash income of less than two US dollars per day from farming.

Table 4.4: Annual household income from farm enterprises in the 2008/9 season

Enterprise	Yamayo		Korepa		t-value
	Growers n=75 (%)	Income per seller (K)	Growers n=75 (%)	Income per seller (K)	
Coffee	100	n=75 804	100	n=74 924	1.04
Other crops	97	n=73 1837	97	n=72 1498	1.10
Pigs	92	n=54 874	93	n=43 907	0.43
Goats	21	n=7 450	1	n=0 -	-
Chickens	7	n=5 1000	1	n=1 4000	-

Source: Survey data, 2009

Table 4.5 indicates the incidence of sample households that bought particular seasonal farm inputs, and the proportion of these buyers that used credit to finance these inputs. Approximately 80 per cent of respondents in both Yamayo and Korepa bought coffee seed or seedlings. The average buyer spent K19 on non-hybrid coffee seed in Yamayo, and K48 in Korepa. Amounts spent by buyers of hybrid coffee seed were much larger but very few respondents (4%) purchased hybrid seed. Of the households that bought non-hybrid coffee

seed, nine per cent and 22 per cent used credit to finance these purchases in Yamayo and Korepa respectively.

Table 4.5: Expenditure on seasonal farm inputs and incidence of credit use in the 2008/9 season

Inputs	Yamayo			Korepa			t-value
	Buyers n=75 (%)	Spend per buyer (K)	Buyers using credit (%)	Buyers n=75 (%)	Spend per buyer (K)	Buyers using credit (%)	
Seed for coffee	77	n=58 19	9	80	n=59 48	22	2.25**
Hybrid seed for coffee	4	n=3 200	0	3	n=2 125	0	0.83
Fertiliser for coffee	1	n=1 50	0	0	n=0 -	0	-
Chemicals for coffee	93	n=70 100	3	92	n=70 87	0	1.59 ⁺
Seed for other crops	96	n=72 99	6	80	n=59 93	29	0.38
Fertiliser for other crops	96	n=72 69	3	63	n=47 89	4	1.22
Chemicals for other crops	97	n=73 46	3	68	n=51 66	0	2.36**
Farm labour	71	n=52 130	17	36	n=27 156	37	0.34
Equipment hire	19	n=14 1	29	44	n=32 37	56	5.30***
Transport	44	n=32 481	3	74	n=54 108	0	1.21
Feed for livestock	7	n=5 224	0	7	n=4 105	0	1.16
Veterinary medicines	1	n=1 20	0	9	n=7 29	0	-
Other seasonal inputs	52	n=39 342	15	45	n=34 158	50	0.91

Note: ⁺, ** and *** signify statistical significance at the 20%, 5% and 1% levels of probability respectively.

Source: Survey data, 2009

Respondents did not purchase fertiliser for coffee but the vast majority (>90%) did purchase chemicals (weedicide and pesticide) to maintain their coffee crop. Despite the

relatively high expenditure on chemicals (in excess of K80 in both wards) almost none of these purchases were financed with credit. This hints at the sources of credit available to small coffee farmers in PNG as non-hybrid seed is usually purchased from neighbours whereas chemicals are purchased from formal outlets. Sources of credit used are presented in Table 4.7.

In Yamayo, the proportion of respondents that purchased seed, fertiliser and chemicals for non-coffee crops was as high, if not higher, than the proportion of respondents that purchased these inputs for coffee production. In both wards, buyers spent considerably less on these inputs to grow coffee than to grow other crops. In Korepa, where respondents complained about seasonal labour shortages, relatively few (36%) were able to hire labour. In Yamayo, where respondents complained about poor access to ploughing services, relatively few (19%) were able to hire equipment. Although the incidence of using credit to finance seed, farm labour and equipment was relatively high - particularly in Korepa - the incidence of using credit to purchase inputs from formal sources (hybrid seed, fertiliser, chemicals and transport) was close to zero. Again, this suggests that while a significant number of households transacted seed, labour and equipment with other households on credit, they did not get cash loans (formally or informally) or credit from traders to finance other inputs.

Table 4.6 indicates the incidence of sample households that owned relevant farm and household assets, and the proportion of these owners that used credit to finance these assets. These data highlight some important points. First, while the vast majority of respondents owned inexpensive items like coffee bags and canvas tarpaulins (on which processed coffee beans are spread for sun drying) the incidence of asset ownership dropped

sharply as the cost of assets increased. In Korepa, less than half the respondents (all of them coffee growers) owned a coffee pulper, 28 per cent a knapsack sprayer and only 12 per cent a wheelbarrow. Even though households in Yamayo had access to reticulated electricity, fewer than five per cent of respondents owned a television (TV) or refrigerator. This hints at severe liquidity problems.

Table 4.6: Asset ownership and incidence of credit use

Asset	Yamayo		Korepa		t-value
	Buyers n=75 (%)	Buyers using credit (%)	Buyers n=75 (%)	Buyers using credit (%)	
Coffee bags	96	n=72 10	100	n=75 3	1.76*
Canvas tarpaulin	96	n=72 8	96	n=70 1	-
Fence	79	n=61 5	92	n=69 1	2.33**
Pruning saw	67	n=50 2	79	n=59 2	1.65*
Pruning secateurs	59	n=44 2	81	n=61 2	3.11***
Coffee pulper	63	n=45 9	49	n=39 5	1.65*
Knapsack sprayer	68	n=51 4	28	n=24 13	5.32***
Wheelbarrow	20	n=15 7	12	n=11 18	1.34 ⁺
Television (TV)	5	n=4 0	4	n=3 0	0.39
Refrigerator	4	n=3 0	0	-	1.76*
Vehicle	1	n=1 100	1	n=1 0	-

Note: ⁺, *, ** and *** signify statistical significance at the 20%, 10%, 5% and 1% levels of probability respectively.

Source: Survey data, 2009

Second, very few asset owners used credit to finance assets, including assets that typically have some collateral value. This is consistent with the earlier finding that very few coffee

growers in Yamayo and Korepa used credit to finance seasonal inputs purchased from formal suppliers. Even where the incidence of credit use was relatively high (e.g. 13% for knapsack sprayers and 18% for wheelbarrows in Korepa) the corresponding incidence of asset ownership was very low, implying that less than five per cent of the sample households had used credit to finance these assets. No TVs or refrigerators were financed with credit. Only one respondent in each ward owned a vehicle, and one of these vehicles was not credit financed. During the survey, many respondents complained that they could not finance a coffee pulper and had to sell their crop as unprocessed coffee cherries (wet beans).

Table 4.7 shows the sources of credit used to finance seasonal farm inputs and movable assets. None of the borrowers in Korepa, and only eight per cent of those in Yamayo, used formal credit to finance seasonal farm inputs.

Table 4.7: Sources of credit used for seasonal farm inputs and term assets

Credit source	Yamayo	Korepa
Credit used to finance seasonal farm inputs:	n=13	n=20
Friend (%)	92	100
Bank (%)	8	0
Credit used to finance term assets:	n=8	n=4
Friend (%)	87.5	75.0
Bank (%)	12.5	0
NGO/Donor (%)	0	25.0

Source: Survey data, 2009

In the case of movable assets, formal borrowing accounted for one of eight credit transactions in Yamayo and one of four credit transactions in Korepa. One respondent in

Yamayo had secured a loan from a commercial bank to finance a car, fencing materials and transport costs, and one respondent in Korepa had secured a loan from an NGO to finance a wheelbarrow, knapsack sprayer, canvas tarpaulin and fencing materials. Farmers in both wards complained about their lack of access to banks, financial institutions and government credit schemes.

Figure 4.1 illustrates respondents' perceptions of their access to sources of formal credit. This contrasts with Figure 4.3 which illustrates respondents' perceptions of their access to sources of informal credit. Despite the presence of formal lenders in or near the study area, the vast majority (92-99%) of respondents claimed that they were unlikely to secure credit from any of these sources - including publicly funded credit schemes administered by organisations such as the CIC, CCGS, SSSPP and NADP for the benefit of small farmers.

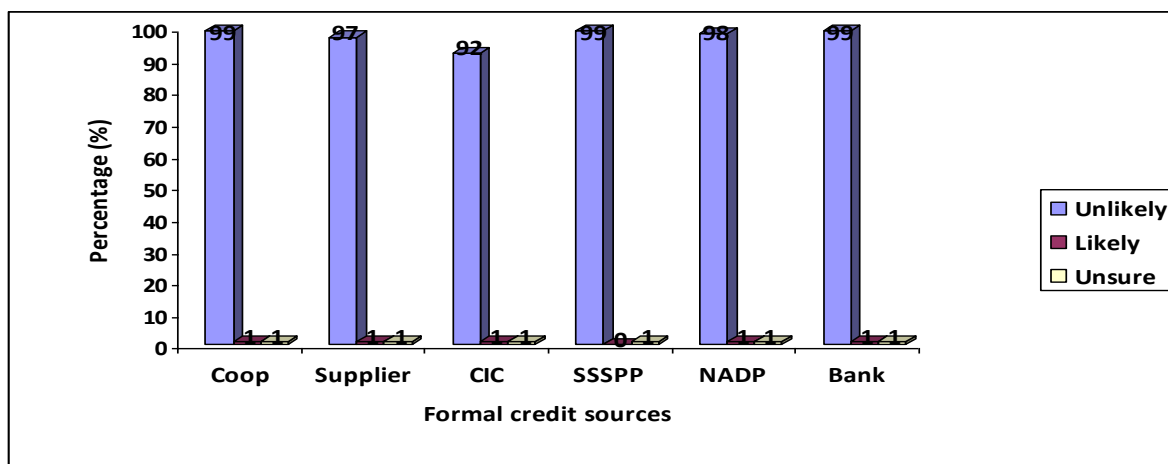


Figure 4.1 Perceived access to sources of formal credit (n=150)

Source: Survey data, 2009

Only 14 per cent of the respondents felt that that they did not need to borrow from formal lenders to finance their farming enterprises as they had sufficient savings (Figure 4.2). A substantial share (44%) felt that formal borrowing was too risky, and 13 per cent thought it was too expensive. Twelve per cent did not know where or how to apply. This information suggests some scope for PNG's formal lenders to adopt lending technologies employed by

successful development finance institutions (DFIs) and micro-financiers in other developing countries (Meyer & Nagarajan, 2000, pp.26-33)

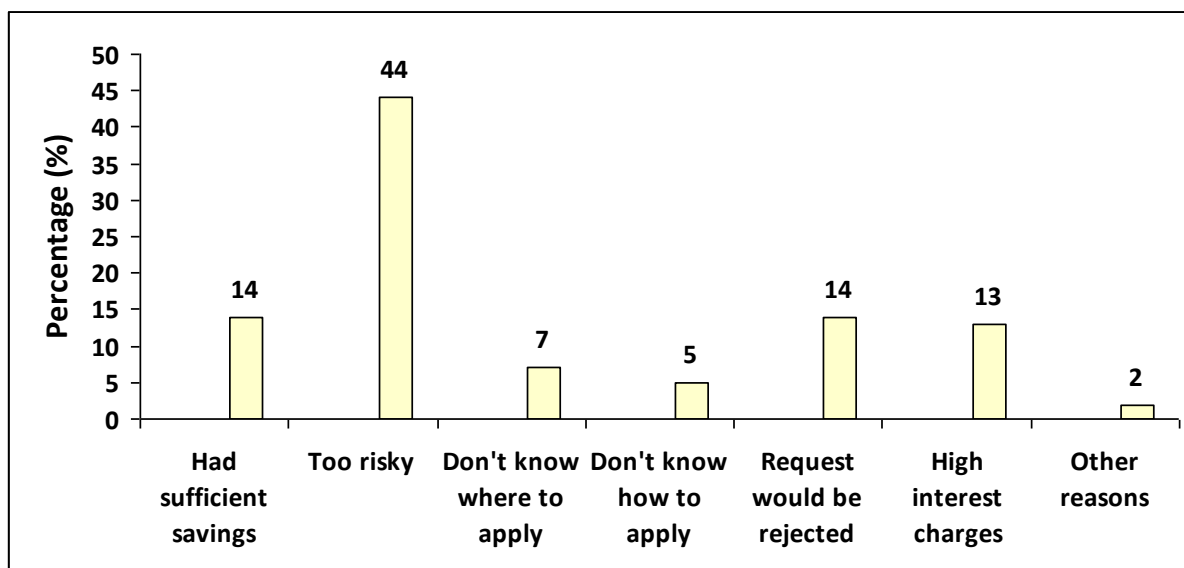


Figure 4.2 Reasons for not using formal credit (n=150)

Source: Survey data, 2009

Figure 4.3 shows that all 150 respondents perceived that they could purchase inputs on credit when transacting with sellers who knew them (friends) and sixty per cent believed that they would be able to borrow from a local lender – excluding rotating savings and credit associations (ROSCAs) - if they did not have enough cash to meet farm expenses. This suggests a weak history of collective savings institutions in the study area. More importantly, respondents' contrasting perceptions about access to informal and formal agricultural credit reinforce the view that formal lenders in PNG have not succeeded in addressing problems arising from asymmetric information. Confronted with inadequate information about small farmers, and high costs of monitoring and enforcing small loans in rural areas, formal lenders appear to have introduced lending criteria, loan terms and procedures that the typical coffee grower cannot meet. If liquidity is more limiting than other factors constraining small coffee growers (see Chapter 5), then policy and lending practices that reduce transaction costs, including risks, in formal lending become important

because informal lenders clearly do not have the resources needed to finance term assets and inputs traded in the formal sector.

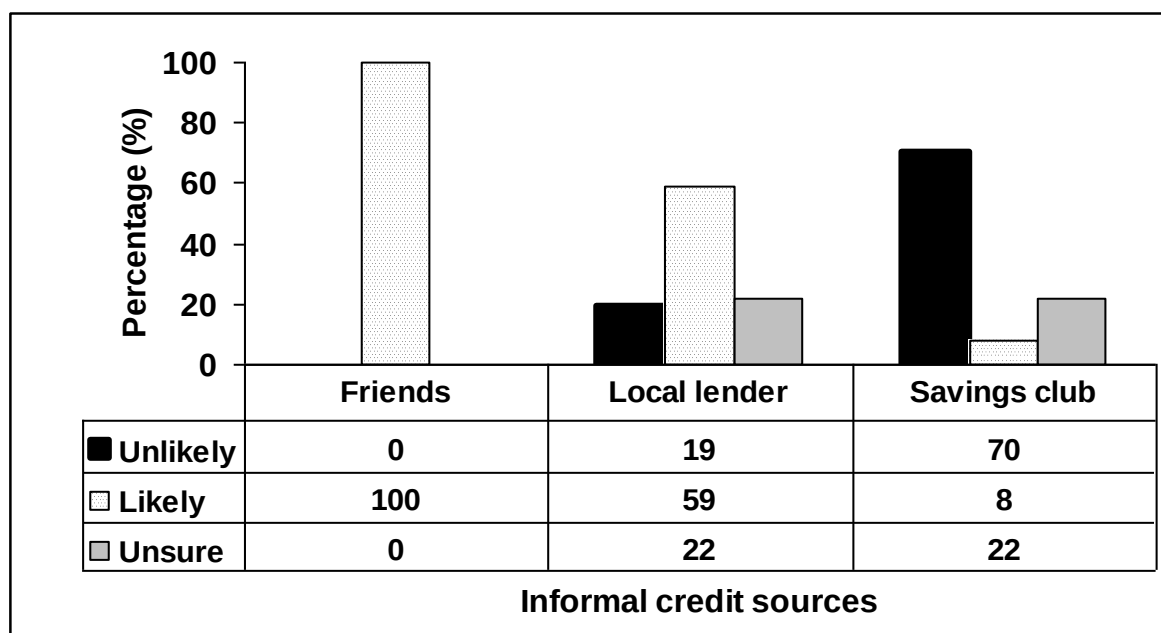


Figure 4.3: Perceived access to sources of informal credit (n=150)

Source: Survey data, 2009

Only two per cent of the respondents identified a bank account as their preferred mode of savings. One-half indicated a preference for investments in livestock and other assets that could be easily liquidated, and 42 per cent stated that they would rather keep cash at home. The latter finding suggests that it is difficult for respondents to deposit savings at a bank as Table 4.8 shows that almost a quarter of the sample households did own bank accounts (17% in Yamayo and 30% in Korepa). Sample households saved with two of the three banks that serve the Eastern Highlands Province, the Bank of the South Pacific (BSP) and the Australia and New Zealand (ANZ) banking group. In Yamayo, households with bank accounts were distributed almost equally between BSP (9%) and ANZ (8%). A similar proportion of Korepa households banked with ANZ (9%) but a much higher proportion banked with BSP (21%). A plausible explanation for this marked difference is that Korepa had previously been targeted for development projects that helped households to open bank accounts with the state-owned PNG Banking Corporation before it was sold to BSP.

Table 4.8: Household savings in banks

Variables	Yamayo (n=75)	Korepa (n=75)	t-value
Households with accounts at BSP (%)	9	21	2.05**
Households with accounts at ANZ (%)	8	9	0.29
Mean savings at BSP (Kina)	n=7 1529	n=16 1072	1.39
Mean savings at ANZ (Kina)	n=6 2267	n=7 1214	0.64

Note: ** signifies statistical significance at the 5% level of probability.

Source: Survey data, 2009

Table 4.9 presents the average time taken by sample households to reach coffee buyers and communication and health services. Mean times taken to access communication services differ between the study wards with more time required in Yamayo, despite its relative proximity to the national highway.

Table 4.9: Transaction cost indicators

Variables	Yamayo (n=75)	Korepa (n=75)	t-value
Mean time taken to sell coffee (hours)	2.88	2.98	0.52
Mean time taken to reach postal services (hours)	2.68	2.43	1.89*
Mean time taken to reach bus services (hours)	0.80	0.61	3.13***
Mean time taken to reach telephone (hours)	2.68	2.34	2.58***
Mean time taken to reach urban hospital (hours)	2.79	2.69	0.80

Notes: * and *** signify statistical significance at the 10% and 1% levels of probability respectively.

Source: Survey data, 2009

It takes between two and three hours for respondents in either ward to access a coffee buyer, telephone or postal service. Considering that both Yamayo and Korepa are located close to Goroka, it is evident that poor feeder roads and transport services impose considerable transaction costs on rural households in PNG.

Figure 4.4 summarises respondents' perceptions of changes in their coffee production over the past five years. More than 90 per cent of sample households in both wards reported that their coffee production had declined.

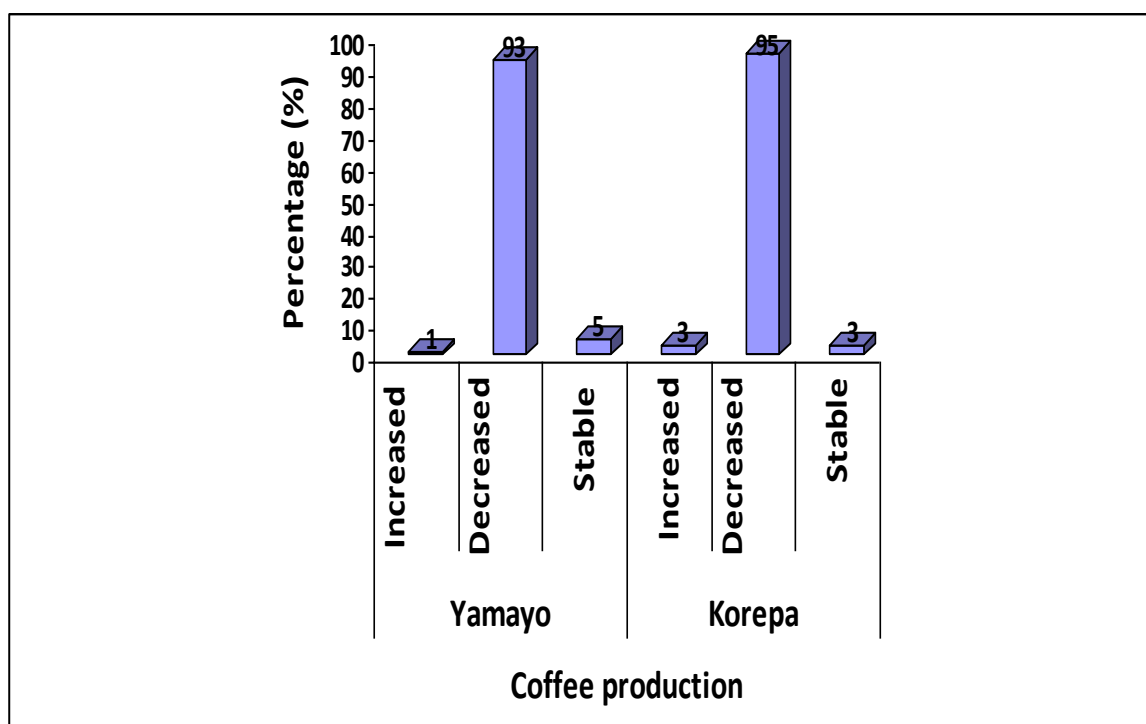


Figure 4.4: Perceived changes in coffee production over the past five years (n=150)

Source: Survey data, 2009

Table 4.10 lists respondents' reasons for declining coffee production. Although the incidence of these reasons differs between Yamayo and Korepa, the most prevalent problem in both wards is that seasonal inputs and labour have become less affordable to farmers. Some respondents attributed this to insufficient cash flow and others to declining profitability. Pest, disease and soil fertility problems also reflect inadequate applications of seasonal inputs. It is interesting that theft and deficiencies in the CIC's extension, information and training services were mentioned much more frequently than were weather-related problems and land shortages.

Table 4.10: Perceived causes of declining coffee production

Problems	Yamayo (n=75)	Korepa (n=75)	t-value
Shortage of labour and management time (%)	76	90	2.44**
Cannot afford inputs (%)	72	92	3.28***
Pests and diseases (%)	64	36	3.55***
Theft of coffee cherries (%)	28	39	1.39
Lack of information about coffee farming (%)	31	32	0.18
Poor soil condition (%)	36	23	1.80*
Poor farm management (%)	19	23	0.60
Unpredictable weather (%)	3	16	2.86***

Note: *, ** and *** signify statistical significance at the 10%, 5% and 1% levels of probability respectively.
Source: Survey data, 2009

Cash flow and profitability problems were compounded by the *wantok* system which imposes an informal tax on household income. When asked what share of an additional K1000 they would ‘donate’ to kin, the mean ‘donation’ amounted to K180 ($\pm$ K7.40), implying an informal marginal tax rate of 18 per cent on revenue earned from farming.

Table 4.11 summarises information about contact with extension staff and participation in training courses. Almost 50 per cent of respondents in Yamayo, and 60 per cent in Korepa, could not name the local extension officer. Nevertheless, those that did had been visited frequently, especially in Korepa where the extension officer had averaged more than four visits over the previous two months. Respondents that had not been visited attributed this to weak infrastructure and resource constraints that prevented government officers from reaching households. In Yamayo, two-thirds of the respondents were aware of training courses offered in coffee production. Although the vast majority of respondents felt that they could get (general) farming information, the findings presented in Table 4.10 suggest that about one third of respondents in both wards lacked (specialist) information about

coffee production. This could reflect concerns about the quality of information provided by CIC, the organisation mandated and funded by the government to provide technical extension and advisory services to small coffee growers.

Table 4.11: Farming information, extension and training

Variables	Yamayo (n=75)	Korepa (n=75)	t-value
Extension worker known by name (%)	52	41	1.31 ⁺
Visits by extension worker over past two months	n=39 2.1	n=31 4.5	4.49***
Aware of coffee training course offered by CIC (%)	68	44	3.03***
Aware of coffee training course by SSSPP (%)	67	31	4.70***
Aware of any training course offered by SSSPP (%)	55	25	3.82***
Aware of any training course offered by FPDA (%)	67	44	2.85***
Able to get farming information when needed (%)	96	99	1.01
Households that belong to a farmers' cooperative (%)	1	3	0.58

Note: ⁺, ** and *** signify statistical significance at the 20%, 5% and 1% levels of probability respectively.
Source: Survey data, 2009

Figure 4.5 shows that some 20 per cent of the coffee farmers sampled in this study did not list CIC as their preferred source of information. Very few sample households (<3%) belonged to a farmer's cooperative.

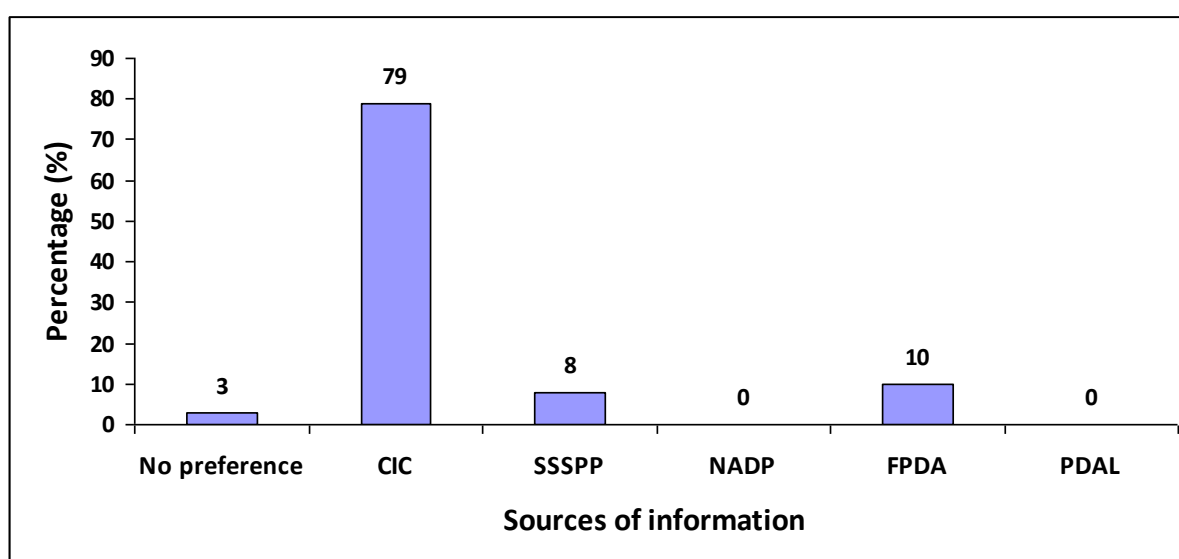


Figure 4.5 Preferred information sources (n=150)

Source: Survey data, 2009

In summary, this chapter highlights a number of constraints facing small coffee farmers in the study area. They are poorly educated, sacrifice a great deal of time to access markets and services, experience cash flow problems and cannot access credit to finance inputs and assets sold in formal markets owing to stringent lending criteria, inflexible loan terms and complex application procedures. In addition, they suffer crop losses due to theft, land disputes and damage caused by stray livestock. The *wantok* system imposes a substantial tax on their earnings and many growers cannot get quality information from public extension services. However, univariate statistics can be misleading as they often mask the effects of other variables. A multivariate analysis is required to identify the relative importance of each constraint when the effects of other constraints are accounted for and held constant. Chapter 5 reports the results of a logistic regression analysis used for this purpose.

Chapter 5

Factors Influencing Small Farmer Investment in Coffee Production

This chapter presents a logit analysis of factors constraining respondents' investment in seasonal inputs applied to coffee production. The object of this empirical analysis is to test the hypothesis that coffee production on small farms in the study area was constrained by cash flow problems, and that this is an important constraint relative to other problems like high transaction costs in product and input markets, inadequate land and family labour, informal income tax (*wantok*), low levels of education, poor extension services and tenure insecurity. The survey data used in this logit analysis are presented in Appendix C.

5.1 A logit model of factors influencing coffee production

The dependent variable of the logit model estimated in this study distinguished between sample farmers who invested less than K100 in seed, fertiliser and chemicals used to produce coffee over the previous 12 months from those who invested more than K100 in these inputs. The dependent variable was based on investment rather than yield or revenue as it is a better measure of the farmer's intention to produce and is much less sensitive to changes in climatic conditions and product prices. The K100 cut point was identified by studying the distribution of investments made in non-labour seasonal inputs. Figure 5.1 shows that the frequency distribution was positively skewed. The cut point was therefore taken close to median level of investment (K100) rather than at the mean level of investment (K120). The (dichotomous) dependent variable scored one if investment was equal to or greater than K100, and zero if investment was less than K100. This split the

sample into a ‘high’ investor group of 89 respondents with a mean investment of K165, and a ‘low’ investor group of 61 respondents with a mean investment of K53.

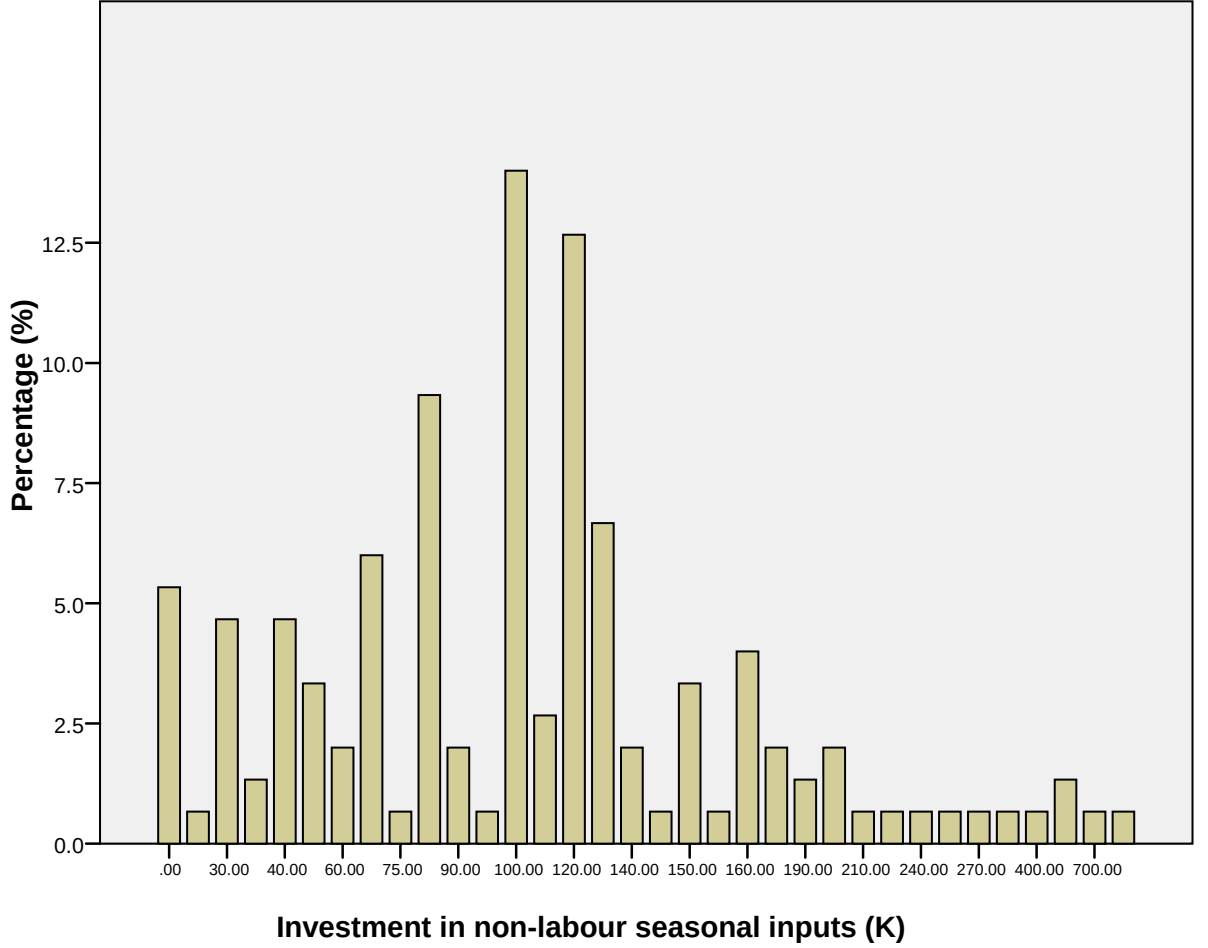


Figure 5.1: Distribution of investments in seasonal farm inputs
(Source: Survey data, 2009)

The following general multiple regression model could be estimated using Ordinary Least Squares (OLS):

$$F_i = \sum_{n=1}^k \beta_n X_{ni} + u_i$$

Where F_i is a dichotomous variable taking the value of one if the household was classified as a high investor and zero if classified as a low investor. X_{ni} is a vector of k attributes for

the i th household and u_i , the disturbance term, has a mean of zero. This represents the linear probability model (LPM), since the conditional expectation of Y_i given X_{ni} , or $E(Y_i | X_{ni})$, can be interpreted as the probability that the event will occur given X_{ni} (Gujarati, 2003, pp.584- 586).

However, the LPM faces certain problems. First, the disturbances u_i do not satisfy the OLS assumptions of normality or homoscedasticity (Gujarati, 2003, pp.584- 586). Second, there is no guarantee that the predicted $E(Y_i | X_{ni})$ will necessarily lie between the logical limits of zero and one. Third, the model is linear and therefore assumes that the marginal effect of X_i remains constant over the probabilities (Maddala, 1983, pp.15-16).

A more plausible model would predict probabilities ranging from zero to one, and would allow them to vary nonlinearly with X (Aldrich and Nelson, 1984, p.26). Geometrically, this describes the curve of the cumulative distribution function (CDF) of a random variable. Historically, and practically, the CDFs chosen to represent dichotomous response models are the logistic (resulting in the logit model) and the normal (resulting in the probit model). There is no compelling reason to choose one of these models over the other. In practice the logit model is often used because of its comparative mathematical simplicity (Gujarati, pp.2003: 614).

The logistic distribution function is represented as:

$$P_i = E(Y_i = 1 | X_{ni}) = 1/(1+e^{-Z_i}) \quad (5.1)$$

where
$$Z_i = \sum_{n=1}^k \beta_n X_{ni}$$

and P_i is the probability that the i th case belongs to group 1 conditional on the X_i , and e is the base number of the natural logarithm.

As Z_i ranges from $-\infty$ to $+\infty$, so P_i ranges from zero to one and is nonlinearly related to the independent variables (X_{ni}). From equation 5.1, the natural log of the odds in favour of being classified as a member of group 1 can be expressed as follows:

$$L_i = \ln(P_i/1-P_i) = Z_i = \sum_{n=1}^k \beta_n X_{ni} \quad (5.2)$$

L_i is called the logit, and equation 5.2 describes the generalised logit model (Gujarati, pp.2003: 597). The independent explanatory variables on the right hand side of the equation (and their expected signs) included in this study are defined in Table 5.1.

The first three variables in Table 5.1 were included in the logit model as control variables, and not as policy variables. It was anticipated that ‘Ward’ would impact negatively on investment in seasonal farm inputs used in coffee production because Yamayo (which scored zero on this dummy variable) was at lower altitude than Korepa and therefore more likely to achieve higher yields. ‘Coffee Land’ controlled for differences in the area of land cultivated to coffee by respondents. Those farming larger areas were expected to invest more in seasonal inputs. ‘Coffee land share’ measures the degree of specialisation in coffee. Increasing specialisation was expected to have a positive impact on investment in seasonal coffee inputs owing to the household’s greater reliance on income from this source.

Table 5.1: Explanatory variables considered in the logit model

Explanatory variable	Expected sign	Description of variable
Ward	-	Dummy scoring 0 for Yamayo and 1 for Korepa
Coffee land	+	Area planted to coffee (hectares)
Coffee land share	+	Coffee land/Total area cropped
Liquidity	+	Sum of cash (Kina) earned from farm and non-farm enterprises + wage income + formal savings + value of pigs and goats
Transaction cost	-	Sum of hours required to access Telephone + Post office + Bus + Town + Coffee buyer
Family farm labour	+	A ratio indicating the amount of family farm labour per capita computed as [No. of farmers in the household + 0.5(Housekeepers + Scholars + Pensioners) – Sick members] ^{1.1} /Household members
Wantok tax	-	Kina that would be paid to kin if farm income increased by K1000
Extension	+	Number of visits by an extension officer over the previous two months
Education	+	Years of formal schooling completed by the household head
Security	+	A dummy variable scoring 0 if the household attributed declining coffee production or failure to cultivate land to crop losses resulting from theft, land disputes or damage caused by stray livestock

‘Liquidity’, the first of seven policy variables included in the logit model, was measured as the sum of formal savings, wage income, cash revenue from farm and non-farm enterprises, and the market value of pigs and goats. Unused credit is also a source of liquidity but was excluded from the measure used in this study because virtually none of the respondents had access to formal credit and loans made by informal lenders were small

in size. As noted in section 2.1.5, access to formal credit is important because large financiers are less prone to covariant and systemic risk than are small, informal lenders. Formal lenders can diversify their lending portfolios and offer more services - including the large and longer-term loans that farmers need to finance moveable assets and fixed improvements. An increase in liquidity makes it easier for households to finance farm inputs. Liquidity was therefore expected to impact positively on investment in coffee production.

Transaction costs were approximated by summing the time required by a household member to access the nearest telephone, post office, bus, town and coffee buyer. The proxy variable, 'Transaction cost' ranged from 3.5 to 24.5 hours and was symmetrically distributed with a mean and median of 11.5 hours. The literature reviewed in section 2.1.5 shows that many researchers view high transaction costs as a fundamental constraint to rural development in PNG. An increase in Transaction cost was therefore expected to impact negatively on investment in coffee production.

'Family farm labour' was expressed as a ratio of household labour equivalents available for farm work relative to household size. Family farm labour equivalents were computed as the number of farmers in the household, less sick members, plus half the sum of housekeepers, school children and pensioners. The household's stock of family farm labour equivalents was then raised to the power 1.1 to account for 'complex cooperation'. Complex cooperation refers to the increasing efficiency of workers in farm production as more family labour becomes available (Fenwick, 1998, pp.36-37). The denominator of the family farm labour ratio, household size, accounts for work time lost caring for dependents. Thus, if two families have the same per capita farm labour equivalents, the

ratio used to measure family farm labour in this study will be higher for the larger of the two families owing to the effect of complex cooperation. This variable is of policy interest because the stock of family farm labour would increase if health care services were improved (section 2.1.6). An increase in Family farm labour relaxes the household's labour constraint and was therefore expected to impact positively on investment in coffee production.

'*Wantok* tax' is the value of cash or goods that respondents claimed they would pay to kin (*wantoks*) if their farm income increased by K1000. The literature reviewed in section 2.1.8 highlighted the pervasiveness of this informal income tax in PNG. Apart from creating disincentives for investment, *wantok* tax also reduces the ability of farmers to invest. This variable is of policy importance because improvements in social protection programmes are expected to diminish the need for informal taxes, and hence the rate at which *wantok* tax is applied. An increase in *Wantok* tax is therefore expected to reduce levels of investment in seasonal inputs.

'Extension' was measured as the number of visits that respondents received from extension officers over the two months preceding the survey. It was expected that Extension would encourage farmers to adopt yield-increasing technology and therefore impact positively on investment in seasonal inputs. However, the literature reviewed in section 2.1.7 questioned the quality of PNG's under-funded and poorly managed extension services.

'Education' was measured as the number of formal school years completed by the household head as the main decision-maker in cash farming enterprises. It is generally accepted that educated farmers allocate inputs more efficiently than uneducated farmers.

This suggests a positive relationship between education and yield for any given level of investment in inputs. However, the relationship between education and investment is less obvious. Welch (1978) argues that education reduces the cost of assembling and interpreting information, and therefore promotes investment in yield-increasing technologies like fertiliser and fertiliser-responsive hybrid seed. Bizoza, *et al.* (2007) anticipated a positive relationship between education and investment in seasonal inputs used by small potato growers in Rwanda. The coefficient estimated for education in their regression model was positive but not statistically significant. They attributed this to very small farm sizes because the productivity of education falls as farm size diminishes (Welch, 1978). Respondents in this study did not rank small farm size as an important problem. It was therefore expected that Education would impact positively on their level of investment in coffee production.

‘Security’ is a dummy variable scoring one if the household did not suffer crop losses from theft, land disputes or damage caused by neighbours’ livestock, zero if it did. As such, this variable provided a rough measure of land tenure security. The literature reviewed in sections 2.1.2 and 2.1.3 suggests that small farmers in PNG are constrained by high levels of physical and tenure insecurity. Households that suffered crop losses from theft, land disputes or livestock damage were therefore expected to discount investments in farming more heavily than those who did not suffer from one or more of these sources of tenure insecurity. It follows that Security was expected to impact positively on investment in seasonal coffee inputs.

5.2 Results of the logit model

Table 5.2 presents the mean value of each explanatory variable computed for low and high investors. Univariate t-tests provide some support for the expected causal relationships. As expected, high investors tended to be located in the more productive Yamayo ward, farmed larger areas of coffee and were more specialised in coffee production. On average, low investors faced higher transaction costs and had less liquidity, education and security than did high investors. Significant differences were not detected for the other policy variables, namely, Extension, *Wantok* tax and Family farm labour. However, univariate tests are not a reliable indicator of the contribution made by each explanatory variable to group membership as they do not account for the effects of other independent variables. For this reason, all of the explanatory variables were included in the logit model.

Table 5.2: Mean values of variables used to explain differences between low and high coffee investors

Explanatory variable	Low investors n=61	High Investors n=89	t-value
Ward (Yamayo=0, Korepa=1)	0.67	0.38	3.64***
Coffee land (Ha)	0.37	0.70	7.53***
Coffee land share (%)	37.17	41.93	2.19**
Liquidity (Kina)	4987.05	7762.78	2.32**
Transaction cost (hours)	12.71	10.57	4.51***
Family farm labour (per capita)	0.76	0.80	0.77
<i>Wantok</i> tax (Kina)	189.34	174.72	0.99
Extension (visits)	1.69	1.30	1.06
Education (years)	5.64	6.61	2.08**
Security (Insecure=0, Secure=1)	0.02	0.08	1.88*

Note: *, ** and *** signify statistical significance at the 10%, 5% and 1% levels of probability respectively.

Table 5.3 presents a matrix of bivariate correlation coefficients that were computed to check for signs of multicollinearity in the explanatory variables as the logit model assumes that these variables are independent. The correlation coefficients were all well below $|0.5|$ with the exception of the coefficient computed for correlation between coffee land and coffee land share ($r=0.51$). Since neither of these two variables was of policy interest, it was not anticipated that multicollinearity would pose a problem when interpreting the parameters of the estimated logit model.

Table 5.3: Bivariate correlation coefficients computed for the explanatory variables

Explanatory variable	Ward	Coffee land	Coffee land share	Liquidity	Transaction cost	Family farm labour	Wantok tax	Extension	Education
Coffee land	-.073								
Coffee land share	-.008	.510							
Liquidity	-.124	.216	-.072						
Transaction cost	-.142	-.351	-.065	-.244					
Family farm labour	-.041	-.079	.010	-.154	.015				
Wantok tax	-.094	-.073	-.107	.286	.105	-.111			
Extension	.167	-.091	-.138	.185	-.034	-.056	.373		
Education	.163	.170	.092	-.081	-.195	.027	-.066	-.006	
Security	-.118	.145	.123	-.006	-.029	-.061	-.129	-.115	-.008

The logit model was estimated using the maximum likelihood technique (SPSS 17, 2009) and standardised values of the explanatory variables. The results are presented in Table 5.4. The omnibus chi-square tests if the model with the explanatory variables is significantly different from the model with only the intercept. Statistical significance indicates that there is adequate fit of the data to the model. The Hosmer and Lemeshow chi-square provides a more robust test of goodness of fit than does the omnibus chi-square test. In this case, non-significance indicates that model prediction is not significantly

different from observed values (Garson, 2009). Both chi-square statistics reported in Table 5.4 indicate that the estimated model is statistically significant. Nagelkerke's R^2 , like the OLS R^2 , ranges from zero to one but measures the strength of association rather than goodness of fit and is generally lower than the corresponding OLS R^2 (Garson, 2009). The model's ability to classify cases provides a more intuitive test of its predictive power. Table 5.4 shows that the estimated model classified 80 per cent of the low investors correctly and 85 per cent of the high investors correctly. The overall correct classification rate (83%) exceeded the 'proportional by chance' rate of correct classification (52%) by a margin of 60 per cent. Both Nagelkerke's R^2 and the more intuitive test of correct classification indicate that the estimated model has good predictive power.

Table 5.4: Estimated parameters of the logit model

Explanatory variable	Standardised		Wald statistic
	β	$\text{Exp}(\beta)$	
Constant	1.337	3.806	14.06***
Ward	-1.111	0.329	14.34***
Coffee land	1.402	4.063	6.98***
Coffee land share	0.020	1.021	0.01
Liquidity	2.276	9.737	7.14***
Transaction cost	-1.221	0.295	11.71***
Family farm labour	0.537	1.710	4.59**
Wantok tax	-0.484	0.616	2.77*
Extension	-0.184	0.832	0.56
Education	0.347	1.415	2.04 ⁺
Security	0.264	1.302	0.74
Omnibus model chi-square	85.01***		
Hosmer and Lemeshow chi-square	11.76		
Nagelkerke R^2	0.59		
Classification rate	Low investors		High investors
Cases correctly classified (%)	80.0		85.4

Note: ⁺, *, ** and *** signify statistical significance at the 15%, 10%, 5% and 1% levels of probability respectively.

The Wald statistic tests the null hypothesis that an estimated logistic regression coefficient (β) is zero. Table 5.4 shows that of the seven policy variables, three (Liquidity, Transaction cost and Family farm labour) have β s statistically significant at the one or five per cent levels of probability, one (*Wantok* tax) has β significant at the ten per cent level of probability, and one (Education) has β significant at the 15 per cent level of probability. Variance Inflation Factors (VIFs) computed for the policy variables ranged from 1.1 to 1.3 suggesting that multicollinearity was not a problem in these variables. Coffee land and Coffee land share had VIF's of 1.8 and 1.5 respectively. This suggests no more than moderate collinearity between these two control variables (Gujarati, 2003: 362). $\text{Exp}(\beta)$, the exponent of β , measures the impact of a unit change in the corresponding X on the odds (i.e. $P/1-P$) of being a high investor. For example, if $\beta_3=0$ then $\text{Exp}(\beta_3)=1$ and a unit change in X_3 is predicted to increase the odds of being a high investor by a factor of 1, i.e. a unit change in X_3 has no impact on the odds of being a high investor. In this study, the extent to which each $\text{Exp}(\beta)$ differs from unity indicates the relative importance of the corresponding X because the X_i were standardised with a mean of zero and variance of unity. Accordingly, Liquidity is the most important of the significant policy variables, followed equally by Family farm labour and Transaction cost, and then by Education and *Wantok* tax.

5.3 Discussion of the logit results

While this discussion focuses on the seven policy variables included in the empirical logit model, it is worth noting that the signs of the logistic regression coefficients estimated for Ward and Coffee Land were consistent with *a priori* expectations. Increasing specialisation in coffee production appeared to have no significant impact on investment, but this result

may have been affected by moderate collinearity between Coffee land and Coffee land share.

The logit analysis identified cash-flow (liquidity) problems as the most important determinant of investment in seasonal coffee inputs in the study area. An increase of one standardised unit in household liquidity is predicted to raise the odds of being a high investor by a factor of almost 10, *ceteris paribus*. Respondents were unable to finance farm inputs purchased in formal markets (like fertiliser and hybrid seed) as they could not access formal credit. As noted in Chapter 2, respondents' access to formal loans appeared to be constrained by inadequate supply of development finance and stringent lending criteria stipulated by formal lenders. Both of these constraints are rooted in the problem of asymmetric information - government is reluctant to provide more development finance because adverse selection and moral hazard result in default rates that are unacceptably high, and commercial banks require farmers to pledge collateral (a substitute for information) to secure their loans.

An increase of one standardised unit in Farm family labour is predicted to raise the odds of being a high investor in seasonal coffee inputs by a factor of 1.71 (71%), *ceteris paribus*. Better health services that increase the per capita supply of family labour are therefore expected to enhance small-scale coffee production in the study area and in other parts of rural PNG where morbidity rates are very high (Nita, 2006:xiii; World Bank, 2004). An increase of one standardised unit in Transaction cost is predicted to lower the odds of being a high investor by almost 71 per cent (1-0.295), *ceteris paribus*. This evidence from the study area supports the argument that small-scale coffee production in PNG would benefit from investments in infrastructure that reduce transaction costs in product and input

markets. Better physical infrastructure will also make it easier for lenders to assess loan applications and to monitor clients in rural areas. Likewise, efforts to reduce transaction costs by improving the legal infrastructure would help to increase the collateral value of assets that small farmers can pledge as security for loans.

Education had a positive impact on investment in seasonal coffee inputs. An increase of one standardised unit in the farmer's level of formal schooling is predicted to raise the odds of being a high investor in seasonal coffee inputs by a factor of 1.4, *ceteris paribus*. This is consistent with the *a priori* view that education promotes investment in yield-increasing technologies like fertiliser and fertiliser-responsive hybrid seed, and that coffee production was not constrained by farm sizes in the study area. During the survey, farmers expressed regrets that they did not complete their schooling as commercial farming was knowledge intensive. It was also observed by the researcher that many children were not at school because households could not afford school fees.

Wantok tax is particularly interesting as no other studies appear to have measured the impact of informal income taxes on investment in PNG. Overfield (1991) reported that more than 90 per cent of the respondents in his Eastern Highlands study attributed poor coffee production to social and cultural obligations. In this study, the marginal *wantok* tax rate on farm income was estimated at 18 per cent and the logit analysis shows that this has a significant negative impact on investment in seasonal coffee inputs. An increase of one standardised unit in *Wantok* tax is predicted to lower the odds of being a high investor by 38 per cent (1-0.616), *ceteris paribus*. This situation is likely to persist while social protection programmes offered by the government are perceived to be inadequate. Shifting the *wantok* tax into cost effective public social protection programmes may not reduce the

tax burden on farmers, but it would reduce their exposure to covariant risk. Devereux (2001) notes that informal safety nets like the *wantok* system are concentrated among the poor themselves and are not robust in the face of covariant shocks like drought and floods.

The logistic regression coefficient estimated for Security was positive but not statistically significant. However, the low Wald statistic may only show that there was very little variation in the dummy variable used to measure security. The group means presented in Table 5.2 highlight the problem as 95 per cent of the respondents scored a zero on the dummy variable –primarily because problems caused by stray livestock were so pervasive in the study area. Consequently, it would be imprudent to conclude that investment in seasonal coffee inputs is not adversely affected by tenure (or physical) insecurity in PNG.

Contrary to expectations, the logistic regression coefficient estimated for Extension was not positive. Statistical insignificance points to an ineffective extension service. This finding is consistent with claims reported in section 2.1.7 that CIC officers were not delivering effective services to farmers. The next and final chapter of this thesis presents the main conclusions drawn from these findings and offers recommendations for decision-makers in government, the CIC and commercial banks in PNG.

Chapter 6

Summary, Conclusions and Policy Recommendations

This chapter provides a brief summary of the study (Section 6.1), its conclusions (Section 6.2) and policy recommendations (Section 6.3). The final section outlines limitations of the research and proposes potential areas for future research.

6.1 Summary

Papua New Guinea's coffee remains the second largest export crop and the key income generator for over 50 per cent of the nation's households. However, coffee production has been declining since 1998. This study did not seek to explain the decline in aggregate production over time. Instead, it examined the importance of liquidity (cash flow) problems relative to other constraints faced by small coffee farmers in the Eastern Highlands during the 2008/9 season. More than 90 percent of PNG's coffee is produced by small farmers in the Highlands provinces. The study was motivated by evidence of a severe shortage of formal agricultural credit. The purpose was to offer policy recommendations aimed at alleviating the most binding constraints. The main objective was therefore to identify and rank significant constraints to small-scale coffee producers in the Eastern Highlands.

To accomplish this objective, farm and household-level data were gathered in a multi-stage sample of 150 small coffee farmers located in two wards of the Daulo District in the Eastern Highlands Province using a structured questionnaire. Descriptive information provided a wealth of information about household demographics, farm earnings and

expenditure, sources of credit, access to markets and services, and perceived problems. Logit analysis was then used to identify and rank significant constraints to investment in seasonal inputs applied to coffee during the 2008/9 season.

The descriptive statistics highlighted a number of potential constraints faced by the respondents. They were poorly educated; it took them long time to access markets and services; they experienced cash flow problems and could not access credit to finance farm inputs and assets sold in the formal sector; they suffered crop losses due to theft, disputes and damage caused by stray livestock; the *wantok* system imposed a substantial informal tax on their earnings; coffee production had become less profitable and many growers did not get quality information from public extension services.

The virtual absence of formal credit was attributed to problems stemming from asymmetric information. Confronted with inadequate information about small farmers, and high costs of monitoring and enforcing small loans in rural areas, formal lenders appear to have introduced lending criteria, loan terms and procedures that the typical coffee grower cannot meet. If liquidity is a binding constraint, the information problem becomes critical as the data showed that informal lenders lacked the resources needed to finance assets and inputs traded in the formal sector. Logit analysis was used to identify the relative importance of each constraint when the effects of other constraints were accounted for and held constant.

Results from the logit analysis identified liquidity as the most important determinant of respondents' investment in coffee production, followed equally by family farm labour and transaction cost, and then by education and the informal (*wantok*) tax – after controlling for differences between wards and areas cropped to coffee. Agricultural extension and

tenure insecurity had no significant impact. However, the variable created to measure tenure security lacked variation as virtually all of the respondents suffered crop losses as a result of theft, land disputes or damage caused by stray livestock. The signs of the logistic regression coefficients estimated for the significant explanatory variables were consistent with *a priori* expectations.

6.2 Conclusions

Small coffee growers in the study area faced severe cash flow (liquidity) problems. The survey data suggest that the liquidity problem reflects poor access to formal credit, and that this, in turn, reflects a more fundamental problem of asymmetric information. The implication is that efforts by small farmers in the Eastern Highlands to produce marketable surpluses (of all crops) are constrained by the virtual absence of agricultural credit. This is not to suggest that the government should simply increase the supply of subsidised credit channelled through DFIs like the CCGS, but rather that it needs to address the information problems confronting all formal lenders (including banks and input suppliers) in rural PNG. The root causes of the information problem can be traced to poor physical and legal infrastructure that raise the costs of gathering information about prospective borrowers, monitoring clients and enforcing contracts.

High transaction costs also affect access to product, input and service markets required by small farmers. This study found that it took small coffee farmers several hours to access the nearest telephone, post office, bus, town or coffee buyer. Improvements to the rural infrastructure, especially roads, telecommunication and transport, are essential if subsistence farmers are to become small commercial farmers. Apart from improving access

to markets and freeing up labour, public investments that reduce transaction costs will make asset markets more efficient, providing formal lenders with new sources of collateral for loans.

The probability of being a high investor in coffee production increased with the amount of labour that households could provide and with the farmer's level of education. When viewed against high levels of morbidity and low levels of education observed in rural PNG, it can be anticipated that production on small farms would increase with improvements in rural health services and education. However, observations from the survey suggest that households are not taking full advantage of the education services currently provided as respondents expressed regrets about not completing their schooling. This, and the presence of school-age children at home because school fees were unaffordable suggests that low levels of rural education may have more to do with the cost of schooling rather than its availability.

Wantok tax is particularly interesting as no other studies appear to have measured the impact of informal income taxes on investment in PNG. It was estimated that this informal tax would reduce increased farm earning by approximately 18 per cent, and would have a significant negative impact on investment in farming. *Wantok* tax is likely to persist while the available social protection programmes are perceived to be inadequate. Shifting the *wantok* tax into cost effective public social protection programmes may not reduce the tax burden on farmers, but it would reduce their exposure to covariant risk. Informal safety nets like the *wantok* system are concentrated among the poor themselves and are not robust in the face of covariant shocks like drought and floods.

It was expected that higher levels of contact with agricultural extension services would lead to greater investment in yield-enhancing technologies but the results of the logit analysis showed the number of visits by extension staff had no impact on investment in coffee production. It could therefore be concluded that the information and advice provided by extension staff is of poor quality.

Although there was no evidence that tenure security affected investment in coffee production, it should not be concluded that security is unimportant as there was insufficient variation in the variable used to measure tenure. The fact that so many respondents suffered crop losses as a result of theft, land disputes or damage caused by stray livestock suggests that both tenure and physical insecurity are indeed pervasive problems for small farmers in PNG.

6.3 Policy recommendations

The following recommendations are based on the conclusions drawn from this research and are aimed at enhancing agricultural development in PNG:

- The government needs to improve physical and legal infrastructure in rural areas to alleviate information problems faced by banks and DFI's, reduce transaction costs confronting farmers in all markets, and to increase the collateral value of moveable assets. In terms of physical infrastructure, rural PNG needs more all-weather roads and bridges, and much greater outreach in affordable transport and telecommunications. In terms of legal infrastructure, it is important that farmers can

rely on courts of law to defend their property rights to land and uphold commercial contracts. These public services have to be efficient and affordable to farmers.

- Provide better and more affordable access to rural health, education and social protection services.
- Upgrade the quality of information provided by extension staff and focus scarce extension resources on emerging commercial farmers. In the short-run, existing extension officers could be trained and provided with performance-based incentives. In the long-term, government needs to attract more skilled extension staff.
- If the government decides to recapitalise the CCGS (and other DFIs), it should divert its subsidy away from interest rates and provide one-off subsidies to finance investments in lending technologies and management information systems that have proved successful in microfinance. Subsidies to establish credit bureaus for rural clients would also help to address the more fundamental problem of asymmetric information.

6.4 Limitations and recommendation for future research

The findings of this research are based on data collected from one district. Since tenure security is a major issue in PNG, it would be better to consider a larger sample from different regions of the country to draw a fair conclusion. Therefore, future studies of farming constraints require better measures of tenure and physical security and study sites

with different levels of security. This study did not explain the reasons for PNG's declining coffee production. This might be the subject of future research.

Other areas of interest for future research would be an analysis of CCGS loan defaults and lending technologies and the effectiveness of agricultural extension services in PNG. It would also be useful to determine what type of public social protection services would best substitute for those currently provided by the *wantok* system, and how affordable education and health services are to rural households.

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Appendix A: Daulo coffee farmer questionnaire

DATE: _____ INTERVIEWER'S NAME: _____

Participation in this survey is voluntary and strictly confidential. You will not be identified as a respondent, and will remain anonymous in any publications emanating from this research. You may withdraw your participation at any time, and may ignore questions that you prefer not to answer.

The information gathered in this survey will be used by researchers to identify factors that constrain small coffee farmers in PNG and to recommend ways of overcoming these constraints to the CIC. The research is being conducted by Jetori Jay Mauro towards a Masters degree at Lincoln University, New Zealand. Your assistance is greatly appreciated.

Questions addressed to the farmer about his or her household relate to all household members including members not present at the time of interview (*e.g.* migrant workers who contribute to household income)

Ward (**Yamayo** or **Korepa**) _____

Random No. _____

Farmer (name and family name) _____

Farmer's gender **Male** or **Female**

Is the farmer **single**, **married** or **widowed**? _____

Is the farmer also the household head or *de facto* household head? **Yes** or **No**

How long has the household lived here? Years _____

How much own land does the household have for cropping? (specify units) _____

Will the household use all of its own cropland this season? **Yes** or **No**

If no, what portion of its arable land will it use? % _____

List (in the order that the respondent mentions them) the main reasons for not cultivating all of the cropland *eg*, **risk of drought**, **lack of cash to buy inputs**, **no ploughing service in the area**, **cattle/pig damage the crops**, **tribal fights**, *etc.*

1 _____

2 _____

3 _____

Did the household hire or borrow extra land to grow crops last season? **Yes** or **No**

If yes; how much extra land did it hire and/or borrow (specify units) _____

If the household hired extra land, did it pay the landowner cash or a part of the crop? _____

If the household paid cash, did it pay all of the cash before planting started?

Yes or No

If the household borrowed extra land, did it provide **labour** or any other service (please specify) to use the land? _____

How much land is planted to coffee (specify units) _____

Does your house have **electricity**, a **generator** or **no** electrical power? _____

How many rooms do the household members use to sleep in? _____

Does the family have a **flush**, **pit**, or **no** toilet of its own? _____

What is your main source of drinking water, an **unprotected** source (e.g. an open spring), a **protected** source, a public **standpipe** or water **pipd** to your house? _____

What fuel do you use most often for cooking; **wood**, **kerosene**, **gas** or **electricity**? _____

Household Composition

Household member (note respondent)	Gender (M or F)	Age in years	Occupation*	For wage employees, income per month (Kina)	Disability and pension payments (K/month)	School years completed
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

* Occupation should be categorized as Wage Employed (**WE**), Farmer (**F**), Self-employed (**SE** - eg trader), Housekeeper (**H**), Scholar or student (**S**), Disabled or Pensioner (**P**), Unemployed (**U**) if seeking work, **Infant** if too young to attend school.

Crops grown during the past year

Crop type	Grown during past year (Yes or No)	Sold during past year (Yes or No)	Gross income from sales (If Kina > 50)	Time to reach point of sale (hrs)	Mode of transporting produce*
Coffee					
Corn					
Sugar					
Yam					
Pandanus					
Potatoes					
Kau kau					
Cassava					
Taro					
Peanuts					
'Green' Veg					
Bananas					
Pumpkin/squa					
Other					
Timber					

For office use only **Cropinc**

* Carried by household members (**carry**), Own vehicle (**own**), or **service** eg bus, taxi or contractor.

Livestock

Livestock type	Current herd size	Sales during past year (Yes or No)	Gross income from sales (if Kina > 50)	Time to point of sale (hrs)
Goats				
Pigs				
Chickens/ducks				
Bees				
Fish				

For office use only **Livinc** =

Seasonal farming expenses during past year

Purchased input	Used last season (Yes or No)	Total cost (If Kina > 20)	Time taken to reach main supplier (hrs)	Borrowed cash to pay, or paid over time (Yes or No)	Source of credit used*
Coffee seedlings					
Coffee hybrid seed					
Fertiliser for coffee					
Chemicals for coffee					
Seed for other crops					
Fertiliser for other crops					
Chemicals for other crops					
Farm labour					
Equipment hire					
Contractor/Transport service					
Livestock feed					
Vet. medicines					
Other					

* **Friend** or relative, **local** money lender, savings **club**, **cooperative** or other input **supplier**, a **bank**, the **CIC**, **SSSPP**, **NADP**, or another source (eg coffee **buyer/processor/exporter** or an **NGO/donor**).

If none of these seasonal inputs was financed with credit during the past year, were any financed with credit during the previous two years? **Yes** or **No**

If so, which seasonal inputs were financed with credit and what sources of credit were used?

Purchased input	Year 2007/2008	Source of credit used*

* **Friend** or relative, **local** money lender, savings **club**, **cooperative** or other input **supplier**, a **bank**, the **CIC**, **SSSPP**, **NADP**, or another source (e.g. coffee **buyer/processor/exporter** or an **NGO/donor**).

Does the household own any of the following assets, and were any of them financed with credit?

Asset	Latest year of purchase	Borrowed cash to pay for asset or paid over time (Yes or No)	Source of credit used*
Wheelbarrow			
Knapsack sprayer			
Pruning saw			
Pruning secateurs			
Bags			
Coffee pulper			
Canvas			
Fencing to protect crops			
Tractor			
Vehicle			
Refrigerator/freezer			
Television			

* **F**riend or relative, **l**ocal money lender, savings **club**, **co**operative or other input **supplier**, a **bank**, the **CIC**, **SSSPP**, **NADP**, or another source (eg coffee **buyer/processor/exporter** or an **NGO/donor**).

If the household does not have enough cash to finance **farm expenses**, do you think that it could get credit from any of the following sources? (tick where appropriate)

Informal credit sources	Yes	No	Not sure
Friends or relatives			
Local money lender			
Savings club			
Other informal sources (specify)			
Formal credit sources	Yes	No	Not sure
Cooperative			
Input suppliers			
CIC			
SSSPP			
NADP			
Bank (specify)			

If the household has not used **formal credit** to finance farm expenses, why not? If the respondent gives more than one reason, please rank them in the order mentioned:

Reason	Yes or No	Order mentioned
Household has sufficient savings		
Do not like incurring debt		
Do not know where to apply for credit		
Do not know how to apply for credit		
Do not apply because the request would be rejected		
Interest charges are too high		
Other (specify)		

During the past year, did the household borrow money or use credit to buy any consumer goods (eg furniture, clothes, building materials, school fees, food)? **Yes or No**

Self employment

Did the household earn income from any of the following sources during the past year?

Activity	Yes or No	Gross annual income (if > K100 per annum)
Hiring out accommodation		
Hiring out contractor services or equipment		
Pulping coffee		
Baking, brewing or selling meals		
Building or repairing houses		
Blind/wall making, stone or metalwork		
Making or repairing furniture		
Repairing vehicles or machinery		
Sewing or cobbling		
Shop-keeping		
Hawking		
Handicrafts*		

* Making and selling mats, baskets, pottery or curios, tanning and dyeing.

Farming information

What is the agricultural extension officer's name? _____

How many times did the extension officer make contact with you or another member of your household during the past two months? _____

Were any of the following training courses offered in this area during the past year?

Course subject	Yes or No	Course offered by?*
Coffee production		
Production of other crops		
Livestock or poultry production		
Soil conservation		
Farm budgeting /management		

* **CIC, SSSPP, NADP, FPDA, PDAL** other (please specify).

Can you get farming information when you need it? **Yes or No**

If yes, who do you prefer to get it from (**CIC, SSSPP, NADP, etc?**) _____

Do you or any household member currently belong to a farmer's cooperative, farmer's association or garden club? **Yes or No**

Wantok

If you had a very good farming season and earned an extra K1000, would you be expected to give part of this extra income to help kin or church? **Yes or No**

If yes, how much of this extra K1000 would you be inclined to give? K_____

Services and health

How long would it usually take you to reach the closest?

Service	Hours
Telephone	
Postal service	
Bus/taxi service	
Clinic	
Hospital	

How many household adults have been too sick to work some days during the past month?

Constraints to coffee farming

Would you say that your coffee production has **increased**, **decreased** or remained **stable** over the past five years? _____

If your coffee production has been falling what are the main reasons for this decline?

1 _____

2 _____

3 _____

Saving activity

If the farmer/household head has money to save, how or where is this money saved? (If the respondent gives more than one answer please rank them in the order mentioned.

Action	Yes or No	Order mentioned
Deposit the money in a bank		
Deposit money in a savings club (<i>eg</i> Wokmeri/Sande)		
Buy livestock		
Buying other assets (like coffee cherries) to be sold later		
Lend it to others (maket moni)		
Entrust the money to someone else for safe-keeping		
Keep the cash at home		
Other (please specify)		

If the household does have money in a bank account, please provide the following information:

Account	Name of bank	Time to reach bank (hours)	Current level of savings (K)*
1			
2			
3			

* Score as: <K100, K100-K500, K500-K1000, >K1000.

Thank you for your time and assistance

Appendix B: Variable definitions for the Daulo coffee farmer survey

Variable	Definition
Case	= Case number
Village	= Village number
Ward	= 0 for Yamayo council ward and 1 for Korepa council ward
Randno	= Random number
Gender	= 1 if male, 0 otherwise
Status	= 1 if single, 2 if married, 3 if widowed
Head	= 1 if household head is male, 0 otherwise
Stay	= Number of years household has resided in the area
Land	= Hectares (ha) of land available for crop production
Use	= 1 if household intends to cultivate all cropland, 0 otherwise
Share	= Percentage (%) of cropland cultivated
Pcash	= 1 if land is not cultivated due to lack of cash, 0 otherwise
Pplow	= 1 if land is not cultivated due to absence of ploughing service, 0 otherwise
Ppigs	= 1 if land is not cultivated fearing pig damage, 0 otherwise
Plabour	= 1 if land is not cultivated due to labour shortage, 0 otherwise
Mount	= 1 if land is not cultivated due to mountainous features, 0 otherwise
Fertile	= 1 if land is not cultivated due to poor soil fertility, 0 otherwise
Drought	= 1 if land is not cultivated due to drought, 0 otherwise
Erosion	= 1 if land is not cultivated fearing soil erosion, 0 otherwise
Dispute	= 1 if land is not cultivated due to land disputes or tribal fights, 0 otherwise
PriceC	= 1 if land is not cultivated due to high costs of inputs, 0 otherwise
Lndhire	= 1 if land was leased or borrowed, 0 otherwise
Lndextra	= Hectares (Ha) of extra land leased in
Prent	= 1 if household paid cash for extra land hired, 2 if household shared part of crop, 3 if household paid both cash and crop, (0 if none)
Pplant	= 1 if household paid cash up front before planting, 0 otherwise
Pborr	= 1 if household provided labour for use of the land, 0 if other service
Cofland	= Hectares (Ha) of land planted to coffee alone
Power	= Type of electrical power used: 1 if electricity, 2 if generator, 3 if none
Rooms	= Number of rooms available for use by household members
Toilet	= Type of family toilet: 1 if flush toilet, 2 if pit toilet, 3 if no toilet
Water	= Source of household drinking water: 1 if unprotected, 2 if protected, 3 if public standpipe, 4 if piped into house
Fuel	= Type of fuel used for household cooking: 1 if wood, 2 if kerosene, 3 if gas, 4 if electricity
Members	= Number of household members
Admale	= Number of adult males in household (>16 years)
Adfemale	= Number of adult females in household (>16 years)
Infant	= Number of children too young to attend school (<6 years)
Farmer	= Number of adult males and females who engaged in farming activities
Employed	= Number of adults engaged in paid employment (school teacher)
Selfemp	= Number of adults engaged in self-employment activities (trader)
Keeper	= Number of adults engaged in housekeeping (stays home)
Student	= Number of children at junior school, senior school or tertiary institutions
Pensioner	= Number of adults receiving pensions

Unemp	=	Number of unemployed adults
Wageinc	=	Sum of monthly wage incomes (Kina)
Headedu	=	School Standard passed by <i>De Facto</i> household head
Hiedu	=	Highest level of education achieved by any household member
Gcoffee	=	1 if household grew coffee, 0 otherwise
Gcorn	=	1 if household grew corn (maize), 0 otherwise
Gsugar	=	1 if household grew sugarcane, 0 otherwise
Gyam	=	1 if household grew yam, 0 otherwise
Gpand	=	1 if household grew Pandanus trees, 0 otherwise
Gpotato	=	1 if household grew English (Irish) potatoes, 0 otherwise
Gkaukau	=	1 if household grew sweet potato (kaukau/kumara), 0 otherwise
Gcassava	=	1 if household grew cassava/tapioca, 0 otherwise
Gtaro	=	1 if household grew taro, 0 otherwise
Gpeanuts	=	1 if household grew peanuts (groundnuts), 0 otherwise
Gvegies	=	1 if household grew all green vegetables, 0 otherwise
Gbanana	=	1 if household grew bananas, 0 otherwise
Gtimber	=	1 if household grew trees for timber, 0 otherwise
Gother	=	1 if household grew other crops for cash, 0 otherwise
Scoffee	=	1 if household sold coffee, 0 otherwise
Sother	=	1 if household sold the other crops, 0 otherwise
Icoffee	=	Income from coffee (Kina)
Iother	=	Sum of income from other crops (Kina)
Tcoffee	=	Time taken to reach point of sale for coffee (Hours)
Mcoffee	=	Mode of transporting coffee: 1 if public transport service (bus, contractor), 2 if carried by household members, 3 if own vehicle
GoatN	=	Current number of goats
PigN	=	Current number of pigs
ChickN	=	Current number of chickens
Sgoat	=	1 if goats were sold, 0 otherwise
Spig	=	1 if pigs were sold, 0 otherwise
Schick	=	1 if chickens were sold, 0 otherwise
Igoat	=	Sum of income from goats (Kina)
Ipig	=	Sum of income from pigs (Kina)
Ichick	=	Sum of income from chickens (Kina)
Cofsd	=	1 if coffee seed or seedling was purchased, 0 otherwise
Cofhysd	=	1 if hybrid coffee seed or seedling was purchased, 0 otherwise
Cofert	=	1 if coffee fertiliser was purchased, 0 otherwise
Cofchem	=	1 if coffee weedicide or insecticide was purchased, 0 otherwise
Cropsd	=	1 if crop seed or seedling was purchased, 0 otherwise
Cropfrt	=	1 if crop fertiliser was purchased, 0 otherwise
Cropchm	=	1 if crop weedicide or insecticide was purchased, 0 otherwise
Farmlab	=	1 if farm labour was hired, 0 otherwise
EquipH	=	1 if farm equipment was hired, 0 otherwise
Transp	=	1 if contractor or transport service was hired, 0 otherwise
Livfeed	=	1 if livestock feed was purchased, 0 otherwise
Vetmed	=	1 if veterinary medicine was purchased, 0 otherwise
OtherC	=	1 if other farm inputs were purchased, 0 otherwise
CofsdK	=	Expenditure on coffee seed or seedling (Kina)
CofhysdK	=	Expenditure on hybrid coffee seed or seedling (Kina)
CofertK	=	Expenditure on coffee fertiliser (Kina)

CofchemK	=	Expenditure on weedicide or insecticide for coffee (Kina)
CropsdK	=	Expenditure on other crops seed or seedling (Kina)
CropfrtK	=	Expenditure on fertiliser for other crops (Kina)
CropchmK	=	Expenditure on weedicide or insecticide for other crops (Kina)
FarmlabK	=	Expenditure on hired farm labour (Kina)
EquipHK	=	Expenditure on hired farm equipment (Kina)
TranspK	=	Expenditure on hired contractor or transport service (Kina)
LivfeedK	=	Expenditure on livestock feed (Kina)
VetmedK	=	Expenditure on veterinary medicines (Kina)
OtherK	=	Expenditure on other farm inputs (Kina)
Tsedcof	=	Time taken to reach main coffee seed or seedling supplier (Hours)
Thysed	=	Time taken to reach hybrid coffee seed or seedling supplier (Hours)
Tfetcof	=	Time taken to reach coffee fertiliser supplier (Hours)
Tchcof	=	Time taken to reach supplier of coffee weedicide or insecticide (Hours)
Tcrpsed	=	Time taken to reach supplier of other crops seed or seedling (Hours)
Tftcrp	=	Time taken to reach supplier of other crops' fertiliser (Hours)
Tcropch	=	Time taken to reach supplier of other crops' weedicide or insecticide (Hours)
Tfmlab	=	Time taken to reach and recruit farm labour (Hours)
TeqipH	=	Time taken to reach supplier of hired farm equipment (Hours)
Ttrans	=	Time taken to reach contractor or transport service (Hours)
TfedL	=	Time taken to reach livestock feed supplier (Hours)
Tvtmd	=	Time taken to reach veterinary medicine supplier (Hours)
Tother	=	Time taken to reach other farm inputs supplier (Hours)
Cashcs	=	1 if a cash loan or credit was used to purchase coffee seed or seedling, 0 otherwise
Cashysd	=	1 if a cash loan or credit was used to purchase hybrid coffee seed or seedling, 0 otherwise
Cashcc	=	1 if a cash loan or credit was used to purchase weedicide or insecticide for coffee, 0 otherwise
Cashcrp	=	1 if a cash loan or credit was used to purchase other crop seed or seedling, 0 otherwise
Casftcrp	=	1 if a cash loan or credit was used to purchase fertiliser for other crops, 0 otherwise
Cashcoc	=	1 if a cash loan or credit was used to purchase weedicide or insecticide for other crops, 0 otherwise
Cashfl	=	1 if a cash loan or credit was used to hire farm labour, 0 otherwise
Casheh	=	1 if a cash loan or credit was used to hire farm equipment, 0 otherwise
Castrns	=	1 if a cash loan or credit was used to hire contractor/transport service, 0 otherwise
Casfedl	=	1 if a cash loan or credit was used to purchase livestock feed, 0 otherwise
Casvetm	=	1 if a cash loan or credit was used to purchase veterinary medicines, 0 otherwise
Casother	=	1 if a cash loan or credit was used to purchase other farm inputs, 0 otherwise
		Sources of credit for the following operating farm inputs financed with cash loan or credit;
Crdcsc	=	Coffee seed or seedling: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input

		supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crdhysd	=	Hybrid coffee seed or seedling: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crdfcofrt	=	Coffee fertiliser: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddcc	=	Coffee weedicide or insecticide: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddcrp	=	Other crops seed or seedling: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddftcrp	=	Other crops fertiliser: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddcoc	=	Other crops weedicide or insecticide: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddfl	=	Farm labour hire: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddch	=	Farm equipment hire: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddtrns	=	Contractor or transport service hire: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddfedl	=	Livestock feed: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crddother	=	Other farm inputs: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
InptFin	=	1 if seasonal input was financed with credit during the previous two years, 0 otherwise
Potato	=	1 if potato seed was financed with credit, 0 otherwise
Chem	=	1 if potato insecticide or fungicide was financed with credit, 0 otherwise
Vehicle	=	1 if vehicle was financed with credit, 0 otherwise
PotY	=	Year in which potato seed (sprouts) was purchased
ChemY	=	Year in which weedicide, insecticide or fungicide was purchased

Crdsou	=	Source of credit for farm inputs purchased in 2007/2008: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO/donor or others
WhbaY	=	Year in which wheelbarrow was purchased
KnapsY	=	Year in which knapsack sprayer was purchased
PrsaY	=	Year in which pruning saw was purchased
PrseY	=	Year in which pruning secateurs was purchased
BagsY	=	Year in which bags were purchased
CopulY	=	Year in which coffee pulping machine (pulper) was purchased
CnvsY	=	Year in which canvas tarpaulin was purchased
FencY	=	Year in which fencing materials were purchased
VehiY	=	Year in which vehicle was purchased
RefrY	=	Year in which refrigerator or freezer was purchased
TeleY	=	Year in which television was purchased
CasWB	=	1 if wheelbarrow was financed with credit or cash loan, 0 otherwise
CasKS	=	1 if knapsack sprayer was financed with credit or cash loan, 0 otherwise
CasPS	=	1 if pruning secateurs were financed with credit or cash loan, 0 otherwise
CasPrSe	=	1 if wheelbarrow was financed with credit or cash loan, 0 otherwise
Casbag	=	1 if bags were financed with credit or cash loan, 0 otherwise
CasCP	=	1 if coffee pulper was financed with credit or cash loan, 0 otherwise
Cascnv	=	1 if canvas was financed with credit or cash loan, 0 otherwise
Casfenc	=	1 if fencing was financed with credit or cash loan, 0 otherwise
Casveh	=	1 if vehicle was financed with credit or cash loan, 0 otherwise
Casrefr	=	1 if refrigerator or freezer was financed with credit or cash loan, 0 otherwise
Castv	=	1 if television was financed with credit or cash loan, 0 otherwise Sources of credit for the following assets financed with cash loan or credit;
CrdWB	=	Wheelbarrow: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
CrdKS	=	Knapsack sprayer: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
CrdPS	=	Pruning saw: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crdprse	=	Pruning secateurs: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crdbag	=	Bags: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
CrdCP	=	Coffee pulper: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crdcnvs	=	Canvas: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others

Crdfenc	=	Fencing: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
Crdveh	=	Vehicle: 0 if none (used own cash), 1 if friend or relative, 2 if local money lender, 3 if savings club, 4 if cooperative, 5 if input supplier, 6 if bank, 7 if CIC, 8 if SSSPP, 9 if NADP, 10 if NGO, donor or others
CrdFnd	=	1 if sourcing credit from a friend or relative is likely, 0 if sourcing credit from a friend is unlikely, 2 if household head is unsure
CrdLoc	=	1 if sourcing credit from local money lender is likely, 0 if sourcing credit from local money lender is unlikely, 2 if household head is unsure
Crdclub	=	1 if sourcing credit from savings club is likely, 0 if sourcing credit from savings club is unlikely, 2 if household head is unsure
Crdcop	=	1 if sourcing credit from credit cooperative is likely, 0 if sourcing credit from credit cooperative is unlikely, 2 if household head is unsure
Crdsup	=	1 if sourcing credit from input supplier is likely, 0 if sourcing credit from input supplier is unlikely, 2 if household head is unsure
CrdCIC	=	1 if sourcing credit from CIC is likely, 0 if sourcing credit from CIC is unlikely, 2 if household head is unsure
CrdSSSPP	=	1 if sourcing credit from SSSPP is likely, 0 if sourcing credit from SSSPP is unlikely, 2 if household head is unsure
CrdNADP	=	1 if sourcing credit from NADP is likely, 0 if sourcing credit from NADP is unlikely, 2 if household head is unsure
CrdBnk	=	1 if sourcing credit from bank is likely, 0 if sourcing credit from bank is unlikely, 2 if household head is unsure
Fcrdrej	=	Reason for not using (rejecting) formal credit: 0 if household did not take any action, 1 if household had sufficient savings, 2 if household did not like incurring debt, 3 if household did not know where to apply for credit, 4 if household did not know how to apply for credit, 5 if household did not apply because the request would be rejected, 6 if household thought interest charges were too high
Conborr	=	1 if household borrowed money or used credit to finance consumer goods (furniture, clothes, building materials, food, school fees), 0 otherwise
Iaccom	=	1 if household earned income from renting out accommodation, 0 otherwise
Iserv	=	1 if household earned income from hiring out contractor services or equipment, 0 otherwise
Ipulp	=	1 if household earned income from pulping coffee, 0 otherwise
Imeal	=	1 if household earned income from baking, brewing or selling meals, 0 otherwise
Ibldg	=	1 if household earned income building or repairing houses, 0 otherwise
Iwall	=	1 if household earned income from wall making,
Ifurn	=	1 if household earned income from making or repairing furniture, 0 otherwise
Irepr	=	1 if household earned income from repairing vehicles or machinery, 0 otherwise
Isew	=	1 if household earned income from sewing or cobbling, 0 otherwise
Ishop	=	1 if household earned income from shop-keeping, 0 otherwise
Ihawk	=	1 if household earned income from hawking, 0 otherwise
Icraft	=	1 if household earned income from handicrafts, 0 otherwise
Inonfrm	=	Sum of income from non-farm activities (Kina)

Name	=	1 if agricultural extension officer's name was known, 0 otherwise
Visits	=	Number of extension officer's visits with household members
CICcof	=	1 if training courses on coffee was conducted by CIC, 0 otherwise
SSSPCof	=	1 if training courses on coffee was conducted by SSSPP, 0 otherwise
SSSPoth	=	1 if training courses on other crops was conducted by SSSPP, 0 otherwise
FPDAoth	=	1 if training courses on other crops was conducted by FPDA, 0 otherwise
Info	=	1 if household indicated that they could get farming information when they need it, 0 otherwise
Prefer	=	Household farming information preference: 0 if none (no preference), 1 if CIC, 2 if SSSPP, 3 if NADP, 4 if FPDA, 5 if PDAL
Member	=	1 if household members belong to a farmers cooperative, 0 otherwise
Wantok	=	1 if household gave part of extra income to help kin or church, 0 otherwise
Give	=	Current level of cash household is inclined to give away (Kina)
Tel	=	Time taken to reach closest public telephone service centre (Hours)
Post	=	Time taken to reach closest post office (Hours)
Bus	=	Time taken to reach closest bus or taxi stop (Hours)
Clinic	=	Time taken to reach public clinic or health centre (Hours)
Hospital	=	Time taken to reach public hospital (Hours)
Sick	=	Number of household members who were too sick to work
Cofprod	=	Coffee production: 0 if no comments (unsure), 1 if increased, 2 if decreased, 3 if remained stable,
Pest	=	1 if coffee production declined due to pest and disease, 0 otherwise
Expense	=	1 if coffee production declined due to high cost of farm inputs (especially weedicide or insecticide), 0 otherwise
Soil	=	1 if coffee production declined due to poor soil structure and low levels of soil nutrients, 0 otherwise
Labor	=	1 if coffee production declined due to lack of farm labour, 0 otherwise
Finfo	=	1 if coffee production declined due to lack of farming and extension information, 0 otherwise
Mgmt	=	1 if coffee production declined due to poor farm management, 0 otherwise
Garden	=	1 if coffee production declined due to other gardening activities, 0 otherwise
Drain	=	1 if coffee production declined due to poor farm drainage, 0 otherwise
Climate	=	1 if coffee production declined due to climate change and unpredictable weather patterns, 0 otherwise
Cashp	=	1 if coffee production declined due to lack of cash or cash flow problems, 0 otherwise
Steal	=	1 if coffee production declined due to stealing of ripe cherries, 0 otherwise
ShortL	=	1 if coffee production declined due to land shortage, 0 otherwise
Drug	=	1 if coffee production declined due to drug (marijuana) cultivation and addiction, 0 otherwise
SavOne	=	Household cash saving method One: 0 if none (head did not take any action), 1 if head deposited money in a bank, 2 if head deposited money in a savings club, 3 if head bought livestock (pig, goat, chicken), 4 if head bought other assets (coffee cherries) to be sold later, 5 if head lent money to others, 6 if head entrusted the money to someone else for safe-

		keeping, 7 if head kept the cash at home, 8 if head saved money in other ways
SavTwo	=	Household cash saving method Two: 0 if none (head did not take any action), 1 if head deposited money in a bank, 2 if head deposited money in a savings club, 3 if head bought livestock (pig, goat, chicken), 4 if head bought other assets (coffee cherries) to be sold later, 5 if head lent money to others, 6 if head entrusted the money to someone else for safe-keeping, 7 if head kept the cash at home, 8 if head saved money in other ways
Bnkacc	=	1 if household had money in bank accounts, 0 otherwise
BSP	=	1 if household had savings deposited in first bank account, 0 otherwise
ANZ	=	1 if household had savings deposited in second bank account, 0 otherwise
BSPS	=	Current level of savings deposited in first bank account (Kina)
ANZS	=	Current level of savings deposited in second bank account (Kina)

Appendix C: Data used to estimate the logit model

Case	Ward	Land	Cofland (Coffee land)	Coffee land share	Ppigs	Dispute	Steal	Security	Members	Farmer	Keeper	Student	Pensioner
1	0	1.00	0.40	0.40	1	0	0	0	2.00	2	0	0	0
2	0	0.70	0.50	0.71	1	0	0	0	2.00	2	0	0	0
3	0	2.00	0.50	0.25	1	0	0	0	5.00	2	0	2	0
4	0	0.50	0.20	0.40	0	0	0	1	1.00	1	0	0	0
5	0	0.70	0.40	0.57	1	0	0	0	1.00	1	0	0	0
6	0	0.20	0.10	0.50	1	1	0	0	4.00	2	0	2	0
7	0	0.70	0.30	0.43	1	0	1	0	3.00	2	0	1	0
8	0	0.80	0.40	0.50	1	1	0	0	4.00	2	0	1	0
9	0	0.60	0.30	0.50	1	0	0	0	1.00	1	0	0	0
10	0	1.80	0.40	0.22	1	0	0	0	4.00	2	0	2	0
11	0	1.00	0.60	0.60	0	0	0	1	3.00	0	0	1	0
12	0	0.50	0.30	0.60	1	0	0	0	3.00	2	0	0	0
13	0	0.50	0.20	0.40	0	0	1	0	3.00	2	0	0	0
14	0	0.70	0.40	0.57	1	1	0	0	4.00	2	0	2	0
15	0	1.50	0.50	0.33	1	0	0	0	3.00	2	0	0	0
16	0	1.00	0.50	0.50	1	0	0	0	4.00	2	0	0	0
17	0	0.70	0.40	0.57	1	0	1	0	4.00	3	0	1	0
18	0	0.80	0.20	0.25	1	0	0	0	1.00	2	0	0	0
19	0	1.00	0.50	0.50	1	0	0	0	4.00	2	0	2	0
20	0	1.00	0.40	0.40	1	0	0	0	4.00	2	0	2	0
21	0	0.50	0.10	0.20	1	0	0	0	1.00	1	0	0	0
22	0	0.50	0.30	0.60	1	0	0	0	1.00	1	0	0	0
23	0	0.80	0.40	0.50	1	0	0	0	6.00	2	0	4	0
24	0	0.70	0.20	0.29	1	0	0	0	5.00	2	0	3	0
25	0	1.80	0.50	0.28	1	0	0	0	7.00	4	0	3	0
26	0	2.00	0.40	0.20	1	0	1	0	7.00	4	0	3	0
27	0	2.50	0.60	0.24	1	0	0	0	6.00	4	0	2	0
28	0	1.90	0.40	0.21	1	0	1	0	8.00	4	0	4	0
29	0	1.50	0.50	0.33	1	0	1	0	5.00	2	0	2	0
30	0	2.10	0.40	0.19	1	0	1	0	2.00	2	0	0	0
31	0	1.70	0.50	0.29	1	0	1	0	6.00	2	0	3	0
32	0	1.50	0.40	0.27	1	0	1	0	5.00	2	0	3	0
33	0	1.60	0.45	0.28	1	0	1	0	5.00	2	0	3	0
34	0	2.00	0.60	0.30	1	0	0	0	7.00	4	0	2	0
35	0	1.50	0.70	0.47	1	0	1	0	2.00	2	0	0	0
36	0	0.70	0.30	0.43	1	0	1	0	4.00	2	0	2	0
37	0	1.00	0.40	0.40	1	0	0	0	8.00	4	0	3	0
38	0	1.80	0.40	0.22	1	0	0	0	5.00	2	0	3	0
39	0	0.90	0.30	0.33	1	0	0	0	6.00	0	1	3	0
40	0	2.50	0.40	0.16	1	0	0	0	2.00	2	0	0	0
41	0	1.80	0.80	0.44	1	0	0	0	2.00	2	0	0	0
42	0	2.50	1.20	0.48	1	0	0	0	2.00	2	0	0	0
43	0	1.50	0.50	0.33	1	0	0	0	1.00	1	0	0	0
44	0	1.80	0.90	0.50	1	0	0	0	3.00	2	0	1	0
45	0	2.30	1.00	0.43	1	0	0	0	4.00	2	0	2	0
46	0	1.80	0.80	0.44	1	0	0	0	2.00	2	0	0	0
47	0	2.50	1.20	0.48	1	0	0	0	4.00	2	0	1	0
48	0	2.30	0.80	0.35	1	0	0	0	6.00	2	0	3	0
49	0	2.80	1.00	0.36	1	0	0	0	2.00	2	0	0	0

Case	Ward	Land	Cofland (Coffee land)	Coffee land share	Ppigs	Dispute	Steal	Security	Members	Farmer	Keeper	Student	Pensioner
50	0	2.50	1.30	0.52	0	0	0	1	4.00	2	0	1	0
51	0	2.00	1.00	0.50	0	0	0	1	1.00	1	0	0	0
52	0	1.50	0.80	0.53	1	0	1	0	1.00	1	0	0	0
53	0	2.00	0.80	0.40	0	0	1	0	2.00	2	0	0	0
54	0	1.30	0.60	0.46	1	0	0	0	1.00	1	0	0	0
55	0	1.40	0.50	0.36	0	0	0	1	1.00	1	0	0	0
56	0	1.50	0.80	0.53	0	0	0	1	1.00	1	0	0	0
57	0	2.00	1.00	0.50	1	0	0	0	6.00	2	0	2	0
58	0	2.00	1.30	0.65	1	0	0	0	3.00	3	0	0	0
59	0	1.50	0.80	0.53	1	0	0	0	4.00	2	0	0	0
60	0	2.50	1.00	0.40	0	1	1	0	7.00	2	0	4	0
61	0	2.50	1.30	0.52	0	0	1	0	2.00	2	0	0	0
62	0	2.30	1.20	0.52	1	0	0	0	3.00	2	0	1	0
63	0	2.00	1.30	0.65	1	0	1	0	3.00	2	0	1	0
64	0	2.50	1.00	0.40	1	0	0	0	4.00	2	0	2	0
65	0	0.80	0.20	0.25	1	0	0	0	2.00	2	0	0	0
66	0	1.50	0.80	0.53	1	0	0	0	1.00	1	0	0	0
67	0	1.50	0.50	0.33	1	0	0	0	6.00	3	0	2	0
68	0	1.00	0.30	0.30	1	0	0	0	2.00	2	0	0	0
69	0	1.50	0.60	0.40	1	0	0	0	3.00	2	0	0	0
70	0	1.00	0.40	0.40	1	0	0	0	4.00	4	0	0	0
71	0	1.50	0.30	0.20	1	0	1	0	3.00	3	0	0	0
72	0	3.20	0.50	0.16	1	0	1	0	4.00	2	0	1	0
73	0	2.00	0.40	0.20	1	0	1	0	5.00	2	0	1	0
74	0	1.20	0.40	0.33	1	0	1	0	4.00	2	0	2	0
75	0	3.50	1.30	0.37	1	0	0	0	7.00	2	0	4	0
76	1	2.50	0.50	0.20	1	0	0	0	5.00	4	0	1	0
77	1	2.50	1.30	0.52	0	0	0	1	5.00	1	0	2	0
78	1	2.00	0.50	0.25	1	0	0	0	3.00	2	0	1	0
79	1	1.50	0.50	0.33	1	0	0	0	4.00	2	0	1	0
80	1	1.80	0.30	0.17	1	0	0	0	2.00	1	0	1	0
81	1	1.00	0.50	0.50	1	0	0	0	1.00	1	0	0	0
82	1	1.00	0.50	0.50	1	0	0	0	2.00	2	0	0	0
83	1	2.00	1.00	0.50	1	0	0	0	5.00	2	0	2	0
84	1	1.30	0.50	0.38	1	0	0	0	1.00	0	0	1	0
85	1	1.50	0.50	0.33	1	0	0	0	2.00	2	0	0	0
86	1	1.50	0.50	0.33	1	0	0	0	3.00	2	0	0	0
87	1	1.00	0.25	0.25	1	0	0	0	2.00	2	0	0	0
88	1	1.00	0.50	0.50	1	1	1	0	3.00	2	0	1	0
89	1	1.00	0.60	0.60	1	1	0	0	5.00	2	0	3	0
90	1	1.00	0.50	0.50	1	0	1	0	3.00	2	0	0	0
91	1	0.80	0.40	0.50	1	1	0	0	1.00	1	0	0	0
92	1	2.00	1.00	0.50	1	1	1	0	2.00	2	0	0	0
93	1	2.50	1.50	0.60	1	0	0	0	1.00	1	0	0	0
94	1	2.45	1.25	0.51	1	1	0	0	2.00	2	0	0	0
95	1	1.32	0.80	0.61	1	0	0	0	6.00	2	0	4	0
96	1	1.20	0.40	0.33	1	1	0	0	1.00	1	0	0	0
97	1	2.00	1.50	0.75	1	0	1	0	1.00	1	0	0	0
98	1	2.50	1.00	0.40	1	0	0	0	2.00	2	0	0	0
99	1	1.30	0.30	0.23	1	1	0	0	1.00	1	0	0	0
100	1	2.50	1.50	0.60	1	0	0	0	4.00	2	0	2	0

Case	Ward	Land	Cofland (Coffee land)	Coffee land share	Ppigs	Dispute	Steal	Security	Members	Farmer	Keeper	Student	Pensioner
101	1	1.00	0.50	0.50	1	0	0	0	4.00	2	0	0	0
102	1	0.80	0.30	0.37	1	0	0	0	3.00	2	0	1	0
103	1	1.00	0.20	0.20	1	0	0	0	5.00	2	0	3	0
104	1	1.20	0.60	0.50	1	0	1	0	1.00	1	0	0	0
105	1	0.30	0.10	0.33	1	1	0	0	2.00	2	0	0	0
106	1	1.00	0.25	0.25	1	0	0	0	1.00	1	0	0	0
107	1	1.00	0.50	0.50	1	0	1	0	3.00	2	0	0	0
108	1	1.00	0.50	0.50	1	0	1	0	4.00	2	0	2	0
109	1	1.00	0.50	0.50	1	0	0	0	4.00	2	0	2	0
110	1	0.50	0.15	0.30	1	1	0	0	1.00	1	0	0	0
111	1	1.50	0.25	0.17	1	0	1	0	8.00	2	0	4	0
112	1	0.60	0.20	0.33	1	0	1	0	1.00	1	0	0	0
113	1	3.00	1.50	0.50	1	1	1	0	1.00	1	0	0	0
114	1	2.00	1.00	0.50	1	0	1	0	5.00	2	0	0	0
115	1	2.50	1.00	0.40	1	0	1	0	4.00	2	0	1	0
116	1	2.00	1.10	0.55	1	0	1	0	7.00	4	0	1	0
117	1	1.00	0.50	0.50	1	0	1	0	2.00	2	0	0	0
118	1	1.50	0.25	0.17	1	0	1	0	8.00	6	0	1	0
119	1	0.70	0.50	0.71	1	0	0	0	3.00	2	0	0	0
120	1	0.50	0.10	0.20	1	0	0	0	1.00	1	0	0	0
121	1	0.50	0.25	0.50	1	0	1	0	1.00	1	0	0	0
122	1	2.50	0.50	0.20	1	0	1	0	6.00	6	0	0	0
123	1	1.00	0.20	0.20	1	0	0	0	5.00	2	0	2	0
124	1	2.00	0.50	0.25	1	0	1	0	4.00	2	0	2	0
125	1	1.50	0.50	0.33	0	0	0	1	4.00	2	0	1	0
126	1	1.00	0.25	0.25	1	1	1	0	1.00	1	0	0	0
127	1	0.50	0.20	0.40	1	0	0	0	1.00	1	0	0	0
128	1	1.50	0.50	0.33	1	0	0	0	4.00	2	0	0	0
129	1	0.50	0.20	0.40	1	1	0	0	1.00	1	0	0	0
130	1	1.00	0.30	0.30	1	0	0	0	5.00	2	0	1	0
131	1	0.50	0.20	0.40	1	0	0	0	1.00	1	0	0	0
132	1	0.90	0.40	0.44	1	0	0	0	6.00	2	0	3	0
133	1	0.90	0.27	0.30	1	0	0	0	2.00	2	0	0	0
134	1	2.00	0.50	0.25	1	1	0	0	6.00	2	0	0	0
135	1	1.00	0.40	0.40	1	0	1	0	7.00	2	0	3	0
136	1	1.50	0.50	0.33	1	1	1	0	5.00	2	0	1	0
137	1	1.00	0.60	0.60	1	0	0	0	2.00	2	0	0	0
138	1	0.70	0.30	0.43	1	0	1	0	1.00	1	0	0	0
139	1	1.00	0.35	0.35	1	0	1	0	7.00	2	0	4	0
140	1	0.90	0.30	0.33	1	0	0	0	4.00	2	0	1	0
141	1	1.50	0.50	0.33	1	0	1	0	6.00	2	0	3	0
142	1	1.00	0.45	0.45	1	0	1	0	3.00	2	0	1	0
143	1	0.70	0.35	0.50	1	0	0	0	3.00	2	0	0	0
144	1	1.50	0.65	0.43	1	0	1	0	6.00	2	0	2	0
145	1	2.50	1.50	0.60	1	0	0	0	8.00	2	0	3	0
146	1	2.00	0.35	0.18	1	1	1	0	6.00	2	0	2	0
147	1	0.70	0.25	0.36	1	1	0	0	2.00	2	0	0	0
148	1	1.50	0.25	0.17	1	1	0	0	3.00	2	0	1	0
149	1	1.00	0.40	0.40	1	0	1	0	4.00	4	0	0	0
150	1	0.50	0.25	0.50	1	0	1	0	6.00	4	0	1	0

Case	Sick	Family farm labour	Headedu (Education)	Wageinc	Icoffee	Iother	Igoat	Ipig	Ichick	Inonfrm	BSPS	ANZS	Formal savings
1	0.0	1.07	6	0	600	1900	0	700	0	1000	0	0	0
2	0.0	1.07	6	0	350	0	0	0	0	220	0	0	0
3	0.0	0.67	3	0	500	980	500	700	0	600	0	0	0
4	0.0	1.00	4	0	250	350	0	0	0	150	0	0	0
5	0.0	1.00	2	0	500	0	0	0	0	0	0	0	0
6	0.0	0.84	7	0	250	400	0	500	0	230	0	0	0
7	1.0	0.52	7	0	450	550	0	0	0	110	0	0	0
8	0.0	0.68	6	0	300	430	200	0	0	200	0	0	0
9	0.0	1.00	4	0	300	200	100	0	0	160	0	0	0
10	0.0	0.84	10	0	400	800	0	800	0	500	0	0	0
11	0.0	0.16	1	300	350	150	0	700	0	200	0	0	0
12	0.0	0.71	4	0	250	150	0	100	0	0	0	0	0
13	0.0	0.71	4	0	300	450	0	500	0	60	0	0	0
14	0.0	0.84	3	0	200	150	0	0	0	50	0	0	0
15	0.0	0.71	6	0	1800	2600	0	1400	0	1700	0	0	0
16	0.0	0.54	5	0	300	890	0	500	0	500	0	0	0
17	0.0	0.99	3	0	300	550	200	500	0	0	0	0	0
18	0.0	2.14	6	0	250	550	0	500	0	70	0	600	600
19	1.0	0.54	4	0	500	1000	0	800	0	400	0	0	0
20	1.0	0.54	6	0	800	1150	0	1400	0	1200	0	0	0
21	0.0	1.00	8	0	400	660	0	500	0	350	0	0	0
22	0.0	1.00	2	0	400	450	0	300	0	150	0	0	0
23	0.0	0.77	3	0	600	1600	150	0	0	600	0	0	0
24	1.0	0.55	0	0	800	2450	0	700	0	900	0	0	0
25	0.0	0.93	6	0	550	4550	0	2000	0	2550	0	0	0
26	1.0	0.75	6	0	1200	1820	0	0	1000	1650	1500	0	1500
27	0.0	0.98	9	0	1200	2750	0	700	0	1670	1000	0	1000
28	2.0	0.57	6	0	1200	1750	0	1400	1000	2700	0	250	250
29	1.0	0.43	6	0	800	1950	0	700	0	1600	200	0	200
30	0.0	1.07	6	0	600	1550	0	700	0	950	0	0	0
31	1.0	0.46	6	0	600	1600	0	1200	0	1700	0	0	0
32	0.0	0.79	6	0	600	2300	0	700	0	1650	1500	0	1500
33	2.0	0.31	6	0	900	1610	0	1000	0	2600	0	0	0
34	2.0	0.48	8	500	600	1160	0	1200	0	4900	0	0	0
35	0.0	1.07	8	0	600	2450	0	1400	1000	3800	0	0	0
36	1.0	0.54	6	0	650	1770	0	1400	0	980	0	0	0
37	0.0	0.82	2	460	550	2540	0	700	0	1600	0	0	0
38	1.0	0.55	6	0	650	1800	0	1200	0	2000	0	0	0
39	0.0	0.36	10	30	600	2750	0	700	0	3450	0	0	0
40	0.0	1.07	10	0	400	4400	0	0	1000	1250	0	0	0
41	0.0	1.07	10	0	800	1700	0	900	0	500	0	0	0
42	0.0	1.07	10	0	1200	1600	1200	0	0	600	0	0	0
43	0.0	1.00	6	0	800	800	0	800	0	300	0	0	0
44	0.0	0.91	6	0	800	1000	0	900	0	800	0	0	0
45	0.0	0.84	4	0	1200	1900	800	0	0	600	0	0	0
46	1.0	0.50	6	0	1000	1200	0	900	0	500	0	0	0
47	0.0	0.68	6	0	1200	1600	0	0	0	400	0	0	0
48	1.0	0.46	6	0	1000	1400	0	1200	0	800	0	0	0
49	1.0	0.50	4	0	1000	1600	0	800	1000	800	0	0	0
50	0.0	0.68	6	0	2000	1600	0	1200	0	400	0	0	0

Case	Sick	Family farm labour	Headedu (Education)	Wageinc	Icoffee	Iother	Igoat	Ipig	Ichick	Inonfrm	BSPS	ANZS	Formal savings
51	0.0	1.00	6	0	1300	1500	0	0	0	200	0	0	0
52	0.0	1.00	6	0	800	1400	0	800	0	400	0	0	0
53	0.0	1.07	10	0	1000	1600	0	1200	0	800	0	1000	1000
54	0.0	1.00	6	0	800	1070	0	800	0	150	0	0	0
55	0.0	1.00	6	0	800	1380	0	0	0	400	0	0	0
56	0.0	1.00	6	0	1200	1700	0	900	0	0	0	0	0
57	1.0	0.36	8	0	1300	1900	0	900	0	450	0	0	0
58	1.0	0.71	3	0	1300	2060	0	800	0	700	0	0	0
59	1.0	0.25	6	0	1200	1380	0	800	0	600	0	0	0
60	0.0	0.66	2	0	3000	15900	0	0	0	70000	0	10000	10000
61	0.0	1.07	10	0	1000	1550	0	0	0	700	0	0	0
62	0.0	0.91	6	0	1000	1600	0	800	0	500	0	0	0
63	0.0	0.91	10	0	1600	2700	0	600	0	700	0	0	0
64	0.0	0.84	6	0	1000	1650	0	800	0	500	0	0	0
65	0.0	1.07	10	0	400	400	0	0	0	1200	0	1500	1500
66	0.0	1.00	6	0	600	440	0	800	0	200	0	0	0
67	0.0	0.77	12	600	650	2100	0	0	0	1400	1500	0	1500
68	0.0	1.07	10	0	200	450	0	0	0	300	0	0	0
69	0.0	0.71	6	0	400	1450	0	1400	0	1000	0	0	0
70	0.0	1.15	0	0	400	1350	0	900	0	600	0	0	0
71	0.0	1.12	0	0	400	1200	0	800	0	1350	0	0	0
72	1.0	0.39	2	0	800	5990	0	900	0	4700	2500	0	2500
73	0.0	0.55	6	0	1400	6600	0	800	0	5500	0	250	250
74	0.0	0.84	4	0	600	1400	0	900	0	700	0	0	0
75	0.0	0.66	4	0	3300	5800	0	0	0	6500	2500	0	2500
76	1.0	0.79	0	0	1200	1400	0	1400	0	800	0	0	0
77	1.0	0.20	12	870	3000	900	0	0	0	1000	2000	0	2000
78	1.0	0.52	6	0	1000	1100	0	0	0	200	0	0	0
79	1.0	0.39	6	0	400	2280	0	800	0	150	0	0	0
80	0.0	0.78	3	0	800	1700	0	0	0	850	0	0	0
81	0.0	1.00	6	0	700	400	0	0	0	0	0	500	500
82	0.0	1.07	4	0	1000	570	0	0	0	200	0	0	0
83	0.0	0.67	7	0	1000	500	0	800	4000	0	1000	0	1000
84	0.0	0.47	10	0	800	700	0	0	0	0	0	0	0
85	0.0	1.07	6	0	1000	620	0	0	0	0	0	0	0
86	1.0	0.33	6	0	500	570	0	0	0	0	0	500	500
87	1.0	0.50	2	0	700	600	0	500	0	0	0	0	0
88	0.0	0.91	5	0	800	890	0	0	0	300	0	0	0
89	1.0	0.55	9	0	700	660	0	0	0	500	0	0	0
90	0.0	0.71	8	0	600	560	0	0	0	0	0	0	0
91	0.0	1.00	6	0	400	520	0	0	0	0	0	1000	1000
92	0.0	1.07	6	0	1000	620	0	0	0	200	0	0	0
93	0.0	1.00	3	0	1500	480	0	0	0	0	0	0	0
94	0.0	1.07	6	0	1500	1260	0	0	0	360	0	0	0
95	0.0	0.77	12	0	600	1860	0	0	0	300	0	0	0
96	0.0	1.00	9	0	500	470	0	900	0	0	500	0	500
97	0.0	1.00	10	0	1500	500	0	0	0	0	0	4000	4000
98	0.0	1.07	12	0	1000	850	0	0	0	0	0	0	0
99	0.0	1.00	7	0	700	750	0	0	0	0	0	0	0
100	0.0	0.84	6	0	1500	1520	0	800	0	500	1000	0	1000

Case	Sick	Family farm labour	Headedu (Education)	Wageinc	Icoffee	Iother	Igoat	Ipig	Ichick	Inonfrm	BSPS	ANZS	Formal savings
101	0.0	0.54	6	0	1000	1120	0	900	0	800	1000	0	1000
102	1.0	0.52	10	0	500	430	0	0	0	160	0	0	0
103	1.0	0.55	4	0	400	1120	0	800	0	200	500	0	500
104	0.0	1.00	8	0	1000	700	0	0	0	0	0	0	0
105	0.0	1.07	10	0	400	830	0	0	0	200	0	0	0
106	0.0	1.00	4	0	700	790	0	0	0	0	0	0	0
107	0.0	0.71	10	0	500	1290	0	0	0	200	0	500	500
108	0.0	0.84	6	0	1000	500	0	1000	0	800	0	0	0
109	0.0	0.84	6	0	900	1300	0	1000	0	600	0	0	0
110	0.0	1.00	7	0	200	900	0	0	0	300	0	0	0
111	0.0	0.57	3	0	400	450	0	0	0	200	0	0	0
112	0.0	1.00	6	0	200	0	0	0	0	200	0	0	0
113	0.0	1.00	10	0	2000	4000	0	800	0	600	1000	0	1000
114	0.0	0.43	8	0	4000	1270	0	700	0	600	1000	0	1000
115	0.0	0.68	6	0	3000	4800	0	1000	0	600	2000	0	2000
116	0.0	0.75	6	0	4000	1050	0	900	0	1000	0	0	0
117	0.0	1.07	10	0	800	2200	0	600	0	800	0	0	0
118	0.0	0.98	10	0	2000	1520	0	700	0	1000	0	1500	1500
119	1.0	0.33	10	0	3700	6428	0	1400	0	400	0	500	500
120	0.0	1.00	7	0	200	500	0	800	0	800	0	0	0
121	0.0	1.00	10	0	900	1450	0	0	0	550	0	0	0
122	0.0	1.20	0	0	700	1140	0	2000	0	800	0	0	0
123	0.0	0.67	6	0	0	4250	0	2000	0	8800	500	0	500
124	1.0	0.54	6	0	700	1630	0	1000	0	2200	0	0	0
125	0.0	0.68	8	0	1200	4400	0	1500	0	1500	500	0	500
126	0.0	1.00	8	0	600	750	0	0	0	1000	0	0	0
127	0.0	1.00	2	0	400	0	0	0	0	140	0	0	0
128	0.0	0.54	6	0	800	2250	0	600	0	1000	0	0	0
129	0.0	1.00	4	0	150	400	0	180	0	200	0	0	0
130	0.0	0.55	10	0	200	700	0	0	0	1150	0	0	0
131	0.0	1.00	10	0	200	1700	0	1800	0	450	0	0	0
132	2.0	0.26	10	0	600	2200	0	700	0	1700	150	0	150
133	0.0	1.07	4	0	100	1800	0	700	0	300	0	0	0
134	1.0	0.17	6	0	600	1800	0	700	0	550	0	0	0
135	2.0	0.22	6	0	400	1640	0	700	0	250	0	0	0
136	0.0	0.55	6	0	600	1210	0	800	0	350	0	0	0
137	0.0	1.07	8	0	1000	1050	0	140	0	800	0	0	0
138	0.0	1.00	2	0	400	450	0	0	0	400	0	0	0
139	0.0	0.66	6	0	400	1400	0	1400	0	650	0	0	0
140	0.0	0.68	2	0	400	1080	0	700	0	800	0	0	0
141	0.0	0.66	2	0	400	2100	0	800	0	1150	0	0	0
142	0.0	0.91	10	0	1400	3700	0	700	0	2000	2500	0	2500
143	0.0	0.71	6	0	600	1550	0	800	0	1000	0	0	0
144	0.0	0.56	2	0	800	2000	0	900	0	1600	0	0	0
145	1.0	0.34	10	0	2000	1350	0	1800	0	500	500	0	500
146	0.0	0.56	10	0	1000	1000	0	800	0	300	2000	0	2000
147	0.0	1.07	6	0	100	550	0	500	0	350	0	0	0
148	0.0	0.91	8	0	400	10700	0	500	0	3200	1000	0	1000
149	0.0	1.15	10	0	400	1200	0	700	0	1000	0	0	0
150	1.0	0.66	2	600	600	450	0	800	0	500	0	0	0

Case	GoatN	Goat value	PigN	Pig value	Liquidity	CofsdK	CofhysdK	CofertK	CofchemK	Investment in coffee inputs	High or low investor
1	0	0	3	1200	5400	0	0	0	75	75	0
2	0	0	1	400	970	40	0	0	100	140	1
3	3	450	5	2000	5730	0	0	0	100	100	1
4	0	0	0	0	750	0	0	0	100	100	1
5	2	300	2	800	1600	0	0	0	80	80	0
6	7	1050	4	1600	4030	0	0	0	120	120	1
7	0	0	7	2800	3910	0	0	0	0	0	0
8	2	300	0	0	1430	0	0	0	100	100	1
9	3	450	1	400	1610	0	0	0	50	50	0
10	0	0	4	1600	4100	0	0	0	0	0	0
11	0	0	5	2000	3700	0	0	0	40	40	0
12	1	150	3	1200	1850	0	0	0	0	0	0
13	0	0	5	2000	3310	0	0	0	0	0	0
14	0	0	3	1200	1600	0	0	0	100	100	1
15	0	0	6	2400	9900	0	0	0	70	70	0
16	0	0	1	400	2590	0	0	0	0	0	0
17	3	450	2	800	2800	0	0	0	40	40	0
18	1	150	1	400	2520	0	0	0	40	40	0
19	3	450	4	1600	4750	30	0	0	100	130	1
20	0	0	1	400	4950	0	0	0	70	70	0
21	0	0	2	800	2710	0	0	0	30	30	0
22	0	0	2	800	2100	0	0	0	35	35	0
23	8	1200	0	0	4150	0	0	0	80	80	0
24	0	0	6	2400	7250	0	0	0	80	80	0
25	0	0	8	3200	12850	0	0	0	100	100	1
26	2	300	4	1600	9070	58	0	0	100	158	1
27	1	150	7	2800	10270	50	0	0	100	150	1
28	0	0	6	2400	10700	30	0	0	150	180	1
29	0	0	8	3200	8450	0	0	0	100	100	1
30	0	0	6	2400	6200	20	0	0	100	120	1
31	0	0	8	3200	8300	20	0	0	70	90	0
32	0	0	8	3200	9950	30	0	0	100	130	1
33	0	0	6	2400	8510	20	0	0	100	120	1
34	0	0	6	2400	10760	0	0	0	50	50	0
35	2	300	6	2400	11950	0	300	0	100	400	1
36	0	0	6	2400	7200	0	0	0	100	100	1
37	0	0	5	2000	7850	0	0	0	100	100	1
38	0	0	4	1600	7250	50	150	0	70	270	1
39	0	0	6	2400	9930	0	150	0	100	250	1
40	1	150	0	0	7200	0	0	0	100	100	1
41	0	0	7	2800	6700	30	0	0	120	150	1
42	10	1500	0	0	6100	40	0	0	150	190	1
43	0	0	4	1600	4300	30	0	0	80	110	1
44	0	0	7	2800	6300	30	0	0	200	230	1
45	7	1050	4	1600	7150	0	0	0	100	100	1
46	0	0	7	2800	6400	30	0	0	100	130	1
47	0	0	7	2800	6000	50	0	0	100	150	1
48	0	0	10	4000	8400	40	0	0	100	140	1
49	0	0	1	400	5600	0	0	0	100	100	1
50	0	0	10	4000	9200	0	0	0	120	120	1

Case	GoatN	Goat value	PigN	Pig value	Liquidity	CofsdK	CofhysdK	CofertK	CofchemK	Investment in coffee inputs	High or low investor
51	0	0	4	1600	4600	40	0	0	120	160	1
52	0	0	5	2000	5400	30	0	0	100	130	1
53	0	0	6	2400	8000	30	0	0	100	130	1
54	0	0	4	1600	4420	30	0	0	100	130	1
55	0	0	5	2000	4580	40	0	0	80	120	1
56	0	0	4	1600	5400	0	0	0	120	120	1
57	0	0	7	2800	7350	40	0	0	150	190	1
58	0	0	10	4000	8860	40	0	0	120	160	1
59	0	0	7	2800	6780	30	0	0	80	110	1
60	0	0	3	1200	100100	0	0	0	200	200	1
61	0	0	4	1600	4850	30	0	0	100	130	1
62	0	0	4	1600	5500	40	0	0	200	240	1
63	0	0	6	2400	8000	0	0	0	120	120	1
64	0	0	7	2800	6750	40	0	0	100	140	1
65	0	0	0	0	3500	50	0	0	70	120	1
66	0	0	4	1600	3640	30	0	0	100	130	1
67	0	0	4	1600	7850	0	0	50	70	120	1
68	0	0	1	400	1350	0	0	0	100	100	1
69	0	0	4	1600	5850	0	0	0	150	150	1
70	0	0	6	2400	5650	0	0	0	100	100	1
71	0	0	4	1600	5350	0	0	0	100	100	1
72	0	0	4	1600	16490	0	0	0	100	100	1
73	0	0	6	2400	16950	0	0	0	100	100	1
74	0	0	6	2400	6000	20	0	0	70	90	0
75	0	0	4	1600	19700	0	0	0	200	200	1
76	0	0	8	3200	8000	0	0	0	100	100	1
77	0	0	6	2400	10170	200	200	0	200	600	1
78	0	0	5	2000	4300	0	0	0	80	80	0
79	0	0	7	2800	6430	20	0	0	80	100	1
80	0	0	5	2000	5350	0	0	0	120	120	1
81	0	0	2	800	2400	20	0	0	60	80	0
82	0	0	5	2000	3770	40	0	0	120	160	1
83	0	0	12	4800	12100	30	0	0	120	150	1
84	0	0	0	0	1500	25	0	0	120	145	1
85	0	0	3	1200	2820	40	0	0	120	160	1
86	0	0	3	1200	2770	0	0	0	80	80	0
87	0	0	10	4000	5800	0	0	0	80	80	0
88	0	0	8	3200	5190	0	0	0	120	120	1
89	0	0	4	1600	3460	0	0	0	80	80	0
90	0	0	3	1200	2360	30	0	0	80	110	1
91	0	0	2	800	2720	20	0	0	60	80	0
92	0	0	4	1600	3420	0	0	0	100	100	1
93	0	0	3	1200	3180	0	0	0	120	120	1
94	0	0	3	1200	4320	40	0	0	140	180	1
95	4	600	0	0	3360	0	0	0	80	80	0
96	0	0	4	1600	3970	30	0	0	60	90	0
97	0	0	2	800	6800	60	0	0	150	210	1
98	0	0	4	1600	3450	60	0	0	120	180	1
99	0	0	3	1200	2650	40	0	0	80	120	1
100	0	0	1	400	5720	40	0	0	80	120	1

Case	GoatN	Goat value	PigN	Pig value	Liquidity	CofsdK	CofhysdK	CofertK	CofchemK	Investment in coffee inputs	High or low investor
101	0	0	7	2800	7620	0	0	0	80	80	0
102	0	0	4	1600	2690	0	0	0	80	80	0
103	0	0	7	2800	5820	20	0	0	100	120	1
104	0	0	4	1600	3300	40	0	0	80	120	1
105	0	0	3	1200	2630	20	0	0	80	100	1
106	0	0	2	800	2290	0	0	0	80	80	0
107	0	0	3	1200	3690	40	0	0	80	120	1
108	0	0	1	400	3700	20	0	0	100	120	1
109	0	0	7	2800	6600	40	0	0	120	160	1
110	0	0	0	0	1400	0	0	0	30	30	0
111	0	0	0	0	1050	0	0	0	60	60	0
112	0	0	2	800	1200	0	0	0	0	0	0
113	0	0	2	800	9200	500	0	0	300	800	1
114	0	0	4	1600	9170	400	0	0	200	600	1
115	0	0	4	1600	13000	200	50	0	100	350	1
116	0	0	6	2400	9350	50	0	0	60	110	1
117	0	0	2	800	5200	50	0	0	70	120	1
118	0	0	6	2400	9120	100	0	0	30	130	1
119	0	0	5	2000	14428	400	0	0	300	700	1
120	0	0	4	1600	3900	0	0	0	0	0	0
121	0	0	0	0	2900	50	0	0	50	100	1
122	0	0	7	2800	7440	20	0	0	0	20	0
123	0	0	8	3200	18750	50	0	0	0	50	0
124	0	0	8	3200	8730	0	0	0	70	70	0
125	0	0	8	3200	12300	30	0	0	100	130	1
126	0	0	1	400	2750	0	0	0	70	70	0
127	0	0	3	1200	1740	0	0	0	0	0	0
128	0	0	3	1200	5850	0	0	0	60	60	0
129	0	0	1	400	1330	0	0	0	40	40	0
130	0	0	1	400	2450	0	0	0	40	40	0
131	0	0	4	1600	5750	20	0	0	76	96	0
132	0	0	4	1600	6950	20	0	0	60	80	0
133	0	0	4	1600	4500	0	0	0	30	30	0
134	0	0	2	800	4450	0	0	0	30	30	0
135	0	0	3	1200	4190	0	0	0	70	70	0
136	0	0	1	400	3360	0	0	0	35	35	0
137	0	0	5	2000	4990	80	0	0	80	160	1
138	0	0	20	8000	9250	0	0	0	30	30	0
139	0	0	6	2400	6250	0	0	0	50	50	0
140	0	0	6	2400	5380	0	0	0	40	40	0
141	0	0	6	2400	6850	0	0	0	70	70	0
142	0	0	2	800	11100	0	0	0	70	70	0
143	0	0	6	2400	6350	0	0	0	40	40	0
144	0	0	4	1600	6900	0	0	0	70	70	0
145	0	0	6	2400	8550	0	0	0	200	200	1
146	0	0	6	2400	7500	0	0	0	60	60	0
147	0	0	4	1600	3100	0	0	0	50	50	0
148	0	0	2	800	16600	0	0	0	70	70	0
149	0	0	4	1600	4900	0	0	0	30	30	0
150	0	0	1	400	3350	0	0	0	30	30	0

Case	Visits (Extension)	Give (Wantok tax)	Tel	Post	Bus	Hospital	Tcoffee	Transaction cost
1	2	300	4.0	4.0	1.0	4.0	4.0	17.0
2	0	200	4.0	4.0	1.0	4.0	3.0	16.0
3	0	100	3.0	3.0	1.0	3.0	3.0	13.0
4	0	250	3.0	3.0	0.5	3.0	3.0	12.5
5	0	100	3.0	3.0	0.5	3.0	3.0	12.5
6	3	100	3.0	3.0	0.5	2.0	3.0	11.5
7	4	250	3.0	3.0	0.5	3.0	3.0	12.5
8	2	100	3.0	3.0	0.5	3.0	3.0	12.5
9	2	300	3.0	3.0	0.5	3.0	3.0	12.5
10	0	100	2.0	2.0	1.0	2.0	3.0	10.0
11	0	200	3.0	3.0	0.5	3.0	3.0	12.5
12	0	300	3.0	3.0	0.5	3.0	3.0	12.5
13	4	100	3.0	3.0	0.5	3.0	3.0	12.5
14	0	100	3.0	3.0	0.5	3.0	3.0	12.5
15	1	250	4.0	4.0	1.0	4.0	4.0	17.0
16	0	300	4.0	4.0	1.0	4.0	4.0	17.0
17	0	300	3.0	3.0	0.5	3.0	3.0	12.5
18	0	200	3.0	3.0	0.5	3.0	3.0	12.5
19	4	100	2.0	2.0	1.0	2.0	3.0	10.0
20	1	200	4.0	4.0	1.0	4.0	3.0	16.0
21	4	150	4.0	4.0	1.0	5.0	4.0	18.0
22	0	200	4.0	4.0	1.0	4.0	4.0	17.0
23	1	200	4.0	4.0	1.0	4.0	4.0	17.0
24	3	250	6.0	6.0	1.0	6.0	4.0	23.0
25	3	250	1.0	1.0	0.5	1.0	2.0	5.5
26	1	300	3.0	3.0	0.8	3.0	3.0	12.8
27	3	300	3.0	3.0	0.8	3.0	3.0	12.8
28	1	250	3.0	3.0	0.8	3.0	3.0	12.8
29	3	150	3.0	3.0	0.8	3.0	3.0	12.8
30	1	300	3.0	3.0	0.5	3.0	3.0	12.5
31	2	350	3.0	3.0	0.5	3.0	3.0	12.5
32	2	150	3.0	3.0	0.8	3.0	3.0	12.8
33	2	350	3.0	3.0	0.5	3.0	3.0	12.5
34	1	350	2.0	2.0	0.5	2.0	3.0	9.5
35	1	100	2.0	2.0	1.0	2.0	2.0	9.0
36	3	300	3.0	3.0	0.5	3.0	2.0	11.5
37	4	200	3.0	3.0	0.5	3.0	2.0	11.5
38	1	100	3.0	3.0	0.5	3.0	2.0	11.5
39	3	200	3.0	3.0	3.0	3.0	2.0	14.0
40	1	250	3.0	3.0	0.5	3.0	2.0	11.5
41	0	100	2.0	2.0	1.0	2.0	3.0	10.0
42	0	100	2.0	2.0	1.0	2.0	3.0	10.0
43	0	200	2.0	2.0	1.0	2.0	3.0	10.0
44	0	100	2.0	2.0	1.0	2.0	3.0	10.0
45	0	100	2.0	2.0	0.5	3.0	3.0	10.5
46	0	100	2.0	2.0	1.0	2.0	3.0	10.0
47	0	100	2.0	2.0	1.0	2.0	3.0	10.0
48	0	200	2.0	2.0	1.0	2.0	3.0	10.0
49	0	100	2.0	2.0	1.0	2.0	3.0	10.0
50	0	100	2.0	2.0	1.0	2.0	3.0	10.0

Case	Visits (Extension)	Give (Wantok tax)	Tel	Post	Bus	Hospital	Tcoffee	Transaction cost
51	0	100	2.0	2.0	1.0	3.0	3.0	11.0
52	0	100	2.0	2.0	1.0	2.0	3.0	10.0
53	0	100	2.0	2.0	1.0	2.0	3.0	10.0
54	0	100	2.0	2.0	1.0	3.0	2.0	10.0
55	0	100	3.0	3.0	1.0	3.0	3.0	13.0
56	0	100	2.0	2.0	1.0	3.0	2.0	10.0
57	0	200	2.0	2.0	1.0	2.0	3.0	10.0
58	0	200	3.0	3.0	1.5	3.0	2.0	12.5
59	0	100	2.0	2.0	0.5	3.0	3.0	10.5
60	4	350	0.5	0.5	0.5	1.0	1.0	3.5
61	0	100	2.0	2.0	1.0	2.0	3.0	10.0
62	0	100	2.0	2.0	1.0	2.0	2.0	9.0
63	0	100	2.0	2.0	1.0	2.0	3.0	10.0
64	0	100	2.0	2.0	1.0	2.0	3.0	10.0
65	1	250	3.0	3.0	0.8	3.0	3.0	12.8
66	0	100	2.0	2.0	1.0	2.0	2.0	9.0
67	2	250	3.0	3.0	0.5	3.0	3.0	12.5
68	1	150	3.0	3.0	0.5	3.0	3.0	12.5
69	1	250	3.0	3.0	0.8	3.0	3.0	12.8
70	1	250	3.0	3.0	0.8	3.0	3.0	12.8
71	1	150	3.0	3.0	0.5	3.0	3.0	12.5
72	2	350	3.0	3.0	0.5	3.0	2.0	11.5
73	1	250	1.0	1.0	0.5	1.0	2.0	5.5
74	1	250	3.0	3.0	0.5	3.0	3.0	12.5
75	3	150	0.5	0.5	0.5	3.0	3.0	7.5
76	1	250	3.0	3.0	1.0	3.0	4.0	14.0
77	0	100	1.0	1.0	0.3	2.0	3.0	7.3
78	0	200	2.0	2.0	0.5	3.0	3.0	10.5
79	0	150	3.0	3.0	0.5	3.0	3.0	12.5
80	0	200	2.0	2.0	0.5	3.0	3.0	10.5
81	0	100	3.0	2.0	0.5	3.0	3.0	11.5
82	0	100	2.0	2.0	0.5	3.0	3.0	10.5
83	0	150	2.5	2.5	0.5	3.0	2.5	11.0
84	0	100	2.0	2.0	0.3	3.0	4.0	11.3
85	0	100	2.5	2.5	0.5	3.0	3.0	11.5
86	0	100	2.0	2.0	0.5	2.0	2.0	8.5
87	0	100	2.0	2.0	0.5	3.0	3.0	10.5
88	0	100	2.0	2.0	0.5	3.0	3.0	10.5
89	0	200	2.0	2.0	0.3	3.0	3.0	10.3
90	0	100	1.0	1.0	0.5	2.0	3.0	7.5
91	0	100	2.0	2.0	0.3	3.0	3.0	10.3
92	0	200	2.0	2.0	0.5	3.0	3.0	10.5
93	0	100	2.0	2.0	0.5	3.0	3.0	10.5
94	0	200	2.0	2.0	0.5	3.0	3.0	10.5
95	0	200	2.0	2.0	0.5	3.0	3.0	10.5
96	0	100	2.0	2.0	0.5	3.0	3.0	10.5
97	0	200	2.5	2.5	0.5	3.0	3.0	11.5
98	0	100	1.0	1.0	0.5	2.0	2.0	6.5
99	0	100	2.0	2.0	0.5	3.0	3.0	10.5
100	0	100	2.0	2.0	0.5	2.5	3.0	10.0

Case	Visits (Extension)	Give (Wantok tax)	Tel	Post	Bus	Hospital	Tcoffee	<i>Transaction cost</i>
101	0	100	1.0	1.0	0.5	2.5	3.0	<i>8.0</i>
102	0	100	2.0	2.0	0.5	3.0	3.0	<i>10.5</i>
103	0	100	2.0	2.0	1.0	2.0	2.0	<i>9.0</i>
104	0	100	1.0	1.0	0.5	2.0	2.0	<i>6.5</i>
105	0	150	2.0	2.0	0.5	2.5	3.0	<i>10.0</i>
106	0	200	2.0	2.0	0.5	3.0	3.0	<i>10.5</i>
107	0	200	2.0	2.0	0.5	3.0	3.0	<i>10.5</i>
108	0	100	2.0	1.5	1.0	2.0	3.0	<i>9.5</i>
109	0	100	3.0	3.0	1.5	3.0	3.0	<i>13.5</i>
110	4	100	1.0	2.0	1.0	0.5	2.0	<i>6.5</i>
111	4	150	1.0	2.0	1.0	1.0	2.0	<i>7.0</i>
112	0	200	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
113	4	400	2.0	2.0	0.8	2.0	2.0	<i>8.8</i>
114	8	300	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
115	10	400	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
116	10	400	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
117	12	200	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
118	4	400	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
119	3	500	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
120	0	50	2.0	2.0	0.5	2.0	2.0	<i>8.5</i>
121	3	200	2.0	2.0	2.0	2.0	2.0	<i>10.0</i>
122	10	200	3.0	3.0	0.5	2.0	2.0	<i>10.5</i>
123	3	500	3.0	3.0	0.5	3.0		
124	6	300	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
125	3	100	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
126	6	100	3.0	3.0	0.5	3.0	4.0	<i>13.5</i>
127	0	300	4.0	4.0	0.8	3.0	1.0	<i>12.8</i>
128	0	150	3.0	3.0	0.5	3.0	4.0	<i>13.5</i>
129	4	50	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
130	2	100	1.5	3.0	0.5	3.0	3.0	<i>11.0</i>
131	4	200	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
132	2	150	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
133	0	250	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
134	2	100	3.0	3.0	0.8	3.0	3.0	<i>12.8</i>
135	4	150	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
136	4	150	3.0	3.0	0.5	3.0	4.0	<i>13.5</i>
137	3	50	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
138	2	150	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
139	0	150	3.0	3.0	0.5	3.0	4.0	<i>13.5</i>
140	0	150	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
141	5	200	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
142	2	200	3.0	3.0	0.5	3.0	15.0	<i>24.5</i>
143	3	200	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
144	4	250	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
145	0	150	2.0	2.0	1.0	2.0	3.0	<i>10.0</i>
146	0	200	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
147	0	150	0.5	3.0	3.0	3.0	3.0	<i>12.5</i>
148	2	150	4.0	4.0	0.5	4.0	4.0	<i>16.5</i>
149	4	200	3.0	3.0	0.5	3.0	3.0	<i>12.5</i>
150	0	200	4.0	6.0	1.0	4.0	2.0	<i>17.0</i>

Note: Italics represent computed variables and their data values