Agriculture and Rural Development: The Case of Fiji

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Zhongwei Xing

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Abstract

Agricultural growth remains a key pillar for economic development in developing agriculture-based economies, however difficulties remained to integrate rural development, food value chains, technological and institutional innovations, environmental constraints that have changed in the context of agriculture's role. The renewed attention on 'new agriculture for development' framework started to emerge to achieve several dimensions of development. This thesis empirically investigates the issues pertaining to new agriculture for development that can benefit economic growth and address the socio-economic dimensions of development in the case of Fiji. Utilising Fiji's Household Income and Expenditure Survey 2008-09 dataset the study examines macro-micro-level role of agriculture that corresponds to new objectives and apply this approach to evaluate the agricultural efficiency-development linkages.

The empirical methodologies apply appropriate time series, novel cross-sectional approaches, new agricultural indicators and its determinants that examines (1) the impact of agriculture and other sectors to enhance agriculture efficiency; (2) moving beyond farm income by assessing off-farm labour participation and supply allocation decisions in the agricultural households. To achieve desired dimensions of development beyond those driven by market competiveness, (3) the role of remittances in the agricultural production estimations provide a new direction and finding to increase income and identify the causes of success for scaling up agricultural output, followed by (4) reducing poverty and inequality in agricultural households.

In addition to contributing to the broader debates about agriculture-economic development nexus, the findings are also the first on applying new agriculture for development framework in Fiji's case. Results demonstrate that there exist sectoral linkages and to increase economic diversification developing forward linkages through innovations are crucial and advantageous for growth. Findings of double-hurdle factors indicate the push and pull factors that influence household heads' decision to participate and allocate time in off-farm income-generating activities. This implies that demand for labour, even for low-wage workers will not increase without a dynamic rural economy. The failure of low-wage and subsistence living depends on availability of land tenure and investment in agro-based industry clusters. The effects of remittances on agricultural production and diversification show that remittances tend to encourage households to be more diversified in farming, and to grow more cash crops. Findings show that non-farm household income sources contribute significantly towards poverty reduction of the agricultural households. Policies aimed at low-wage to reduce income gaps and creating employment opportunities could exhibit higher labour productivity.

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List of Abbreviations

ADB	Asian Development Bank
ADLI	Agricultural Demand-led Industrialisation
AIS	Agricultural Innovation System
ARDL	Autoregressive Distributed Lag
EIU	The Economist Intelligence Unit
EU	European Union
FAO	Food and Agriculture Organisation
FFV	Fresh Fruit and Vegetables
FIBOS	Fiji Islands Bureau of Statistics
FOCs	First Order Conditions
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
HIES	Households and Income and Expenditure Survey
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
MDGs	Millennium Development Goals
MFNP	Ministry of Finance and National Planning
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PICS	Pacific Island Countries
RBF	Reserve Bank of Fiji
SBC	Schwarz Bayesian Criterion
SUR	Seemingly Unrelated Regression
TFF	Tax Free Factory
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
VAR	Vector Autoregressive
WB	World Bank
WTO	World Trade Organisation

Chapter 1

Introduction

1.1 Background to the Study

The attention on accelerating economic growth, reducing poverty and vulnerability, and narrowing rural-urban disparities for developing countries is through agriculture development. The renewed focus is on 'new agriculture for development' framework to benefit economic growth and address the socio-economic dimensions of development (especially for rural development). An estimated magnitude of over 45 percent of the population in developing countries live in households involved in agriculture and 27 percent in smallholder households, with a large proportion dependent on agriculture for their livelihoods (World Bank, 2007). The agricultural sector generates on average 29 percent of gross domestic product (GDP), employs 65 percent of the labour force in agriculture-based countries, and is key to generating overall growth (ibid, 2007). The recent report by the International Fund for Agricultural Development (IFAD) (2013) estimates that over 1.4 billion poor people are living on less than US$1.25 a day, and over 70 percent of them live in rural areas where agriculture is their main source of livelihood.

There are several reasons for the growing awareness of the role that agriculture plays in the economic and rural development in developing countries. First, agriculture provides the largest source of employment in many countries and will remain the leading economic sector due to its comparative advantage. Moreover, agricultural productivity growth is the primary driver of global poverty reduction initiatives by directly raising the farmers' incomes and contributing indirectly to the reduction of food poverty. According to Kim, Larsen and Theus (2009), the potential growth of the agriculture sector to reduce poverty is four times greater than that from other sectors in the economy. Second, accelerated agricultural growth is widely transformative, that is the growth in farm incomes raises the demand for industrial goods, lowers food prices, curbs inflation, and overall growth increases the demand for unskilled workers. Third, rising agricultural productivity can also encourage broad entrepreneurial activities such as diversification into new products, growth of rural service sectors, emergence of agro-processing industries, and expansion into new markets (Diao, Fan, Headey, Johnson, Pratt, & Yu 2008).

Globalising markets for agricultural products, far-reaching developments in technology, and equally transformative evolution in institutions (including new roles for the state, the private sector, and civil society) have also been altering agriculture's social and economic landscape over the past few decades (World Bank, 2007). Through trade and international agreements, global changes have increasingly affected development options for both industrialised and developing economies. At the national level, continued population growth, expanding economies, and urbanisation have, especially in densely-populated areas, led to unprecedented competition for land and water resources between agriculture and other uses such as infrastructure, urban, industry, and recreation/nature (Todaro & Smith, 2012). It has been noted that, in recent years, growth in agriculture has increasingly occurred in a context where private entrepreneurs coordinate extensive value chains by linking producers to consumers, sometimes across vast distances (Ponte & Gibbon, 2005; Swinnen, 2007; World Bank 2012).

The global agri-food system embodies transformative processes, which operates within and across interconnected political, economic, and social spheres of activity, and have implications for all people. Agricultural production of food, fibre, fuels and an increasing wide range of commodities and industrial inputs have become an integral part to the livelihoods of over 2.6 billion people, the vast majority of whom live in developing countries on incomes of less than $2 per day (World Bank, 2007). Since the 2006-2008 food price crisis and the 2008-2009 global financial meltdown the United Nations Food and Agriculture Organisation (FAO) estimates that about 1.02 billion people are currently undernourished and many of them are rural dwellers (FAO, 2009). In particular, the food crisis of 2007-2008 has shown that producing food is not only an imperative for food security, but is a strategic option for economic development (FAO, 2011).

The nutritional needs and cultural importance of food has changed from commodification of food to the emergence of an increasingly buyer-driven global agri-food system within which transnational firms' state the terms of production and exchange along the entire global value chains (Gereffi, 1994; Ponte & Gibbon, 2005). In addition, bifurcated patterns of food consumption have also emerged where consumers in most Organisation for Economic Co-operation and Development (OECD) countries expect safety, quality, variety, convenience, service as well as low prices from the food system and also demand that production and processing methods are environmentally sustainable, animal friendly, and operated within recognised labour and social standards (Swinnen, 2007). He further notes that these newer demands overlay the already ongoing transformation of food demand due to changes in the labour market participation, demographics, rising incomes, information technologies, and the

leisure home-production trade-off. On the other hand, a low-income level of a large portion of the population in developing countries has resulted in the shift in food expenditure away from the protein- and nutrient-rich foods towards cheaper calorie-rich, and energy-dense foods like grains (FAO, 2009).

The World Bank's *Agriculture for Development* report (2007) points out that agriculture is vital to move hundreds of millions of rural poor out of poverty by focusing on smallholder farming and animal husbandry, employment in the high-value products, and entrepreneurship and jobs in the emerging rural, nonfarm economy. This report notes that this can be achieved by, firstly, increasing the productivity and competitiveness of agriculture in general and creating opportunities for rural non-farm employment, and secondly, by increasing the assets and capabilities of small-scale farm households.

A recent study by Elizaphan and Qaim (2011) suggests that an agribusiness-led development strategy, with stronger productivity growth in the agribusiness value chain system, offers a better opportunity for a rapid and broad-based economic growth and poverty reduction in developing countries that have a greater number of smallholder farmers. This is also consistent with the findings in a report by the United Nations Industrial Development Organisation (UNIDO) that expansion of employment through downstream agro-industrial processing value chains may be one of the few local paths out of poverty for small-scale farmers (UNIDO, 2008).

Innovation and technological advancements in agriculture are essential to reducing poverty, fostering development, and stimulating economic growth in many developing countries (World Bank, 2012). Recognising the need to move from supply-driven to demand-driven innovation, the agricultural innovation system (AIS) approach includes the farmer as part of a complex network of heterogeneous actors engaged in innovation processes, along with the formal and informal institutions and policy environment that influence these processes. In addition, the AIS framework views innovation as a complex web of related individuals and organisations (such as private industry and collective action organisations) all of whom contribute towards the application of new or existing information and knowledge. It also addresses issues such as the capacity of individuals and organisations to learn, change, and innovate; the nature of iterative and interactive learning processes among innovation agents; and the types of interventions that enhance such capacities and processes (ibid).

The experiences of developing countries have shown that while they have been incorporated into the global economy as agricultural exporters, the social, economic, and environmental costs and benefits have been inequitably distributed (Kay, 1997, 2009). Moreover, while some nations have turned to a growing number of entrepreneurial smallholders to enter the agricultural value chains, others have struggled due to economic marginalisation having being excluded from such opportunities. In addition international competition, the process of modernisation, and barriers to markets (e.g. quarantine, food safety standards, quotas etc.) have tended to drive consolidation within national agricultures thus eliminating smallholder farmers (Bryceson, Kay & Mooij, 2000; McCullough, Pingali, & Stamoulis, 2008; Araghi, 2009).

The agriculture sector in Fiji is undergoing a structural change both due to the pressure of commercialisation and increased dependence on trade, especially imports. Thus, the government policies have become the main driving force in the structural changes introduced with diversification of crops implemented to support this sector (Ministry of Primary Industry, 2009). One of the important bottlenecks highlighted by many analysts of Fiji's agricultural sector is the small size of holdings and the inability of local farmers to compete with large scale farming in the West (Barbour & McGregor, 1998; Narayan & Prasad, 2003; Vorelevu & Bhati, 2006; Nacoke, 2007; Young & Vinning, 2007; Asafu-Adjaye, 2008; Haszler, Hone, Graham, & Doucouliagos, 2010; Kumar & Bhati, 2010).

One of the ways to deal with the small-scale farm operations is to bring small and marginal farm holders together under a common production system so as to deal with a particular product (Barbour & McGregor, 1998; Young & Vinning, 2007; Haszler et al., 2010). This requires, first, access to technology by the small and marginal farmers, which has been quite restricted as currently, technology is only available to those who have the capacity to gather and obtain information at a fast speed. Second, small and marginal farmers face price discrimination both in the factor and product markets, resulting in reduced net income flows. Lastly, the capability of small and marginal farmers has always been far better than their larger holding peers in terms of productivity and quality of land but they have limited access to technology (Barbour & McGregor, 1998; Young & Vinning, 2007; Haszler et al., 2010).

At the micro-level, it has also been witnessed that technology transfer is seen to be a pre-requisite for increasing productivity, as well as for transforming subsistence to commercial farming in order to achieve poverty reduction. However, it is a common phenomenon that farmers, like any other kind of entrepreneurs, do not simultaneously adopt innovations as they

appear on the market (Rogers, 1995). Consequently some farmers choose to be innovators (first users) while others prefer to be early adopters, late adopters, or non-adopters (ibid, 1995). For instance, adoption of innovative agricultural practices and newly-developed high-yield seeds have been found to have little success and difficult to implement in Fiji, given that agriculture is a risky business and farmers constantly experience a number of risks and uncertainties. The studies by a number of researchers (Tavola, 1992; Ewins, 1992; Kinsey, Burger, & Gunning, 1998; Gounder, 1999; Firth, 2001) note a number of major challenges for farmers. These include market and non-market related uncertainties, fluctuations of input and output prices as well as non-market-related risks, such as climatic shocks, crop diseases, and pest epidemics in arable lands, and land tenure issues causing racial tensions between the major and minor ethnicities. As a result, fluctuations in farm income may lead to consumption instability and this can be highly undesirable, especially when an agriculture-dependent household is very poor.

At the macro-level, promoting high-value agriculture products and a competitive export agriculture sector as an engine for economic growth has always been the core of Fiji government's strategic vision (Ministry of Primary Industry, 2009). The government's commitment to promote exports is targeted through the implementation of its National Export Strategy (NES) together with support for natural resource-based industries, with the aim of increasing Fiji's self-sufficiency, and food security, and reducing its import dependency (ibid, 2009). This is to be achieved by building agri-business networks, promoting young farmers' training, recognition of industry priorities, and the integration of a professionalised and modernised smallholder agricultural sector to enhance its global agri-food supply chains. The vision of agriculture for development, therefore, is embodied in Fiji's national drive to become a self-sufficient and import independent island nation (Ministry of Primary Industry, 2009). These two strategies are crucial in the era of neo-globalisation.

This thesis argues that by shifting to high-value agriculture; decentralising nonfarm economic activity to rural areas; addressing income disparities; and the successful integration of these processes could enhance Fiji's economic growth thus enabling the country to achieve sustainable rural development. This study will examine the agriculture for development' hypotheses in which agriculture can be a fundamental instrument for rural development and poverty reduction with particular attention to agricultural households in Fiji. The next section discusses the aim, research rationale, and objectives of the study.

1.2 Aim, Objectives and Research Rationale

The aim of the thesis is to examine the new agriculture for development framework focusing on the agricultural households in Fiji by utilising an empirical analysis of the relationship between agriculture and rural development. The research rationale recognises that agriculture can work in concert with other sectors of the economy to promote growth, maintain food security and reduce poverty, thereby making the sector a unique instrument for rural development. As a source of growth for the national economy, agriculture can be a provider of investment opportunities for the private sector, and a prime driver of agriculture-related industries and the rural non-farm economy.

Fiji is an agriculture-based economy; its agriculture sector (including sugar, livestock and subsistence farming) generates income for approximately 65 percent of the total population (Ministry of Primary Industry, 2009). For Fiji to achieve a higher level of success in community development in rural areas, this study focuses on three key research domains, namely, agriculture and economic growth, small-scale farm agriculture and commercialisation, and farm households and their interactions with non-farm activities. The export-led growth hypothesis has considered the role of agriculture as the main determinant of economic growth and a tool for poverty reduction (Mellor, 1976; Triffin & Irz, 2006; Christiaensen, Demery, & Kuhl, 2006; Katircioglu, 2006; Chebbi, 2010; Jatuporn, Chien, Sukprasert, & Thaipakdee, 2011). As agriculture accounts for a large share of employment and national output in Fiji with over 67 percent of the workforce in the agriculture sector (Ministry of Primary Industry, 2009), growth in the agricultural sector will therefore play an important part in people's livelihoods, and provide a pathway out of poverty.

The second domain is linked to small-scale farmers, commercialisation and agri-food systems. As the livelihoods of smallholder farmers and the role of small-scale agriculture are valuable for growth and development, their importance in terms of socioeconomic sustainability and ecological viability for rural development is vital. Given the importance of small-scale agriculture in the island nations, its policy implications at both the national and global levels should be understood and effectively implemented to optimise the socioeconomic impacts of agri-food globalisation on the local economy. As small farm production can play a significant role in economic and rural development through supplying a significant portion of domestic food crop supplies and in generating income for low-income families (Reardon, Codron, Busch, Bingen, & Harris, 2001; Reardon & Berdegue, 2002), small-scale production of many high-value commercial crops can therefore be competitive along with large-scale production

(see Van Zyl, Millor, & Parker, 1996; Eastwood, Lipton & Newell, 2010). Thus, higher levels of efficiency from higher productivity of farm-family labour and lower supervision costs (Binswanger & Elgin, 1992) and family labour is considered more motivated in large farms to enhance agricultural output (Reardon et al., 2001).

In Fiji, many farmers practise subsistence farming, a mode of agriculture in which a plot of land produces only enough food for personal consumption (Barbour & McGregor, 1998). In this context, moving from pure subsistence crops to high-value cash crops can help these farmers gain access to income generating opportunities by selling their produce in the markets. However, most of the agricultural households do not live off farming alone. Analysis of single production systems has given way to an emerging view of rural households as diversified enterprises are not limited to the agricultural sector (Reardon, Stamoulis, Cruz, Balisacan, & Banks, 1998). This implies that non-farm income-generating activities can improve income generating capacities, even in subsistence-oriented regions. Workers' remittances can be an important source of development finance given that 60 percent of Fiji's skilled workers have either emigrated and/or gone overseas as guest workers (United Nations Department of Economic and Social Affairs, 2005, p.1). The fourth domain extends to examine the effects of income inequality and poverty reduction of the agricultural households in Fiji.

Utilising the 'new agriculture for development paradigm' noted above the objectives are created based on four distinct hypotheses of agricultural domains as follows:

1. To evaluate the impact of agriculture and other sectors to enhance agricultural efficiency;
2. To examine the impact of moving beyond farm income by assessing off-farm labour participation and supply allocation decisions in the agricultural households;
3. To analyse the role of remittances in the agricultural production to provide a new direction to increase income earnings through crop diversification and identify the causes of success for scaling up agricultural output; and
4. To examine poverty reduction and income inequality in the agricultural households.

Hence, the empirical chapters in this thesis measure the impact of, first, the extent to which agriculture sector contributes to Fiji's economy, as well as sectoral growth and linkages in the short- and long-run (chapter 3). Second, the evaluation in chapter 4 indicates the effect of the agricultural household member to participate in off-farm economic activities and labour supply allocation. Third, the assessment of remittances-agricultural production nexus is taken (chapter 5) to examine the sources of income on agricultural production and diversification.

Finally, several income measures are utilised to examine the sources of non-farm income of the agricultural households in chapter 6 to reduce poverty and income inequality in Fiji.

1.3 Data and Methodology

The empirical methodologies apply appropriate time series, novel cross-sectional approaches, new agricultural indicators and its determinants to examine agriculture as the basis for economic growth in Fiji that requires a productivity revolution in smallholder farming. The research methodologies employed here consist of theoretical and quantitative components to address the vital linkage in the nexus between agriculture and rural development in the case of Fiji. To address various hypotheses of the agriculture-economic growth nexus, off-farm labour participation, and supply allocation decision-making process, the role of remittances and non-farm income sources in the agricultural households will be examined using macro-level data for agriculture outputs and socioeconomic variables.

Models will be estimated for the hypotheses stated above using EVIEWS and STATA econometric packages for the time series and socioeconomic data. The methodologies used here include time series co-integration procedures for time series data for growth and productivity analysis. The double-hurdle model is utilised for the off-farm labour participation and supply allocation decisions in the agricultural households. This is estimated using the Household Income and Expenditure Survey (HIES) 2008-09 dataset for a total of 3,573 households that comprise of 6,094 persons in 1,201 agriculture-dependent households. In addition, the HIES 2008-09 will be used to further investigate the remittances-household consumption nexus, as well as the role of remittance income in agricultural production and diversification. The level of poverty and inequality is estimated at the regional and household types by agriculture and non-agriculture sectors utilising the HIES 2008-09 dataset.

The methodologies used for empirical investigation provide robustness checks using various model diagnostic tests that are discussed in detail in each chapter. The Vector Autoregressive (VAR) methodology and cointegration tests are used in chapter 3 utilising the bounds tests and Eigen and Trace test statistics to determine any causal relationships among the economic growth sectors. For robustness checks of the models Heckman model selection test (chapter 4) and Tobit restriction likelihood ratio tests have been applied. The Probit method applies likelihood tests (chapter 5) to indicate the robustness of the models. The mathematical models for poverty and inequality axioms are applied in chapter 6 to measure income inequality.

Hence, appropriate econometric methodologies and tests for the models based on each hypothesis are applied to obtain robust results that explain the findings and policy implications of the study.

1.4 Outline of Chapters

This thesis consists of seven chapters. In chapter 1 the Introduction provides the background, objectives and rationale of the study. Chapter 2 reviews the theoretical and empirical literature on the linkages between agriculture and welfare development. First, it discusses the contribution of agricultural sectors to economic growth and its association with non-agricultural sectors. Second, it provides an overview of the interactions between small-holder farmers and commercialisation, as well as the agri-food system and values chains in the context of globalisation. Third, it examines the literature on the effects of remittance income source on the consumption patterns of recipient households followed by exploring studies on the contribution of remittances in agricultural production and diversification. Finally, it provides an analysis of the level, depth and severity of poverty and income inequality for the period 2008-09.

Chapter 3 empirically examines whether the agricultural sector in Fiji is making its full potential contribution to economic growth. In addition, this chapter also explores the potential growth-enhancing factors that contribute to the food and crop productivity growth followed by analysing the agricultural crops production impacts and the inter-sectoral spillovers from the food manufacturing, hotels, and restaurants sectors in Fiji. The econometric methodologies applied to estimate the linkages between agriculture, manufacturing, non-manufacturing, transport and communication, and service sectors use the co-integration approach to examine the long- and short-run causality among these sectors.

Chapter 4 examines the agricultural household level determinants of off-farm labour participation and allocation decisions of adult members in Fiji. The double-hurdle econometric approach employed to capture one's decision of whether or not to participate in the off-farm labour market (the first hurdle), and the amount of working days the participant allocates to the off-farm work (the second hurdle). The model is estimated using a set of various demographic and socioeconomic variables for a total of 6,094 persons in 1,201 agriculture-dependent households derived from the HIES 2008-09 dataset.

Chapter 5 tests the three hypotheses as follows: 1) remittances and household consumption behaviour; 2) remittances and agricultural production; and 3) remittances and agricultural production diversification. The data analysis is based on the HIES data for 2008-09. A total of 3,573 households are included in the analysis of the remittances-household consumption nexus, of which 1,104 households receive remittance.

Chapter 6 examines the level, depth, and severity of poverty, followed by the analysis of income inequality based on the distribution of household income per Adult Equivalent (AE) per week in Fiji using HIES 2008-09 dataset. The household income is defined as the sum of the positive amount of all monetary income sources a household received in the period 2008-09. The total household is further divided into two major groups (i.e., earned income and un-earned income) and consists of eight income components out of the 61 items in the HIES 2008-09. This chapter also estimates the comprehensive effects of non-farm income and un-earned income components on poverty reduction.

Chapter 7 summarises the findings related to the influences of agriculture and rural development in Fiji that are examined at the macro- and micro-level in this thesis. It concludes the study by summarising the empirical findings, and presenting the overall conclusions and policy recommendations. The chapter ends with suggestions for future research and the key areas required for further agricultural sector analysis to improve growth and wellbeing.

Chapter 2

Literature Review

2.1 Introduction

According to the United Nations Industrial Development Organisation (UNIDO) (2008) forecasts, the world's population will grow from 6.7 billion in 2008 to 9 billion by 2050. To feed its 9 billion people by 2050 requires a 70 percent increase in total agricultural production, posing a major challenge to the world farmers to meet this target (Bruinsma, 2009; Burney, Davis, & Lobell, 2010; UNIDO, 2008).[1] As a result, attention has shifted back to the precise role of agriculture in development, while it also remains highly debated. The dual economy models developed in the 1960s and 1970s viewed agriculture as vital but its surplus labour did not add to productivity, thus excess labour and resources were to be drawn to encourage the development of the dynamic productive industrial sector (Lewis, 1954). Much of the development economics literature in the 1960-1980 period supported agricultural development but the post-1980s and 1990s period for many developing countries saw an inclination towards supporting an industrialisation strategy. This led to an urban bias in development planning (Lipton, 1977), and the development of fiscal and trade systems that systematically over-taxed agriculture (Krueger, Schiff, & Valdes, 1988).

An alternative view of agriculture as a leading sector (especially during the early stages of development) has also emerged. This followed the seminal contributions by Johnston and Mellor (1961) and Schultz (1964). They emphasised the critical contributions of agriculture to growth in other sectors, implying that investments and policy reforms in agriculture may actually promote faster overall economic growth, even though agriculture itself might grow at a slower pace than non-agriculture. Several studies have documented the existence of substantial multiplier effects from agriculture to non-agriculture, not only in Asia but also in Sub-Saharan Africa (Haggblade & Hazell, 1989; Hazell & Haggblade, 1991, 1993; de Janvry & Sadoulet, 2009).

The experience of the Green Revolution in Asia during the 1970s and 1980s, where traditional agriculture was rapidly transformed into a fast growing modern sector through the adoption of science-based technology provided further confidence in agriculture as an engine of growth.

[1] These estimates refer to a specific baseline scenario which excludes, among other elements, the effects of climate change on production. These issues have also been noted in the Food and Agriculture Organisation of the United Nations (FAO) (2006) report.

Nonetheless, this belief in the potential of the agricultural sector eroded gradually thereafter, especially in Sub-Saharan Africa, following the poor performance of many agricultural development projects, the secular decline in the world price of food and other primary commodities, and the rising appeal of East Asia's export-led manufacturing growth miracle (World Bank, 2007; Growth Commission, 2008).

The adoption of the Millennium Development Goals (MDGs) by the United Nations member states at the turn of the millennium further added a new dimension to the debate. It shifted the focus in development from fostering economic growth per se to encouraging poverty reduction. Since the latter not only depends on the rate of overall economic growth, but also on the ability of poor people to participate in that growth process, this rekindled the interest in the specific role of agriculture in the development process. The majority of poor people in the developing world depend on agriculture for their livelihood, and it is argued that the poor gained much more from Gross Domestic Product (GDP) growth originating in the agriculture sector and then from an equal amount of GDP growth generated from other sectors. Therefore, achieving the 'pro-poor' or 'shared' growth, that is growth with a maximum pay-off in terms of poverty reduction, would call for policies and investments that support the development of agriculture (Ravallion & Chen, 2003, 2007; Kraay, 2006).

On the growth side, the view of agriculture as an engine of growth in the agricultural-based economies had attracted political traction, partially mediated by the World Bank's 2008 World Development Report entitled '*Agriculture for Development*', and reinforced by the 2007-08 and 2010-11 surge in world food prices (Ivanic & Martin, 2008; Ivanic, Martin, & Zaman, 2012; Wodon & Zaman, 2010). Others have noted that the classical intersectoral linkages are no longer applied with the same force, given the increasingly interconnected markets and that a pro-agriculture strategy will often not deliver the overall growth necessary for rapid poverty reduction (Dercon, 2009).

On the participation side, the large rural population with the majority of rural poor depending on agriculture, suggests that the poor will benefit more from growth originating in agriculture (World Bank, 2007). Nevertheless, it has also been argued that agricultural development will not involve the majority of poor small-scale farmers, and that it can only succeed among larger-scale farmers (Ravallion & Chen, 2003, 2007). In this view, the extent to which the poor would gain from a pro-agriculture strategy is questionable. However, they may also benefit indirectly through the labour market and employment expansion in the non-traditional agro-export sector (Ravallion & Chen, 2003, 2007).

This chapter reviews the theoretical and empirical literature in relation to the nexus between agriculture and welfare development by exploring the linkages between the agriculture and economic growth, commercialisation and small-scale farmers, farm households and income diversification, the effects of remittances on recipient households' patterns of consumption and agricultural production, and the level and severity of poverty and inequality.

2.2 Agriculture and Economic Growth

The literature on the relationship between agriculture and economic growth dates back to the seminal works of Adam Smith, David Ricardo, and Thomas Malthus from the eighteenth century.[2] The modern literature includes the influential works of Johnston and Mellor (1961) and Hayami and Ruttan (1970, 1985). There is an active current debate only partly inspired by the fact that in many developing countries, agriculture still accounts for a significant share of GDP. In fact, the dynamism of agricultural production and its insertion into the rest of the national economy has also been the subject of study in industrialised, high-income countries (see for example, Gardner, 2002).

Development economists in general and agricultural economists in particular have long focused on how agriculture can best contribute to overall growth and modernisation. The early classical theory views economic development as a growth process requiring the systematic allocation of factors of production from the primary sector characterised by low productivity, traditional technology, and decreasing returns to a modern industrial sector with higher productivity and increasing returns. It has been argued that economic growth in such an economy can be achieved by rapid capital accumulation in the non-agriculture (industrial and service) sector, facilitated by drawing from surplus labour in the agriculture sector where productivity is assumed to be lower in agriculture than in the modern sector (Lewis, 1954). This argument was subsequently extended by Ranis and Fei (1961). With lower productivity in agriculture, wages will be higher in the modern sector, which induces labour to move from agriculture to the modern sector, which in turn generates economic growth.[3]

[2] Since 1940s early economists (e.g. Rosenstein-Rodan 1943; Lewis 1954; Scitovsky 1954; Jorgenson 1961; Ranis & Fei 1961) have highlighted the importance of agricultural growth for development and for a country's transformation from a traditional to a modern economy, because of its abundance of resources and its ability to transfer surplus resources to the more important industrial sector.

[3] That is, an economy transits from the first, labour-surplus stage to the second, labour-scarce stage of development. For this reason, Lewis's theory was employed to support the industrialisation strategies between the 1950s and 1970s (Schiff & Valdez, 1992).

The Lewis model formalised by Ranis and Fei (1961) defined three phases of dualistic economic development by sub-dividing the first stage of the Lewis model into two phases. Thereby, the second labour-scarce stage of the Lewis model corresponds to phase three of the Ranis-Fei model. In this growth model, the entry into each phase is marked by three turning points. At the initial stage, the "breakout point" leads to phase-one growth with redundant agricultural labour. The "shortage point" leads to phase-two growth with disguised agricultural unemployment. The third entry point to the economic growth is named, "commercialisation point", which leads to phase-three of self-sustaining economic growth with the commercialisation of the agricultural sector.

According to Schultz (1964), agriculture is important for economic growth in the sense that it guarantees subsistence for society, without which growth is not possible. This early view on the role of agriculture in economics matches the empirical observation of Kuznets (1966) that the importance of the agricultural sector declines with economic development. In this view, the role of agriculture in economic development is to supply cheap food and low wage labours to the modern sector, otherwise, both sectors have few interconnections. Growth and higher productivity in the agricultural sector can contribute to overall economic growth by releasing labour as well as capital to other sectors in the economy.

The importance of intersectoral linkages in driving the growth process is gradually recognised by the early classical theorists. Hirschman (1958), perhaps, was one of the first theorists to emphasise linkage effects in the growth process, although his analysis focused on the backward and forward linkages generated by investments in industrial sectors. On the contrary, Johnston and Mellor (1961) emphasise the existence of production and consumption linkages both within agriculture as well as between agricultural and non-agricultural sectors. The sector generates forward production linkages when agricultural outputs are supplied as inputs to non-agricultural production. Its growth can therefore contribute to expanding agro-processing and processed food marketing, which provides new engines for growth and opportunities to substitute for imports.[4] Such linkage effects can increase employment opportunities in the rural non-farm sector, thereby indirectly generating rural income.

The importance of the linkages between production and consumption is further stressed by Singer (1979) and explicitly embodied in Adelman's (1984) general equilibrium notion of "agricultural demand-led industrialisation" (ADLI). According to her view, a country's

[4] On the consumption side, higher productivity in agriculture can increase the income of the rural population, thereby creating demand for domestically produced industrial outputs. Moreover, agricultural goods can be exported to earn foreign exchange in order to import capital goods.

development strategy should be agriculture-driven rather than export-driven, and increased agricultural productivity would be the initiator of industrialisation. Moreover, Adelman (1984) notes the emphasis should be placed on small-to-medium-size farmers because they are more likely to use domestically produced intermediate goods, as opposed to large-scale producers who might import machinery and other inputs, which would weaken the linkages between agriculture and other sectors. She also suggests that ADLI would work best for low-income countries that are not yet export-driven.

In examining the strength of the linkages between agriculture and the rest of the economy at different development stages for 27 countries, Vogel (1994) finds that the backward linkages are typically stronger at the early stages of development, while the forward linkages are much weaker. The study also found that the demand created by rising rural income accounted for almost 70 percent of the backward linkages. Forward linkages were strengthened at later stages of development owing to a greater and more complex integration of agricultural production with other sectors.

Although various theoretical models suggest opposing roles of agriculture in development, they do not necessarily contradict each other.[5] The models are derived under different economic assumptions (e.g., openness to trade); therefore, it is not surprising that they derive different policy implications. Because developing countries differ with respect to their economic environments, the role of agriculture for development may have to be re-evaluated in each specific case. This is in line with the findings of the *World Development Report 2008* (World Bank, 2007), which suggests that in the agriculture-based economies, agriculture can be the main engine of growth, whereas in transforming countries, agriculture is already less important as an economic activity but still a major instrument to reduce rural poverty. In the urbanised countries, by contrast, agriculture plays the same role as other tradable sectors and subsectors with a comparative advantage and can help to generate economic growth.

Using a panel of 65 developing countries from 1960 to 1985, Timmer (2002) shows a positive correlation between growth in agricultural GDP and its lagged values and non-agricultural

[5] Dercon (2009) challenges the agriculture-first approaches by stating that agriculture in developing countries might be the least productive sector in the economy. He derives this conclusion from a two-sector model elaborated by Eswaran and Kotwal (1993). He explains that, in an open economy, in which both agricultural and modern-sector goods can be traded, linkages between the two sectors become less important for overall growth. As a result, there is less necessity to increase agricultural productivity to induce overall growth and reduce poverty. Both sectors can contribute to growth, but if agriculture is less productive than other sectors, importing food and focusing efforts on other sectors might be more beneficial to a country's development. Having said that, Dercon (2009) admits that, under certain circumstances, the agricultural sector can be crucial for economic growth. If countries are landlocked and closed to international trade, agriculture can be a main driver behind overall growth and should be supported actively.

GDP growth. He suggests that this correlation can be explained by the following: “first-order’ effects of agricultural growth on lower food prices, labour migration, and capital flows from agriculture, as well as “second-order” effects, such as improved nutritional intake, which improves workers’ productivity. Similarly, Gollin, Parente, and Rogerson (2002) illustrate the importance of agriculture during the early stages of development by using both cross-sectional and panel data for 62 developing countries for the period from 1960 to 1990. They find that growth in agricultural productivity is quantitatively important in explaining growth in GDP per worker. This direct contribution accounts for 54 percent of GDP growth. Furthermore, countries experiencing increases in agricultural productivity are able to release labour from agriculture into other sectors of the economy. This sectoral shift accounts for a further 29 percent of GDP growth. The remaining 17 percent is accounted for from non-agricultural growth.

Self and Grabowski (2007) also find a positive relationship between different measures of agricultural productivity (e.g., agricultural GDP per worker) and average growth of real GDP per capita over 1960-1995 period for a cross-section of 89 countries. However, on the basis of panel data from 52 developing countries during 1980-2001, Gardner (2005) concludes that the agricultural sector does not seem to be a primary force behind growth in national GDP per capita. Moreover, he notes that some of the factors that do not show well in the cross-country regressions to explain agricultural GDP per worker may nonetheless be important causes of rural workers’ income growth.

Although the noted empirical investigations establish a correlation between agriculture and GDP growth, they do not imply causation in either direction. The correlation observed could be spurious if both sectors have been growing independently of each other or as a result of a common third factor. To address this issue of endogeneity in empirical work, Tiffin and Irz (2006) use Granger causality tests to establish if agricultural value added per worker has a positive effect on GDP per capita in developing countries. Using the 1960-2000 panel data, Bravo-Ortega and Lederman (2005) employ the generalised method of moments (GMM) and Granger causality tests to examine the effect of agricultural growth on the overall growth rate for a total of 128 countries. They find that an increase in agricultural GDP raises non-agricultural GDP in developing countries, whereas a reverse relation exists for developed countries. They note that there are regional differences in the positive relation in the case of developing countries, with a greater effect in the non-Latin American and Caribbean countries.

An issue that arises with cross-country studies is that differences in country conditions do not allow for a general relationship to exist between agricultural and aggregate economic growth. Factors such as openness to trade could alter the relationship between agriculture and non-agriculture sectors. Global markets may substitute for what Timmer (2002) calls the first-order effects of agricultural growth (because they provide international capital flows and food imports). This might explain the different magnitudes of the positive nexus that Bravo-Ortega and Lederman (2005) find or Latin America compared with other regions. Hence, the importance of linkages between the agricultural sector and the rest of the economy differs across countries. Some studies have shed light on the importance of such linkages in different developing countries. For example, de Janvry and Sadoulet (2009) show that for China from 1980 to 2001, a one percent agricultural growth had an effect on aggregate growth of 0.45 percent, whereas the indirect effect through the non-agricultural sector was half that amount. In line with Mellor's (1976) findings for non-agricultural employment, consumption linkages have been the main drivers of multipliers from agriculture to the rest of the economy.

2.3 Agribusiness: Small-scale Farmers, Commercialisation, and Agri-food Systems

The emergence of agribusiness as an institution for facilitating market exchange in developing countries is not a new phenomenon. Davis and Goldberg (1957) define agribusiness as the sum total of all operations involved in the manufacture and distribution of farm supplies; production operations involved in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of farm commodities and items made from them. Moreover, the impact of modernisation of agriculture, particularly on small-scale farm holders has been discussed for decades as being a driver for reducing poverty and hunger. This section discusses the implications for small-scale farmers in commercialisation farming as well as the agricultural food system and value chains in the context of globalisation.

2.3.1 Small-scale Farmers and Commercialisation

The issue of agricultural commercialisation and the small-scale farmer has gathered momentum for both economic and social development. Many developing countries have witnessed agriculture "moving away from traditional self-sufficiency" to an activity where "farm output is…more responsive to market trends" (Pingali & Rosegrant, 1995, p. 172). It has long been understood that with increasing economic growth, small farm production systems could not remain static and would need to gear themselves to some degree of

commercialisation for their survival. The commercialisation process today has a very different face from that of 10 years ago and what is new in this aspect is the focus on agribusiness, and the scale at which agribusiness is influencing the process of change (Pingali & Rosegrant, 1995). There is a greater degree of integration between producers and the output market, with a strong emphasis on standards in relation to quality and safety. This section discusses the evolution from subsistence to commercial production systems and examines whether small farmers can be successfully integrated into the new agri-food system.

Pingali and Rosegrant (1995) characterise food production systems as subsistence, semi-commercial, and commercial. The increased commercialisation has shifted the farm households away from traditional self-sufficiency goals toward profit- and income-oriented decision making. The farm outputs have therefore become more responsive to market needs. The returns to intensive subsistence production systems, which require high levels of family labour, have generally declined relative to production for the market with the predominant use of purchased inputs. As the level of commercial orientation increases, a mixed farming system will give way to specialised production units whose functions are the production of high-value crop and livestock products. Although agricultural commercialisation puts increased emphasis on specialisation, it is not confined to the production of high-value crops. Therefore, for many farmers the transition to commercial staple crop production is far more pertinent (Reardon et al., 2001; Reardon & Berdegue, 2002).

Some studies have noted that the small farms will be left out of the commercialisation process and will be unable to compete in the market as competition increases and prices fall (Reardon et al., 2001; Reardon & Berdegue, 2002). Consequently, it will increase their dependence on purchased foods as small farm households forgo some or all of their traditional food crops to grow more cash crops for the market (Gross & Underwood, 1971). It will also lead to a reallocation of income within the household in favour of men (who typically grow cash crops) with possibly adverse nutritional consequences for women and children (Hernandez et al., 1974).

On the other hand, studies by von Braun and Kennedy (1994) and von Braun (1995) refute the critics of commercialisation. They summarised a series of comparative studies of selected sites where farm households had switched from semi-subsistence staple food production with low levels of external inputs to production of more crops for sale in the market or to production with more purchased inputs. These studies found that, with few exceptions, commercialisation of agriculture benefits the poor by directly generating employment and

increased agricultural labour productivity. Both the households that have commercialised their production and hired labourers were able to receive direct income benefits. Furthermore, in all but one study von Braun (1995) notes that the increased household income generated by commercialisation was associated with improved nutrition for children in the household.

Although commercialisation by itself rarely has adverse consequences on household welfare, it can be damaging when combined with failures of institutions, policies, or markets. As suggested by von Braun (1995), government policies must therefore facilitate the transition to commercialised agriculture in a manner that benefits the poor and does not simply replace subsistence-related production risks with new market and policy failure risks, which may be even more devastating to the poor.

It is also argued that agricultural intensification and commercialisation that proceeds in certain regions, but not in others, can worsen regional disparities, with lagging regions falling further behind as commodity prices drop in the wake of increasing productivity in the rapidly growing regions (von Braun, 1995). The widening productivity gap between commercialising regions and slower growing, subsistence-oriented regions could both accentuate relative income differences and even cause an increase in absolute poverty in the lagging regions. However, the indirect income benefits are generated through the increased demand for goods and services by the direct income beneficiaries as well as by increased demand for inputs for commercialised agriculture.[6] Similar results have been found for the spread of modern rice technology in Asia (a classic process of commercialisation) in a comprehensive cross-country comparative study by David and Otsuka (1994).[7]

Although the well-functioning products and factor markets help to equalise wages and income across regions, they are not always sufficient. In India, for example, many areas of low potential rainfall have seen little improvement in poverty levels even while irrigated while high potential rainfall areas have made progress (Fan & Hazell, 1999). They note that the worsening regional disparities seem most likely to occur when agriculture is still the predominant source of national employment, and when the non-farm economy is growing at

[6] Von Braun (1995) finds that the wage rate and other employment benefits from commercialisation spreads to other regions when labour migrates from other regions into scheme areas. The study concludes that the more mobile the labour force, the more benefits from commercialisation will spread across the economy and other regions.

[7] They find that the differential impact of new rice technology across regions do not worsen income distribution because of the significant indirect effects that worked through labour, land and product markets. Interregional labour migration from unfavourable to favourable regions tended to equalise wages across regions, allowing landless labour and small-scale farmers in unfavourable areas to also benefit. Landowners in lagging regions are sometimes worse off, but also partially protect their incomes through diversification out of rice.

only moderate rates. In these circumstances, the opportunities for out-migration from, and rural income diversification in, of the backward areas are likely to be smaller. However, where the regional disparities have worsened, increased public investment is needed in these areas, particularly for road and infrastructure development, agricultural research and development, and education (Fan & Hazell, 1999).

While efficiency is often embodied in traditional crop production, it is also seen often for own consumption purposes. However, the difficulty for small-holder farmers is whether the existing production structures can be geared toward the market and at what cost. The alternative is to remain in a form of production that is semi- or fully subsistence. It is noted that, over time, subsistence farming in any form is not a viable activity for safeguarding household food security and welfare (Pingali, 1997). The rapid changes in the food system have put increased pressures on small farmers to diversify and move away from staples and to harness the lucrative gains that derived from the production and trade of high-value crops. This, as suggested by Pingali (1997), seems to imply that small farmers face an either/or option in terms of their crop choice.[8]

To a large extent, another vital perspective is the crop choice, which is determined, a priori, depending on the land potential available to small farmers. For some small farmers, at best, commercialisation can offer the possibility of partial diversification into non-staples. High-potential lands may be used to make a permanent transition to high-value crops, whereas low-potential and marginal land tends to be used for traditional crops (i.e., staple crops) (Pingali, 1997). Moreover, for some farmers any kind of production on marginal lands may not be feasible long term, in which case the emphasis needs to be on providing nonfarm rural employment to support production.

The issue of transaction costs has always been highlighted in the agricultural markets.[9] In many cases, various studies explain the transaction costs in the form of the missing markets such as credit markets (Besley, 1994), labour markets (Bardhan, 1984), and land and product markets (Stiglitz, 1989; Holden & Binswanger, 1998) which are seen in developing countries. To address this, an alternative institutional arrangement has been noted (Binswanger &

[8] Small farms either stay in staples, which are regarded as unprofitable, or they make the changes to shift to alternative high-value production. The potential gains from high-value crops tend on average to be higher than those for staples even though production of high-value crops can be accompanied by greater uncertainty and risk.

[9] Williamson (1979) defines transaction costs as a trade-off between the costs of coordination within an organisation and the costs of transacting and forming contracts in the market. According to the seminal work of Coase (1937), it is precisely because of the presence of transaction costs associated with information, negotiation, monitoring, coordination, and enforcement of contracts that intermediary firms emerge to economise on such costs. See also Hobbs (1997) for detailed information on each separate transaction costs.

Rosenzweig, 1986; Timmer, 1997) along with sharecropping and interlinked markets (see Bardhan, 1980; Braverman & Stiglitz, 1982; Binswanger, Khandkar, & Rosenzweig 1993).

2.3.2 Globalisation: Agriculture, Markets and Value Chain

While economic growth and diet diversification have been the driving forces of agricultural commercialisation, the move towards integration into the agri-food system has been induced by globalisation trends (Gereffi, 1994; Bardhan, 1980; Braverman & Stiglitz, 1982; Binswanger, Khandkar, & Rosenzweig 1993; Swinnen, 2007). Globalisation has resulted in the rapid growth of world trade, internationalisation of production by multinational corporations, and declining informational and communications costs associated with information technology. The potential trade benefits for agriculture arise from two aspects (Pingali & Khwaja, 2004). First, it stems from the possibility of direct increased exposure of agriculture to international competition. The ability to access global markets and specialise in areas of comparative advantage could yield high gains for this sector. Second, it stems from the indirect effects of increased international trade on the growth of non-agricultural sectors, and changing the domestic demand for agricultural goods both quantitatively and qualitatively (Pingali & Khwaja, 2004).

Given the potential for high rewards, the structure of food systems has been radically changed due to globalisation. Traditional food systems were essentially production systems that were highly linear and involved only rudimentary processing and minimal distribution. Modern food systems, on the other hand, are highly integrated with greater forward and backward linkages and significantly involve the private sector in determining the standards and market regulations. These systems exhibit an ever-increasing degree of technological sophistication and process innovation and are much more discriminatory in terms of who is able to enter. Thus, the relationships within the chain are much more complex, and there are far more informational uncertainties within the food system resulting in buyers and sellers having to exchange on a different contractual basis than before. New standards require better screening and monitoring to ensure quality and safety requirements (Boehlje, 1999).

Gereffi (1994) makes an important distinction between the two general chain types with respect to the dominant agents of corporate governance within the value chain. The producer-driven chains, on the one hand, are typically directed by large, and integrated transnational corporations from the upstream/supply end. On the other hand, the buyer-driven chains are

governed by large branded retailers towards the downstream/demand end.[10] In the context of global agri-food chains, the producers and buyers respond to agriculture-based transnational corporations and supermarket chains respectively, although the same transnational interests may essentially control these. It is necessary to point out that there are other important intervening actors along the chain including trading, distribution and export companies but in general, agribusiness outlets and supermarkets have exhibited the greatest degree of concentration and trans-nationalisation and exerted the greatest degree of control (Swinnen, 2007).

Although the globalisation of food retail occurred relatively late, the food retail market has seen the greatest power in the global agri-food chains, particularly the case in fresh fruit and vegetables chains which are increasingly buyer-driven (Ponte & Gibbon, 2005; Swinnen, 2007). Markets for agricultural inputs appears to be strongly associated with the producer-driven chain type, for example, agri-chemical, fertiliser, and biotechnology corporations maintain control over forward and backward linkages in the production process.[11] Moreover, Fold (2002) notes that the distribution of power and authority in the global value chains is often less clearly defined. He points that agri-food chains can be strongly driven by lead firms at different stages along the chain. The empirical studies by Humphrey and Schmitz (2001) and Sturgeon (2001) indicate a broader array of relationships and forms of coordination between the various chain actors. Thus, Gereffi, Humphrey and Sturgeon (2005, p. 75) have put forth a typology, identifying a spectrum of network relations lying between the markets and vertical integration that link the chain actors as follows:

- Markets: inter-firm market relations characterised by spot price transactions and low switching costs for participating parties.
- Modular networks: competent and flexible suppliers make products to customers' specifications.
- Relational networks: complex interactions between chain actors often characterised by mutual dependence and mediated by trust, reputation, kinship or ethnic ties.
- Captive networks: dependent relationships between chain actors often characterised by powerful chain actors monitoring and controlling over weaker chain actors.
- Hierarchy: intra-firm vertical integration.

[10] In distinguishing between these two broad types of chain governance structures, Gereffi (1994) notes that producer-driven chains are most often found in capital- and technology-intensive industries such as automobiles and semiconductors, whereas buyer-driven chains are most commonly found in labour-intensive consumer goods sectors like garments, footwear and consumer electronics.

[11] Given the dominance of transnational retailers in agri-food chains (within which farmers are the primary producers), and the weight of agribusiness transnational corporations in value chains for agricultural inputs (within which farmers are the end consumers), farmers are subject to a cost-price squeeze at the intersection of the two (Ponte & Gibbon, 2005).

Ponte and Gibbon (2005) further emphasise the need for a distinction between the 'forms of coordination' and the 'modes of governance' within the global value chain. They point out that a global value chain "may be characterised by different forms of coordination in various segments, yet a single and relatively coherent mode of overall governance" (Ponte & Gibbon, 2005, p. 3). They also suggest that the nature of quality standards can be the central focal point in shaping chain governance.

A range of mechanisms has emerged as various public and private sector actors have sought to coordinate and control the global agri-food chains. Schemes controlling for safety and quality in agricultural production and trade and the food industry have long existed. These grades and standards (G&S) were initially formulated and overseen by the governments, unilaterally and multilaterally, for reasons associated with public health and safety, biosecurity, and border control. Contrary to the earlier G&S, which were overseen by public institutions and aimed at product standardisation, voluntary certification schemes tend to be administered privately and aimed to achieve product differentiation (Gibbon & Ponte, 2005).[12]

In many cases, the voluntary private schemes match and exceed the existing public codes and mechanisms in their requirements and rigour, thus emerging as a new de factor framework in global agri-food governance. These schemes noted by Reardon, Codron, Busch, Bingen and Harris (2001) can be seen as a source of competitiveness, particularly for retailers who successfully differentiate their products on the basis of such schemes.[13] This is also for the farmers and firms that are able to comply and become certified. In many sectors and especially in fresh fruit and vegetable export chains, accreditation to private standards (while technically voluntary) is essential for firms and farms that want to participate. As the standards contribute to safeguarding consumer safety and helping retailers to position themselves competitively in the markets, much of the cost associated with standards administration and monitoring of standards is transferred to upstream actors in the chain (particularly to export firms and farmers). In the case of small-scale farmers, food quality standards (both public and private) can represent significant and often insurmountable barriers to entry into export chains (Reardon et al., 2001).

[12] In this sense, the G&S sought to bring order and manageability to the globalising food industry and thus ensure quality and safety. While government regulations still play an important role in this respect (Fulponi, 2007; Horton, 2006), voluntary food quality standards and certification schemes are fast emerging as the future of agri-food chain governance

[13] The compliance costs are often high, requiring capital investment in specified infrastructure and facilities, demonstrated adherence to specific procedures and practices, and payment of application, certification and monitoring fees.

For many smallholder farmers in the less-developed and developing countries, the financial costs alone are prohibitive, but low levels of education and technical knowledge (i.e., 'know how"), and inadequate provision of basic infrastructure and services in many rural communities further add to the challenge for farmers in these countries.[14] Runsten and Key (1996) observe that the incidence of production risk arises especially when the farmers in developing countries diversify out of traditional into non-traditional crops where technology has not been developed locally. Another concern is related to the marginalisation of smallholders resulting from some agribusiness firms' preference to work with medium- and large-scale growers, thus exacerbating rural inequality (Little & Watts, 1994; Singh, 2002).

A considerable body of literature notes that small farmers face two main difficulties in trying to adapt to modern food systems. The first, concerns their ability to commercialise from production systems that are often semi- or fully subsistence, and the second, concerns the actual crop or enterprise choice. A number of empirical studies, among them those by Van Zyl, Millor and Parker (1996) and Binswanger and Elgin (1992), conclude that small-scale family farms tend to be more productive than large farms. Eastwood, Lipton and Newell (2010) present an extensive review of the literature on small farm productivity. A major reason cited for higher levels of efficiency is the higher productivity of farm-family labour and lower supervision costs compared to large farms.[15]

2.4 Rural Livelihoods: Agricultural Households and Non-Farm Activities

An understanding of household behaviour is important to analyse the effects of government interventions and external changes in market conditions on the rural economy, rural livelihoods, poverty and household decisions (i.e., production and conduction). Agricultural households, particularly in resource-poor economies, are faced with a complex set of issues that influence, to a very large extent, their livelihoods and livelihood strategies (Singh, Squire, & Strauss, 1986; Ellis, 1993; Taylor & Adelman, 2003). The behaviour of farm households needs to be analysed in terms of production and consumption decisions which are taken

[14] Also, the standards themselves are continuously rising and changing with consumer and retailer expectations, thus ongoing participation is by no means given for a one-time compliant farmers (Henson & Jaffee, 2007).

[15] However, that efficiency is often embodied in traditional crop production, often for own-consumption purposes. The difficulty for small farmers is whether the existing production structures can be geared toward the market and at what cost. The alternative is to remain in a form of production that is semi- or fully subsistence, as over time subsistence farming in any form is not a viable activity for safeguarding household food security and welfare (Pingali, 1997).

simultaneously.[16] This is because, farm households often consume at least a small portion of the output of their own product, and household labour is often an important input into the production process. In other words, most rural households in the developing world are characterised by the mixture of both production activities (the level of output, the demand for factors and the choice of technology) and consumption activities (labour supply and commodity demand). Analysing the behaviour of such households, it integrates decisions over consumption, production and time (labour/leisure) allocation for work and utilises micro-level research on less-developed rural economies (Singh, et al., 1986; Taylor & Adelman, 2003).

The agricultural household model was initially developed and applied by Chayanov and Nakajima in 1923 and 1957, respectively, who noted that the behaviour of farm households could be understood in a household-firm framework (Ellis, 1993). Later, this model was formalised by Becker (1965) in which he explained the time allocation of household members when labour has an opportunity cost and the utility of household is not only derived by market goods but also by household produced goods and total household time endowment. The model has been extended by Barnum and Square (1979) and further elaborated in a series of articles in a study entitled, "Agricultural Household Models: Extensions, Applications, and Policy" (see Singh et al., 1986). This analysis has considered agricultural household models, and it is known as the new-classical farm household model in the academic arena. The agricultural household model has been further developed under the assumption of missing or incomplete markets by de Janvry, Fafchamps, and Sadoulet (1991).

The agricultural household model under the assumption of perfect markets is referred to as the separable household model, which combines the consumer and producer model into a single model, implying that production decisions are independent from consumption decisions of the farm household (Singh et al., 1986). Under this assumption, the household decides (based on its resources and prices) on how much total labour would be used on their own farm in order to maximise profits from farm production, and then utility is maximised by choosing between different levels of consumption and leisure given profits. The members of agricultural households are also willing to participate in off-farm employment activities as long as the off-farm wage rate is greater than the marginal value of farm labour. However, in the presence of market imperfections, the separability assumption collapses and consumption decisions are affected by the production decisions of the household (Taylor & Adelman, 2003). This

[16] The terms of agricultural household and farm household are used interchangeably in this thesis.

implies that households maximise utility, given their resources, the available technology, and household-specific market access and prices.

Rural areas play a central role in contributing towards the achievement of two of the MDGs (i.e., reducing poverty and hunger, and ensuring environmental sustainability). The non-farm income implies that any policy aimed at realising these two MDG goals need to look beyond households' agricultural activities. Non-farm activities, therefore, can play a direct and significant role by contributing significantly to household income and indirectly by shaping agricultural activities with implications on the sustainability of natural resources. It is also noted that pressure on natural resources may be reduced when households have alternative sources of income (Bahamonds, 2003).[17] Barrett, Reardon and Webb (2001) propose a three-way classification of non-farm income, based on sectors (as defined in the national accounts), locations (i.e., rural and urban areas), and self-employment or wage labour. They suggest that this classification allows to examine the dependence of rural households on the local or more distant economies, intersectoral linkages, rural and urban linkages, and the importance of remittances flows.

The households engage in several non-farm activities for various reasons, these are commonly divided into push and pull factors (Barrett et al., 2001; Start 2001). The push factors incur from diversification to risk, diminishing factor returns, liquidity constraints, climatic variability, and a need for self-subsistence in goods and services due to high transaction costs. On the other hand, pull factors result from opportunities created by skills or endowments or by complementarities between farm and non-farm income-generating activities.

The Organisation for Economic Co-operation and Development (OECD) (2009) suggests that major risks in agriculture can be classified as production risk, prices or market risk, financial risk, institutional risk, and human or personal risk. The human or personal risk is associated with the problems of human health or personal relationships which can affect the farm business, for example, accidents, illnesses, deaths, localised wildlife damages or pest infestations, and events such as fire or theft that affect farm activities. Second, the institutional risk arises from uncertainties of government policies and actions, whereas the financial risk refers to the risk facing a farm business that borrows money and creates obligation to repay loan (i.e., interest rates, credit constraints, and other hidden costs for acquiring loans). Third, the price or market risk is related to price fluctuation of both produced commodities and

[17] Several terms such as off-farm, non-farm, non-agricultural, non-traditional have been used interchangeably to denote non-farm income.

inputs used for production that may vary from country to country or commodity to commodity. The production risk may occur from uncertain natural growth processes of crops and livestock (i.e., weather, disease, pest, and other factors).

Farmers, especially the smallholder farmers in developing countries, face a high degree of income instability and risk due to the variability of weather, yields, prices, government policies, global markets, and individual-specific shocks in which farming is undertaken (Alderman & Paxson, 1992; Bliss & Stern, 1982; Dercon, 2002; Morduch, 1995; Townsend, 1994). Several empirical studies have reported that a high degree of farm income variability is associated with risks of various forms in the less-developed and developing countries. Townsend (1994) observes that high yearly fluctuations in output value of major agricultural crops per unit of land based on the 10-year panel data for one of the three International Crops Research Institute for Semi-Arid Tropics (ICRISAT) villages in India. On the other hand, Bliss and Stern (1982) estimate that a two-week delay in the onset of production is associated with a 20 percent decline in yields in Palanpur.

Studies by Newbery and Stiglitz (1981), Alderman and Paxson (1992), Morduch (1995), and Dercon (2002) provide many comprehensive examples of how the rural households in developing countries mitigate the rural sector income risk. These studies show that agricultural-dependent households cope with income risk in two ways. First, the households can smooth income which can be often achieved by making conservative production or employment choices and diversifying economic activities by engaging in off-farm employment or nonfarm sectors. In this way, the households take steps to protect themselves from adverse income shocks before they occur. Second, the households can smooth consumption by borrowing and saving, depleting and accumulating non-financial assets, adjusting labour supply, and employing the formal and informal insurance arrangements to insulate the consumption patterns from income variability in the aftershock period.

In dealing with risk smoothing and income variability, the theoretical model is based on the view of Benjamin and Guyomard (1994) that an individual will participate in the off-farm work when his or her reservation wage is lower than the off-farm wage rate. The theoretical model considers a farm household in which the adult male and female jointly decide on the household consumption (C), and their time endowment (T) between farm work, off-farm work, and leisure (l) (see Benjamin & Guyomard, 1994; Matshe & Young, 2004). The household produces agricultural products on fixed land using labour, seeds, and other inputs such as fertilisers and pesticides. The household's maximisation problem has derived from the utility

function indicating the constraint, production, time constraint and income constraints based on Matshe and Young (2004).

The Fist Order Conditions (FOCs) of farm household models provide a system of supply and demand functions that permits formulating labour allocation decision between the different agricultural and non-agricultural activities (de Janvry et al., 1991). The marginal rate of substitution between consumption and leisure is equal to the ratio of the wage rate and the price of consumption goods. For an individual household member, the off-farm labour participation decision is based on the comparison of market wage rate and the individual's reservation wage. That is, a person may participate in the off-farm work if the difference of expected off-farm labour income between the off-farm wage rate and reservation wage is greater than zero. The reservation wage is an endogenous variable influenced by the other exogenous variables in the model. The variables that raise the reservation wage tend to reduce the probability of off-farm labour participation, while variables that raise the off-farm wage rate increase the probability of seeking off-farm employment. For the variables that increase both the likelihood of off-farm participation and the amount of off-farm working days allocated, the outcome is *a priori* uncertain. Given the welfare-enhancing role of non-farm income in the agricultural households, the next section discusses the nexus between remittance flows and the households' welfare.

2.5 Remittances in Household Consumption and Agricultural Production

Although the analysis of remittance flows shows various socioeconomic ramifications, how the remittance income affects the rural communities has been intensely debated for over the last three decades. Bohning (1975, p. 125) notes that, "doubts have been raised with regard not only to the relief of unemployment but also to the purely beneficial nature of remittances, and some observers have considered emigration detrimental to the development of these countries". Contrary to this argument Griffin (1976, p. 359) notes

> Internal migration is likely to improve the distribution of income in rural areas and accelerate capital formation and technical change on small peasant farms. Migration, in effect, enables the peasantry to overcome the imperfections of the rural credit market by creating opportunities to amass finance capital in the cities for subsequent investment in agriculture.

Stark (1984), notes that migration creates favourable conditions for rural development. However, the findings in the case of Kenya show that, "there is little evidence that urban-rural

remittances have been a significant means to rural economic development" (Rempel & Lobdell, 1978, p. 324). They indicate that despite massive remittances, agricultural development is inconsequential. Wood and McCoy (1985) and Griffith (1985) concur that remittances have contributed little to local agricultural development. In their studies on the Caribbean cane cutters in Florida, the larger part of remittances are spent on housing maintenance, and consumption on durable goods such as household appliances, while only very little is invested.

Acosta, Fajnzylber, and Lopez (2008) point out that there are at least three channels through which migration and remittances can affect the household welfare by providing mechanisms to smooth consumption in the context of negative external shocks. The first assumption is that, in the absence of an efficient credit and insurance mechanisms, migration and remittances can play an important role by allowing households to diversify their income sources which then serve as a risk-coping mechanism. Second, in the presence of negative shocks, the households may ask for additional monetary assistance during hard times. The third channel that remittances assist the households smooth out the effects of negative shocks and increase their welfare is through increased savings and accumulation of assets.

Other studies have also clarified the role of remittances in household economics and the conditions for agricultural investment. For many rural households, migrants or workers' remittances form a major portion of household monetary income (Deere & de Janvry, 1979). However, it can also be a small percentage of total monetary income from the remittances (Oberai & Singh, 1980). How a rural household prioritises remittances suggests that consumption values of remittances substitute investment possibilities and factor endowments (e.g., access to productive resources such as land acquisition, farm inputs, capital and labours, etc.) influence the utilisation of remittances (Arizpe, 1981; Wiest, 1979; Reichert, 1981). In the analysis of 12 selected labour-exporting countries for the period 1974 to 1977,[18] Russell (1986) demonstrates that the remittance income used for consumption clearly favour the households in all these countries. He has estimated that, on average, over 50 percent of remittances are spent on house countries and improvements, and only 9 percent is invested in land acquisition.

Remittances are also found to be correlated with the households' production possibilities. Households with a lower initial consumption level would spend remittance income on daily

[18] The selected labour-exporting countries are Algeria, Bangladesh, Egypt, India, Jordan, Morocco, Pakistan, Syrian Arab Republic, Tunisia, Turkey, Yemen Arab Republic and Yemen PDR (Russell, 1986).

food needs and consumer goods (Stuart & Kearney, 1981). Better-off households with a higher initial consumption level, would spend remittances on housing or land purchases but not necessarily for increasing agricultural production (Rhoades, 1978). Acosta et al., (2008) find that by increasing the income of the recipient households, remittances lead to the changes in expenditure patterns in the case of Mexico, El Salvador, Guatemala, Peru, Nicaragua, and Dominican Republic. They note that remittances may allow previously poor families to meet their basic food needs and subsequently increase their expenditures on housing, education, or health.

Several studies note five factors that explain the deviations in the remittance and agricultural investment nexus. It is suggested that investment in land or modern technology varies with a household's resource endowment, the amount and frequency of remittances, the regional market structure, the availability of additional productive resources, and the managerial experience of the farmer (Arizpe, 1981; Rempel & Lobdell, 1981; Gladwin, 1979; Saint & Goldsmith, 1980).

Adequate capital and management skills are crucial for agricultural development. Certain technologies require large investments, however, the ecological factors can affect the productive capacity and discourage investment in the agricultural activities (for e.g., in semiarid environments with erratic rainfall and prolonged droughts). Market access, market distortion (controlled by few producers/importers), infrastructure imperfections (due to transport, communication problems) may retard regional agricultural development regardless of the productive potential as well as lack of land availability that depends on regional demography and local and tenure system (Upton, 1973; Arizpe, 1981). In addition, cash crops can be risky which require the farmer to absorb losses in some years. If remittances are small and infrequent, a farmer may not want to risk his limited capital on an uncertain venture.[19] Farmers with prior commercial experience will more likely invest remittances as they already have confidence as well as the necessary productive resources (Saint & Goldsmith, 1980; Gladwin, 1979; Arizpe, 1981; Rempel & Lobdell, 1981). A decision to convert monetary capital into productive capital to expand a farmer's production possibilities represents the valuing of investment over savings or consumption (Upton, 1973).

The motivation to remit has been subjected to a combination of economic and social motivations, such as self-interest, altruism, investment, loan repayment, and bequest motives,

[19] To decrease this uncertainty a farmer must know the regional market conditions, the production risk involved, and also have the necessary management skills.

which determine the transfer of resources between the migrants and the household members at home (Stark, 1984; Lucas & Stark, 1985; Stark & Lucas, 1987; Rosenzweig, 1988). These transfers can provide different purposes in the households such as meeting the basic needs of the family; serving as payments for services rendered to migrants; payoffs of an insurance scheme that protects recipients from income shocks; returns on the investments made by the household in the migrant's human capital; and migrant's investment in inheritable assets; or various other combinations thereof (Stark, 1984; Lucas & Stark, 1985).

Various country studies in general, have confirmed the hypothesis that international migration and remittances have a beneficial impact on rural well-being and agricultural production in many developing countries. For instance, Lucas and Stark (1985) find that remittances sent to Botswana allowed rural poor households to survive hardships imposed by the severe droughts, while remittances helped rural poor households in Ghana mitigate the effects of high inflation periods (Lucas, 2006). In the case of rural farm households in Pakistan, Adams (1996) finds that external remittances have a significant effect on the accumulation of land, while internal remittances have a positive and significant effect on the accumulation of agricultural capital.

In Botswana, Lesotho, Malawi and Mozambique, labour migration to South African mines reduced crop production in the subsistence sector in the short-run, but over time, remittances have enhanced both crop productivity and cattle accumulation in these countries, except in Lesotho (Lucas, 1987). In Bangladesh, Mendola (2005) notes that while international migration allows the home-country households' migrants to increase production and income, internal migration does not have significant beneficial effects on rural well-being. In rural China, remittances partially compensate for lost labour, contributing directly to the household income and indirectly to crop production (de Brauw, Taylor, & Rozelle, 2001).

It is also observed that the ways in which migration and remittances affect agricultural production and income go beyond their direct impact on farm activities (Reardon, Taylor, Stamoulis, Lanjouw, & Balisacan, 2001). In South and Southeast Asia, each migrant created an average of three jobs though remittances (Stahl & Habib, 1991). In the case of Mexico, remittances created "second-round" income effects that favour poor people, both inside and outside the rural economy (Taylor & Lopez-Feldman, 2010). This study concludes that both remittance recipient households and non-recipient households benefit from remittance transfers, although it takes several years for the positive effects of migration to take place.

The literature on the remittances-agriculture nexus implies that there is a significant link between remittances and improvement in the welfare and livelihood of the receiving

households in different countries. However, the impact of remittances on agriculture is rather mixed and highly contextual. In some cases, migration and remittances foster household farm investment and agricultural production, while in others, the opposite occurs. Analysis of such impact is vital in small island states where migrations are high and also receive high levels of remittances.

2.6 Poverty and Inequality

The issue of poverty elimination has become one of the main agendas in developing countries to meet the MDGs agreed by 189 United Nations (UN) member countries to halve poverty by 2015. In addition, the World Bank, the United Nations Development Programme (UNDP) and other major donors often assess their policies in relation to their impact on poverty, ranging from debt relief, enhance security, and promote empowerment, to macroeconomic stabilisation. As a result of these efforts and strategies, the population of the poor has declined to 1.4 billion in 2005 from 1.8 billion in 1990 (based on US$1.25 a day in 2005 prices), yet a significant proportion of the population still suffers from poverty or many are on the very edge of poverty (World Bank, 1990, 2001; United Nations, 2009).

The definition of poverty has been one of the more controversial issues in poverty studies as it is difficult to provide a universal definition that satisfies everyone (Sen, 1985, 1999; Alcock, 1997; Dessallien, 1998; Alkire, 2002; Barr, 2005; Stewart, Saith,, & Harriss-White, 2007). The emphasis on the multi-dimensionality of poverty includes economic and noneconomic dimensions of deprivation. The World Bank (2001, p. 15) defines poverty as, “unacceptable human deprivation in terms of economic opportunity, education, health, and nutrition, as well as lack of empowerment and security”.

The key to understanding poverty is the notions of deprivation and well-being. The notion of deprivation includes two aspects. First, it is related to the physiological aspect of deprivation, which considers that people are poor if they lack income, food, clothing and shelter. Second, the sociological perspective of deprivation views the existence of poverty as structural barriers. As such the structural barriers prevent the poor from having access to both external assets (e.g. credit, land, infrastructure and common property), and internal assets (e.g. health, nutrition and education) (World Bank, 2005a; Stewart et al., 2007).

The notion of capability extends the people’s opportunities, but when they are poor, capability of poverty spans across both physiological and sociological deprivation. Accordingly, people are poor not only because the country is poor, but also due to a lack of real opportunity. This

multi-dimensional view notes the complicated and complex strategies needed for poverty alleviation (World Bank, 2005a). As such, poverty requires a measurement as comprehensive as its definition in order to achieve an adequate result. The major approaches to poverty measurement include the following: the monetary approach; the capability approach; the basic needs approach; the social exclusion approach; and the participatory approach.

While the concern is given to poverty reduction, the term poverty still means different things to different people. This means that people, according to their political, social and economic circumstances, will understand poverty differently. Laderchi, Saith, and Stewart (2003, p.3) argue that, "clarification of how poverty is defined is extremely important as different definitions of poverty imply use of different criteria for measurement, potentially the identification of different individuals and groups as poor, and the use of different policy solutions for poverty reduction".

Poverty is not only about income and consumption but also covers the dimensions of education, health, nutrition, shelter, powerlessness, voicelessness, vulnerability, and freedom. The monetary approach focuses on income and consumption to gauge poverty and it has become a dominant part of the literature that employs a range of statistical techniques to measure poverty.[20] This approach views that the standard of living comprises of a set of possibilities available to individuals or households to meet their needs. The possibility of satisfying these needs includes material and non-material items in monetary terms. Thus, an individual is considered poor if he/she lives in a family whose income and consumption falls below a certain threshold or a minimum level (UNDP, 1997; Case & Deaton, 2003; Laderchi, 2007).

The capability approach to poverty extends income and consumption with other social factors (education, health, nutrition, powerlessness, vulnerability) and includes well-being as the freedom of an individual to live a life he or she values (Sen, 1985, 1999). The participatory approach helps reduce poverty problems though its focus on the perception of the poor and from the poor themselves, which could be a source in finding the needed information on poverty. The poor themselves could also be involved as analysts (Sen, 1999).

The basic needs approach views poverty as the deprivation of material requirements for meeting basic human needs and is just as vital to the capability approach that goes beyond the

[20] The minimum level is known as the poverty line, which is calculated on the basis of individual income (or expenditure) or household income (or expenditure). However, precaution is needed when determining a poverty line, because the poverty lines can be different between regions in terms of social, culture and economic environment (Hoeven & Anker, 1994).

lack of personal income. It is noted (UNDP, 1997; Dessallien, 1998) that the incidence of deprivation (similar to capability approach) goes beyond the lack of personal income. It includes indicators such as access to food, shelter, schooling, health, water supply, sanitation facilities and opportunities for both employment and participation in measuring poverty. It addresses the limitation arising from the income perspective that highlights the difference between personal income, public services income, and other forms of non-monetary income.

When measuring the basic needs approach to poverty reduction, two material requirements have been classified as follows: 1) basic needs for food items; and 2) basic needs for non-food items. The approach interprets human well-being that reflects the situation when prices of basic needs items such as food, clothing and shelter increases it is considered to be a decline in an individual's well-being because it directly affects his or her welfare.[21] The households that fall below either one of these estimated poverty lines are considered to be poor. In this context, the basic needs approach can be seen as a monetary approach in which all indicators are converted into a monetary value.

The issues of the distribution of income and wealth and the related phenomena of inequality and poverty have drawn significant attention among economists and other social scientists, ranging from the issues of inter-factoral distribution of a nation's output and income to the issues of income distribution of individuals or households (Chatterjee & Srivastav, 1992). Studies by Gini (1912), Lorenz (1905), Pigou (1912) and Dalton (1920) have shown that there are two dimensions in the light of investigating inequality: technical and policy dimensions. The technical dimension of analysing inequality is considered as a subject of scientific enquiry and therefore is concerned with the choice of an appropriate inequality measure in the states of distribution, while policy dimension relates to the question of social justice inherent in the given distributional states. The literature noted here will be utilised to empirically examine various hypotheses related to agricultural development and household welfare in the case of Fiji.

2.7 Conclusion

The agricultural sector matters greatly in developing countries, where majority of the poor live in rural areas and derive a major part of their income from this sector. The literature on

[21] An example of using the basic needs approach can be seen in the case of Fiji, where Narsey (2008, 2010) estimated food poverty line based on the minimum of 2100 calories per adult per day, and non-food poverty line based on the consumption patterns of household survey during the periods, 2002-03 and 2008 -2009.

agriculture highlights that ‘new agriculture for development’ is vital for both economic growth and rural development in developing countries to generate income, provide rural employment and food at affordable prices in urban areas.

The linkages between agriculture and rural development literature show some invaluable evidence-based findings which are crucial for developing countries in informing policies to improve wellbeing and also make a larger contribution to economic growth and development. The discussion on new agriculture for development and off-farm income, and crop diversification highlight the studies applied in various developing countries to enhance economic growth and development. Other studies point out the importance of agriculture for poverty reduction and income inequality to improve the standard of living.

Given the importance of agriculture for development this study fills the gap for developing countries by applying the ‘new agriculture for development’ framework and also highlights the policies that can be applied to improve economic growth and poverty reduction. A major challenge faced by small island nations is also similar to the issues noted in the developing Asian, African, Latin American and the Caribbean countries. Hence, this study empirically examines the hypotheses of agricultural productivity and sectoral contributions for growth, off-farm labour participation, and supply allocation behaviours in the agricultural households, the effects of remittances on agricultural households, as well as the contribution of non-farm income on poverty reduction in the case of Fiji. The findings provide policy implications specifically in Fiji’s case and also note policies for developing countries to meet the challenges and opportunities for small-scale farmers and agribusiness industries.

Chapter 3

Agriculture and Economic Growth

3.1 Introduction

For developing countries, the quest for sustainable economic growth and development has always been the most important issue for policymakers. In this regard, export-led growth is said to be one of the key economic development strategies adopted by many developing countries. It has been shown that the expansion of aggregate exports has a favourable impact on economic growth, achieved through injections into the circular flow of income thereby improving the output level via the multiplier effect (Adelman, 1984; Chu, 1988; Love & Chandra, 2005; Miller & Upadhyay, 2000; Thronton, 1996, 1997).

In addition to the export-led growth hypothesis, many have also considered the role of agriculture as the main determinant of economic growth and a tool for poverty reduction (Chebbi, 2010; Christiaensen, Demery, & Kuhl, 2006; Jatuporn, Chien, Sukprasert, & Thaipakdee, 2011; Katircioglu, 2006; Mellor, 1976; Triffin & Irz, 2006). One obvious reason for this is that agriculture accounts for large shares of employment and national output in many developing countries. This is also the case for Fiji, a country in the Pacific Rim in which the economy has deep roots in agriculture with over 67 percent of the total workforce employed in the agriculture sector, while tourism remains the largest employer of the indigenous population (Ministry of Tourism, 2009). The contribution of agricultural sector to the nation's economic growth has been crucial, thus in the case of Fiji, promoting agricultural growth and a competitive export agriculture has been regarded as an engine for economic growth which is embedded in the country's development strategies (Ministry of Primary Industry, 2009).

It is, therefore, vital to examine the contribution of agricultural sectors to economic growth along with other non-agricultural sectors (i.e., manufacturing, non-manufacturing industry, and services sectors) to formulate correct development strategies to increase productivity of the relative sectors. This chapter empirically examines the contribution of agriculture to economic growth and its interactions with other sectors in the case of Fiji. In particular, this chapter attempts to investigate whether growth in the agriculture sector of Fiji's economy spills over to manufacturing, non-manufacturing industry and services sectors, or whether these sectors share similar growth rates only when they share some common exogenous

stimuli. Given the Fiji government's commitment to promote high-value agricultural products with the aim of increasing the country's self-sufficiency, food security, and reducing its import dependence, the third objective of this chapter is to examine the potential growth-enhancing factors that contribute to the food and crop productivity growth. The fourth objective is to analyse how far agricultural crop production has been affected by inter-sectoral spillovers from the food manufacturing and hotels and restaurants sectors, and vice versa. The Autoregressive Distributed Lag (ARDL) approach to cointegration methodology is used to estimate the agriculture-growth nexus, followed by the Vector Autoregressive (VAR) approach to estimate the causality among the output growth of agriculture, manufacturing, non-manufacturing, and services sectors in the short- run and long-run.

The rest of the chapter is set out as follows: section 3.2 provides a brief literature review on the nexus of agriculture and economic growth, and the causal linkages between agricultural and non-agricultural sectors. Section 3.3 discusses the data, methodology and model specification utilised in the analyses of various hypotheses noted above. Section 3.4 presents the empirical results followed by the conclusion in the final section.

3.2 A Brief Literature Review

Studies on developed and developing countries have long focused on how agriculture can best contribute to a country's overall economic growth and modernisation. Rosenstein-Rodan (1943), Lewis (1954), Scitovsky (1954), Jorgenson (1961), and Ranis and Fei (1961) highlight the importance of agricultural growth for development and for a country's transformation from a traditional to a modern economy. These studies suggest that agriculture plays a passive role and provides an important source of resources for the development of the industries and other non-agricultural sectors. As such, economic growth can be enhanced by rapid capital accumulation in the non-agriculture (industrial and services) sector, facilitated by drawing surplus labour from the agriculture sector. However, developing countries with their agriculture-based economies depend largely on higher agricultural output to achieve growth in GDP, and given that they have high population, dependence on agriculture for food security is crucial.

Schultz (1964) points out that agriculture sector guarantees subsistence for the society and without it, growth is not possible. While this early view on the role of agriculture in economics remains, the empirical observation of developing nations' transition towards industrialisation shows that agricultural sector contributions have declined over time. A vital

connection between the various sectors of the economy has been the inter-sectoral linkages in driving the growth process. This view, noted by Hirschman (1958) in examining the linkage effects in the growth process, focused on the backward and forward linkages generated by investments in the industrial sector.

Given the large production of agricultural outputs, Johnston and Mellor (1961) emphasised the existence of production and consumption linkages both within agriculture and between the agricultural and non-agricultural sectors. The linkages of the non-agricultural sector generate forward production linkages when agricultural outputs are supplied as inputs to non-agricultural production. The growth in agribusiness and the non-agricultural sectors can therefore contribute to expanding agro-processing and processed food marketing, which provides new engines for growth and opportunities to substitute for imports.

From the consumption side of agricultural outputs, the higher productivity in agriculture can increase the income of rural populations, and it creates the demand for domestically produced industrial outputs. Hence, such linkage effects can increase employment opportunities in the rural non-farm sector and also indirectly generate rural income (see also Johnston & Mellor, 1961). The contribution of agriculture in the growth process is linked to exports that provide foreign exchange earnings and improve the balance of payment deficits.

The contribution of the agriculture sector has been embodied in the general equilibrium idea of “agricultural demand-led industrialisation” (ADLI) as noted by Adelman (1984). The experiences in many Asian, Latin American and Eastern European countries’ development strategies show that there was a focus on agriculture-driven rather than export-driven initiatives and increased agricultural productivity became the initiator of industrialisation (see World Bank, 2006a, 2007). While the 1960s and 1970s saw to the growth in small-sized farmers, the emphasis from the 1980s-1990s shifted to small-to-medium-size farmers that utilised domestically-produced intermediate goods as opposed to large scale producers who might import machinery and other inputs. To increase the linkages between agriculture and other sectors the ADLI was initially best suited to the low-income countries that were not export-driven. However, the globalisation of the world economies from the late 1990s and the further opening of economies to trade saw the benefits in agricultural productivity, agricultural machinery, agriculture innovation, and agribusiness activities, which gathered momentum in enhancing economic growth in the developing countries.

The assessment of the role of agriculture has been undertaken for a cross-section of developing countries and by regions. The strength of the linkages between agriculture and the rest of the economy at different stages of development for 27 countries finds that the backward linkages are stronger at the early stages of development and the forward linkages are found to be much weaker (Vogel, 1994). To test the effects of agricultural outputs on rural income he found that rural income increased and it accounted for 70 percent of the backward linkages. In addition, forward linkages were strengthened at the later stages of development given the greater and more complex integration of agricultural production with other sectors. A recent study by Self and Grabowski (2007) also establishes a positive relationship between the different measures of agricultural productivity and the average growth of real GDP per capita over the 1960-1995 period for a cross-section of countries. Gardner (2005) concludes that the agricultural sector is not the primary force behind growth in national GDP per capita, and that some of the factors though found to be insignificant in the cross-country models explain agricultural GDP per worker as these factors may be an important cause of rural workers' income growth. Using the co-integration framework and Granger-causality tests involving 85 countries Tiffin and Irz (2006) found that agricultural value added Granger caused economic growth in most of the developing countries, while the direction of causality is not clear in developed countries.

To identify the importance of agriculture and economic development for a panel of 65 developing countries over the 1960-1985 periods Timmer (2002) shows a positive correlation between growth in agricultural GDP, its lagged values and non-agricultural GDP growth. He suggests that this correlation can be explained by "first-order' effects of agricultural growth on lower food prices, labour migration, and capital flows from agriculture, as well as "second-order" effects, such as improved nutritional intake, which improves workers' productivity. Similarly, Gollin, Parente, and Rogerson (2002) illustrate the importance of agriculture during the early stages of development by using both cross-sectional and panel data for 62 developing countries for the period 1960 to 1990. They found that growth in agricultural productivity is quantitatively important in explaining growth in GDP per worker. This direct contribution accounts for 54 percent of GDP growth. As countries experience increases in agricultural productivity they are able to release labour from agriculture to other sectors of the economy. This sectoral shift accounts for a further 29 percent of GDP growth. The remaining 17 percent is accounted for from non-agricultural growth.

Using a co-integration framework, Yao (2000) illustrates the extent to which agriculture has contributed to China's economic development. There are two important findings drawn from

this study. First, he found that the agriculture sector is an important force for the growth of other sectors despite the share of agriculture to GDP declines over time. Second, the growth of non-agricultural sectors has little impact on agricultural growth. This is because the government policies have been biased against the agricultural sector, and the restriction on rural-urban migration.

Katircioglu (2006) uses a cointegration analysis to examine the relationship between agricultural output and economic growth in North Cyprus over the period 1975-2002. He found that in the long run agricultural output growth and economic growth as measured by real GDP growth had an equilibrium relationship and there was a feedback relationship between these variables thus indicating a bi-directional causality amongst them. The study concludes that although North Cyprus suffers from political isolation and natural factors (such as drought and environmental concerns), agriculture still has a significant impact on the economy. In the case of Pakistan, Sheikh, Ahmed, Khan, and Khan (2012) investigate the causal relationship between agriculture, GDP and economic growth for the period of 1980 to 2010, and found that the agricultural sector contributes significantly to the GDP growth both in the short- and long-run. In examining the causal relationship between the agricultural and industrial sectors for Pakistan, Hye (2009) finds a causal relationship between these two sectors both in the short- and long-run.

A study by Chebbi (2010) uses Granger causality analysis to test the relationships between agricultural and non-agricultural sectors in Tunisia over the period of 1961-2007. He found that in the short-run agriculture seemed to have a partial role as a driving force in the growth of other non-agricultural sectors and the presence of credit market constraints had a negative impact on the growth of the agricultural output in Tunisia. Matahir (2012) notes a one-way causality from the industrial to agricultural sectors both in the short- and long-run in the case of Malaysia. Seka (2009) notes the agricultural sector Granger-causes industrial growth in the West African States. In the case of India, Chaudhuri and Rao (2004), and Paul (2010) also found that agricultural sector Granger-cause industrial growth.

The studies noted above, on the agriculture-economic growth nexus and its causality impacts suggest that the contribution of agricultural growth to economic development varies from country to country as well as from one time period to another within the same economy. While the cross-sectional studies assume that all countries are homogenous this is not often the case, particularly for small island developing nations. Gounder (2001) and Asafu-Adjaye (2008) explain the unique characteristics of island nations and the reasons for time series

country-specific analysis in the case of Fiji. The next section presents the data and model specifications to investigate if the agricultural sector is inter-related to other sectors in driving the growth process in Fiji

3.3 Data, Methodology and Model Specifications

The data, selection, methodological approaches, assumptions and its associated econometric issues, and model specifications are presented in this section. Various macroeconomic indicators are used, as suggested in the literature, to estimate the role of agriculture in the economic process and its interactions with non-agricultural sectors.

3.3.1 Data

The annual data are collected from a series of the *Key Statistics* released by the Fiji Islands Bureau of Statistics (FIBOS) for the period from 1960 to 2012. The variables used for the agriculture-economic growth nexus are gross domestic product (*GDP*), labour force (*LF*), value of total exports (*X*) and imports (*M*), and value-added of agriculture (*AG*), value-added of manufacturing (*MAN*), value-added of non-manufacturing industry (*IND*), and value-added of services (*SER*) sectors. According to the variable classifications by the FIBOS, agricultural sector includes the cultivation of crops and livestock production, forestry and fishing. Manufacturing sector includes informal activities, manufacture of food products, beverages and tobacco products, and non-food products. The non-manufacturing industry includes construction, mining, quarrying, electricity, gas and water. The services sector includes financial intermediation, real estate and business services, and informal activities. The data for the set of variables used for the growth model are sourced from the FIBOS, World Bank, and Asian Development Bank (ADB).

The list of variables used is presented in Table 3.1. The two sets of annual data analyse the agricultural and non-agricultural sectoral nexus both at aggregate and disaggregate levels.[22] The first set of data is the value-added *AG*, *MAN*, *IND*, and *SER*. The second dataset is the disaggregated values of the agricultural sector which includes the value-added of crop cultivation (*CROP*), food manufacturing value-added (*FDMAN*), and hotels and restaurants value-added (*HTLRES*).[23] All variables are in Fiji dollar (F$) at 2005 constant prices.

[22] The disaggregate data are only available from 1980 onwards.

[23] The crop cultivation (*CROP*) contains the growing of sugarcane, taro, marketing gardening, subsistence, and horticulture. The manufacturing of food products (*FDMAN*) includes sugar, coconut oil, sharps, flour, imported

Table 3.1 List of Time Series Variables and Proxies for Estimation

Variables*	Definition	Proxy	Variable Source
GDP	Gross Domestic Product	Annual economic growth	FIBOS (various)
AG	Agricultural Sector Output	Agricultural sector value-added	
MAN	Manufacturing Sector Output	Manufacturing sector value-added	
IND	Non-manufacturing Sector Output	Non-manufacturing industry value-added	
SER	Services Sector Output	Services sector value-added	
LF	Labour Force	Annual growth of labour force	
CAP	Capital	Fixed physical capital formation	
OPEN	Trade Openness	Exports plus imports (% of GDP)	
COUP	Military Coups	Dummy variable for political instability and civil unrest	
DISASTER	Natural Disaster	Dummy variable is used as a proxy to capture the effects of natural disasters on economic growth	
GCROP	Agricultural Crop Output	Annual growth of crop cultivation	
CROP	Agricultural Crop Output	Crop cultivation value-added	
FDMAN	Food Manufacturing Sector	Food manufacturing sector value-added	
HTLRES	Hotels and Restaurants Sector	Hotels and restaurants sector value-added	
GXAG	Government Expenditure	Government expenditure in agricultural sector per annum	
TRACLAND	Agricultural Machinery	Tractors per 100 sq. km of arable land is used as a proxy for an input of production	World Bank (2012)
TRACNO	Agricultural Machinery	Number of tractors in the country is used as for a proxy for the stock of agricultural physical capital formation	
IRRI	Irrigation	Agricultural irrigated land (% of total agricultural land)	
TELE	Telephone	Telephone lines per 100 people is used as a proxy for infrastructure and communication facilities	
AGLF	Labour Force	Annual Growth of Agricultural Labour Force	ADB (various)

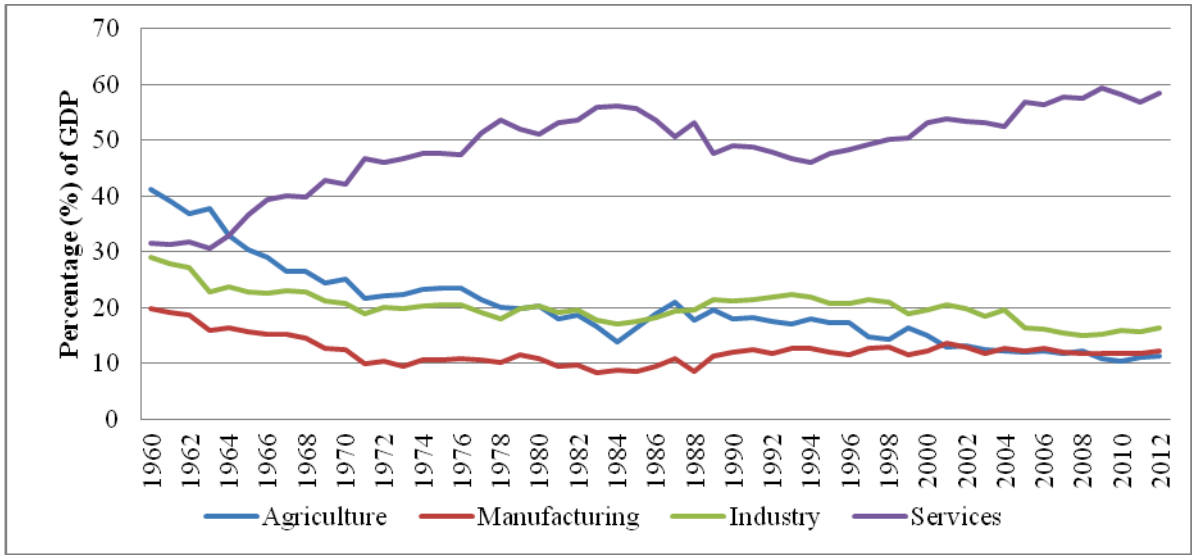
Note: * all variables are in Fiji dollar (F$) at 2005 constant prices.

In discussing the economic indicators in Fiji, Figure 3.1 below provides an overview of Fiji's key trade sector performance for the period of 1960 to 2012. Prior to 1964, the agricultural sector had the highest percentage share of GDP followed by services, non-manufacturing industry and manufacturing sectors. Amongst the major agricultural crops, sugar was the top

butter content and butter. The variable *HTLRES* contains the gross domestic product of hotel stays, camping sites and other provision of short-stay accommodation and restaurants.

income earning crop in Fiji which accounted for 70 percent of export earnings (Narayan & Prasad, 2003). However, the sugar industry's fragility, especially in 1998 due to a severe drought followed by widespread cyclonic flooding, saw a decline in sugar exports by almost 30 percent and the earning by more than F$190 million (EUROPA, 2005).

Figure 3.1 Value Added in Gross Domestic Product by Sectors (% of GDP), 1960-2012



Source: Fiji Islands Bureau of Statistics (various).

The expiry and non-renewable of land leases also contributed to the decline in the annual average agricultural production (Gounder, 2005). The overall reduction in the agricultural sector cannot be taken lightly as such a reduction in this sector has not only led to an adverse effect on the economic performance but also dampened the progress of poverty reduction, as approximately 60 percent of the poor households derive their income from the agricultural sector (Narsey, 2008).

The proportion of manufacturing share to GDP has been stable over time at nearly 13 percent. For many years, the manufacturing sector was dominated by the processing of sugarcane and other agricultural products. This has been diversified with the development of a garment export industry based on the tax-free factory (TFF) scheme through concessional access to the Australian market.[24] The growth in the garment industry contributed to overall improvements in the value-added industry, and the industry played an important role in attracting foreign investments, creating employment, and skilled labour force. However, the gradual erosion of Australian concessions (reductions in Australian tariffs forced Fiji's garment firms to compete with other countries), loss of market quota agreement with the United States (US) at the end

[24] The TFF scheme was introduced in 1987 including incentives of a 13-year tax holiday, duty exemptions on capital goods and raw materials, and freedom to repatriate capital and profits (Fiji Trade and Investment Board, 1999).

of 2004, and the expiry of the World Trade Organisation (WTO) on all textiles and clothing in January 2005, adversely affected the garment industry (Storey, 2004). He notes that the closure of several garment firms and low wages significantly affected the poor population in the urban areas. A large-scale loss of jobs and redundancies in few firms aggravated economic hardship, especially for women and their dependants.

Services (value-added) as a percentage of GDP has increased significantly since 1963, and by far outperformed the contribution of other sectors. In particular, tourism has expanded rapidly since the early 1980s and is the leading economic activity in Fiji. The positive growth gained in the tourism industry is mainly due to heavy promotional campaigns in its major markets, and devaluation of the Fijian currency.[25] However, the tourist arrivals fell sharply from 409,995 in 1999 to 294,070 in the wake of the 2000 coup, which also saw a fall from 545,145 people in 2005 after the 2006 coup to 351,074 people in 2007. The latest wave of tourism promotional campaigns has brought visitor numbers up from 631,868 people in 2010 to 675,050 in 2011 (FIBOS, 2012).

To examine the contribution of agricultural sector to GDP and other sectors in relation to agriculture, Figures 3.2a-3.2d show the plots for agriculture value-added (AG) against GDP, AG against manufacturing value-added (MAN), AG against non-manufacturing industry (IND) and AG against services value-added (SER), respectively. The positive relationships are found between agriculture and GDP (Figure 3.2a) and non-agricultural sectors (Figure 3.2b-3.2d). This suggests that the higher the growth of the agricultural sector, the higher is the rate of improvement in GDP. Likewise, the higher level of growth in agriculture also attributes to the higher rate of improvement in the manufacturing, non-manufacturing industry and services sectors.

Figures 3.3a to 3.3c show the plots for MAN against AG, IND against AG, and SER against AG. Figure 3.3a depicts a positive relationship between the manufacturing and agricultural sectors implying that a higher growth rate in the manufacturing sector increases agricultural value-added. Figures 3.3b and 3.3c also illustrate a positive causal relationship between IND and AG, and SER and AG, respectively. The graphical illustrations indicate that higher levels of growth in the non-manufacturing industry and services sectors, the higher is the rate of growth in the agriculture sector. The graphs indicate some causal relationship from such a

[25] The main markets are Australia, with large contingents also coming from New Zealand, Canada, other Pacific Island countries, the US and United Kingdom (FIBOS, 2012).

scatter plot, however the econometric estimation is utilised next to further ascertain the level of contribution for each of these sectors and their causal relationships.

Figure 3.2a AG versus GDP

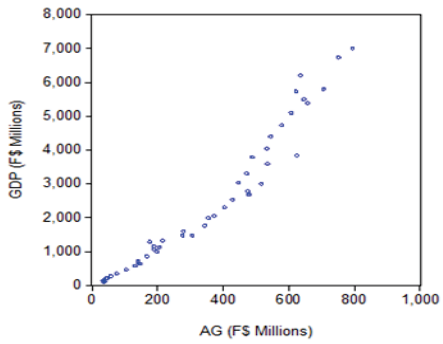


Figure 3.2b AG versus MAN

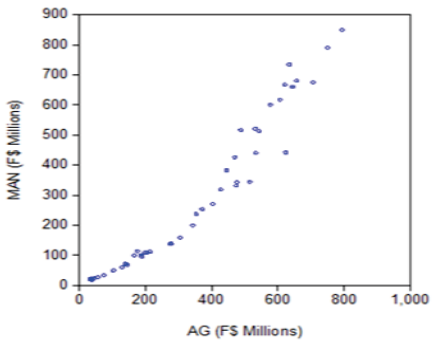


Figure 3.2c AG versus IND

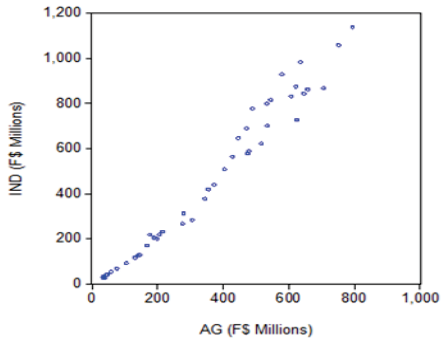


Figure 3.2d AG versus SER

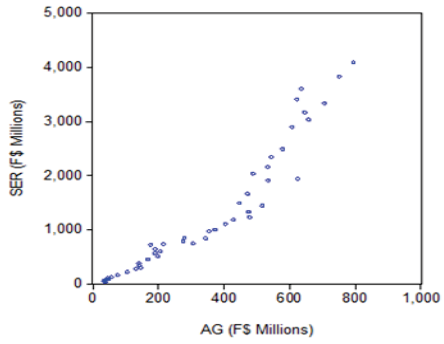


Figure 3.3a
MAN versus AG

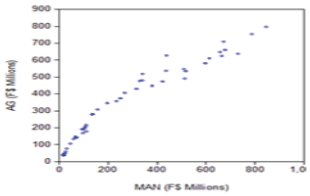


Figure 3.3b
IND versus AG

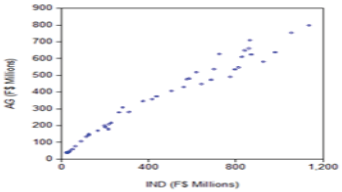
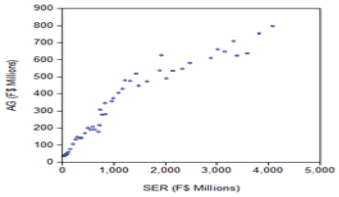


Figure 3.3c
SER versus AG



3.3.2 Agriculture-Economic Growth Nexus: Autoregressive Distributed Lag Approach

The causal relationship between agriculture and economic growth has been one of the most heavily and carefully explored subjects in the empirical literature.[26] The analytical framework of agriculture-economic growth model in the case of Fiji is based on the Solow neoclassical growth model incorporated with an aggregate production function in which:

[26] See Timmer (2002) and Tiffin (2006) for a comprehensive review.

$$Y_t = A_t L_t^{\alpha} K_t^{\beta} \text{ (3.1) and } A_t = f(Z_t, C_t) = Z_t^{\delta} C_t \quad (3.2)$$

In equation (3.1), *Y* is the aggregate production of the economy (i.e., real GDP) at time *t*, *A* is the total factor productivity (TFP), *L* is labour, and *K* represents the stock of capital, and *Z* is a vector of growth-improving variables, i.e., the indicators of agricultural and non-agricultural sectoral development, capital stocks, and trade openness.

Equations (3.1) and (3.2) indicate the conventional growth-enhancing factors (*L* and *K*) as well as the unconventional growth-enhancing factors such as development of agricultural and non-agricultural sectors, physical capital stock, and trade openness.[27] To investigate the impacts of agricultural sector on economic growth through changes in TFP, it is assumed that TFP is a function of unconventional growth-enhancing factors and other exogenous factors (C_t). Combining equations (3.1) and (3.2), the extended aggregate production function and its log form are as follows:

$$Y_t = C_t, L_t^{\alpha}, K_t^{\beta}, AG_t^{\phi}, MAN_t^{\varphi}, IND_t^{\gamma}, SER_t^{\eta}, OPEN_t^{\theta} \quad (3.3)$$

Taking the natural logs of equation (3.3), the econometric model for examining the agriculture-economic growth hypothesis along with other growth-improving variables takes the following form:

$$LY_t = c + aLF_t + \beta CAP_t + \phi LAG_t + \varphi LMan_t + \gamma LIND_t + \eta LSER_t + \theta LOPEN_t + \mu_t \quad (3.4)$$

where *LY* is the log of real GDP, *LF* is the annual growth in labour force, *LCAP* is the log of physical capital formation, *LAG* is the log of agricultural sector value-added, *LMAN* is the log of manufacturing sector value-added, *LIND* is the log of non-manufacturing sector value added, *LSER* is the log of service sector value added, *LOPEN* is the log of the sum of exports and imports to GDP ratio which is a proxy for trade openness, *c* is a constant parameter, *u* is Gaussian error term and *t* is the time series of 1960 to 2012.

The analysis of agriculture-economic growth hypothesis has been extended to include the variables of *COUP* and *DISASTER*. The dummy variable *COUP* takes a value of zero for the years prior the civil unrest and military coups; a value of 1 is assigned for 1987 onwards. The variable *DISASTER* is the number of major climatic effects and natural disasters (i.e., droughts, floods, hurricanes and landslides) had taken place in Fiji during 1960 to 2012. To

[27] Based on many empirical growth studies, these variables are included to capture their contribution to economic growth in the case of Fiji (Lucas, 1987; Grossman & Helpman, 1991; Mankiw, Romer, & Weil, 1992; Triffin & Irz, 2006; Katircioglu, 2006; Chebbi, 2010; Jatuporn, Chien, Sukprasert, & Thaipakdee, 2011; Matahir, 2012).

estimate the impact of military coups and the effects of natural disasters on Fiji's economic growth, equation (3.4) takes the following form:

$$LY_t = c + aLF_t + \beta CAP_t + \phi LAG_t + \varphi LMan_t + \gamma LIND_t + \eta LSER_t + +\theta LOPEN_t + \lambda COUP_t + \omega DISASTER_t + \mu_t \quad (3.5)$$

There are several cointegration techniques for testing the existence of relationships in levels between variables, e.g. Engle-Granger (1987) two-step residual-based procedure, Johansen's system-based rank regression approach (Johansen, 1991, 1995), variable addition approach (Park, 1990), residual-based procedure (Shin, 1994), and stochastic common trends system approach (Stock & Watson, 1988). As a result, a certain degree of pre-testing is required which adds a further degree of uncertainty into the analysis of relationship between the time-series variables of interest (Pesaran & Shin, 1999; Pesaran et al, 2001). In contrast, the Autoregressive Distributed Lag (ARDL) approach to testing for the existence of a relationship between variables in levels is applicable regardless of whether the underling regressors are purely *I*(0), *I*(1) or mutually cointegrated (Pesaran et al, 2001). This approach is applied to examine the validity of agriculture-economic growth hypothesis in the short- and long-run effects developed by Pesaran, Shin and Smith (2001). The ARDL framework shows the following long-run and short-run measures respectively:

$$\begin{aligned}\Delta LY_t = {} & \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta LY_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta LAG_{t-i} + \sum_{i=1}^{p} \alpha_3 \Delta LMAN_{t-i} + \sum_{i=1}^{p} \alpha_4 \Delta LIND_{t-i} \\ & + \sum_{i=1}^{p} \alpha_5 \Delta LSER_{t-i} + \sum_{i=1}^{p} \alpha_6 \Delta LF_{t-i} + + \sum_{i=1}^{p} \alpha_7 \Delta LCAP_{t-i} + \sum_{i=1}^{p} \alpha_8 \Delta LOPEN_{t-i} \\ & + \lambda_1 LY_{t-1} + \lambda_2 LAG_{t-1} + \lambda_3 LMAN_{t-1} + \lambda_4 LIND_{t-1} + \lambda_5 LSER_{t-1} \\ & + \lambda_6 LLF_{t-1} + \lambda_7 LCAP_{t-1} + \lambda_8 LOPEN_{t-1} + \varepsilon_t \end{aligned} \quad (3.6a)$$

$$\begin{aligned}\Delta LY_t = {} & \beta_0 + \sum_{i=1}^{p} \delta_i \Delta LY_{t-i} + \sum_{i=1}^{p} \varpi_i \Delta LAG_{t-i} + \sum_{i=1}^{p} \vartheta_i \Delta LMAN_{t-i} + \sum_{i=1}^{p} \omega_i \Delta LIND_{t-i} \\ & + \sum_{i=1}^{p} \tau_i \Delta LSER_{t-i} + \sum_{i=1}^{p} \zeta_i \Delta LF_{t-i} + + \sum_{i=1}^{p} \psi_i \Delta LCAP_{t-i} \\ & + \sum_{i=1}^{p} \sigma_i \Delta LOPEN_{t-i} + \alpha ECM_{t-1} + \nu_t \end{aligned} \quad (3.6b)$$

This long-run and short-run estimated ARDL models for equation (3.5) are written as follows:

$$\begin{aligned}\Delta LY_t = {} & \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta LY_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta LAG_{t-i} + \sum_{i=1}^{p} \alpha_3 \Delta LMAN_{t-i} + \sum_{i=1}^{p} \alpha_4 \Delta LIND_{t-i} \\ & + \sum_{i=1}^{p} \alpha_5 \Delta LSER_{t-i} + \sum_{i=1}^{p} \alpha_6 \Delta LF_{t-i} + + \sum_{i=1}^{p} \alpha_7 \Delta LCAP_{t-i} + \sum_{i=1}^{p} \alpha_8 \Delta LOPEN_{t-i}\end{aligned}$$

$$+\sum_{i=1}^{p}\alpha_9\Delta COUP_{t-i}+\sum_{i=1}^{p}\alpha_{10}\Delta DISASTER_{t-i}+\lambda_1 LY_{t-1}+\lambda_2 LAG_{t-1}+\lambda_3 LMAN_{t-1}$$
$$+\lambda_4 LIND_{t-1}+\lambda_5 LSER_{t-1}+\lambda_6 LF_{t-1}+\lambda_7 LCAP_{t-1}+\lambda_8 LOPEN_{t-1}$$
$$+\lambda_9 COUP_{t-1}+\lambda_{10} DISASTER_{t-1}+\varepsilon_t \quad (3.7a)$$

$$\Delta LY_t=\beta_0+\sum_{i=1}^{p}\delta_i\Delta LY_{t-i}+\sum_{i=1}^{p}\varpi_i\Delta LAG_{t-i}+\sum_{i=1}^{p}\vartheta_i\Delta LMAN_{t-i}+\sum_{i=1}^{p}\omega_i\Delta LIND_{t-i}$$
$$+\sum_{i=1}^{p}\tau_i\Delta LSER_{t-i}+\sum_{i=1}^{p}\zeta_i\Delta LF_{t-i}++\sum_{i=1}^{p}\psi_i\Delta LCAP_{t-i}+\sum_{i=1}^{p}\sigma_i\Delta LOPEN_{t-i}$$
$$+\sum_{i=1}^{p}\lambda_i\Delta COUP_{t-i}+\sum_{i=1}^{p}\omega_i\Delta DISASTER_{t-i}+\alpha ECM_{t-1}+\nu_t \quad (3.7b)$$

where Δ is difference operator, ε_t and ν_t are random error terms, and all variables are as defined earlier. The error-correction term (ECM_{t-1}) in the short-run estimated models for equations (3.6b) and (3.7b) measures the speed of adjustment to restore equilibrium. The variables are cointegrated if the parameter α's of the error-correction term in each equation are negative and statistically significant in terms of their associated values of t-statistic. This indicates the models can return to long-run equilibrium during the short-term shocks.

Improving the production capacity of agriculture in Fiji through productivity gains is an important policy goal where agriculture plays a crucial role in the economy in terms of food security, employment creation, increasing foreign exchange earnings and contribution to the annual GDP growth. It is also necessary to examine the agricultural crops production-growth nexus based on equations (3.1) and (3.2) to show other sectoral impacts. The econometric model incorporating these factors that attribute to the growth of agriculture production takes the following form:

$$GCROP_t=c+aLTRACLAND_t+\beta LTRACNO_t+\phi IRRI_t+\varphi TELE_t+\gamma AGLF_t$$
$$+\lambda LGXAG_t+u_t \quad (3.8)$$

where *GCROP* is the annual growth of crop cultivation, *LTRACLAND* is the log of tractors per 100 sq. km of arable land, *LTRACNO* is the natural log of the number of tractors, *IRRI* is the percentage of total agricultural land, *TELE* is the telephone lines per 100 people, *AGLF* is the annual growth of labour force in the agriculture sector, *LGXAG* is the natural log of government expenditure in agricultural sector, *c* is a constant parameter, *u* is Gaussian error term and *t* is the time series of 1980 to 2011.

This long-run and short-run estimated ARDL models for equation (3.8) is as follows:

$$\Delta GCROP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta GCROP_{t-i} + \sum_{i=1}^{p} \alpha_2 \Delta LTRACLAND_{t-i} + \sum_{i=1}^{p} \alpha_3 \Delta LTRACNO_{t-i}$$
$$+ \sum_{i=1}^{p} \alpha_4 \Delta IRRI_{t-i} + \sum_{i=1}^{p} \alpha_5 \Delta TELE_{t-i} + \sum_{i=1}^{p} \alpha_6 \Delta AGLF_{t-i} + + \sum_{i=1}^{p} \alpha_7 \Delta LGXAG_{t-i}$$
$$+ \lambda_1 GCROP_{t-1} + \lambda_2 LTRACLAND_{t-1} + \lambda_3 LTRACNO_{t-1} + \lambda_4 IRRI_{t-1}$$
$$+ \lambda_5 TELE_{t-1} + \lambda_6 AGLF_{t-1} + \lambda_7 LGXAG_{t-1} \quad (3.8a)$$

$$\Delta GCROP_t = \beta_0 + \sum_{i=1}^{p} \delta_i \Delta GCROP_{t-i} + \sum_{i=1}^{p} \varpi_i \Delta LTRACLAND_{t-i} + \sum_{i=1}^{p} \vartheta_i \Delta LTRACNO_{t-i}$$
$$+ \sum_{i=1}^{p} \omega_i \Delta IRRI_{t-i} + \sum_{i=1}^{p} \tau_i \Delta TELE_{t-i} + \sum_{i=1}^{p} \zeta_i \Delta AGLF_{t-i} + + \sum_{i=1}^{p} \psi_i \Delta LGXAG_{t-i}$$
$$+ \alpha ECM_{t-1} + \nu_t \quad (3.8b)$$

The ARDL bounds methodology approach is obtained through several steps. In the first step, equations (3.6a), (3.7a) and (3.8a) are estimated using ordinary least square (OLS) method, and F-test shows the existence of long-run relationship among the variables.[28] If the cointegration is established, the long-run coefficients are estimated in the second stage using the selected ARDL model using the Schwarz Bayesian Criterion (SBC).[29] The coefficient of error-correction term (ECM) is obtained in step three for equations (3.6b), (3.7b), and (3.8b).

Several diagnostic tests are conducted to ensure the goodness of fit of the model. These tests examine the serial correlation, functional form, normality and heteroscedasticity associated with the selected model. Furthermore, Pesaran and Pesaran (1997) suggest using the stability test developed by Brown, Durbain and Evans (1975) to test the stability of the coefficients. The tests are cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ).

3.3.3 Agricultural-Non-agricultural Sectoral Nexus: Vector Autoregressive Approach

To capture the dynamic inter-relationships between the agricultural and non-agricultural sectors, the Vector Autoregressive (VAR) model is used to determine the existence of any causal relationships among the sectors (i.e., agriculture, manufacturing, non-manufacturing and services). The cointegration analysis of the general procedure developed by Johansen (1988, 1995) and Johansen and Juselius (1990) methodology distinguishes the short- and long-run effects by testing the number of cointegrating vectors and provides the maximum likelihood estimates of the VAR coefficients. The procedure allows estimating simultaneously

[28] If calculated F-statistic exceeds the upper critical value, then the null hypothesis of no long-run relationship can be rejected irrespective of whether the variables are I(0) or I(1), if the F-value falls within their respective bounds the inference would be inconclusive (Pesaran et al., 2001).

[29] Pesaran and Shin (1999) note using the SBC for parsimony, this study presents the results of the model selected on the basis of SBC criterion for the long- and short-run results.

the system involving two or more variables to overcome the problems associated with traditional regression methods. This procedure is independent of the choice of endogenous variable and allows to test for the presence of more than one long-run structural relationship in the multivariate system and how variables in the system adjust to deviations from such long-run equilibrium relationships (Johansen, 1995; Johansen & Juselius, 1990).

The base-line econometric specification for multivariate cointegration is a VAR representation of a *k*-dimensional time series vector Y_t re-parameterised as a vector error-correction model (VECM), in line with Stock and Watson (2001). The VAR model can be expressed as:

$$\Delta X_t = \underbrace{\sum_{i=1}^{p} \prod_i \Delta X_{t-i}}_{A} + \underbrace{\prod X_{t-1}}_{B} + \Gamma Z_t + \varepsilon_t \tag{3.9}$$

where $\prod_i$ represents matrixes (4×4) for the short-run variables (ΔX_{t-i});

ΔX_t is the matrix vector (4×1) of the lagged dependent variables;

Z_t is a $(4 \times s)$ matrix containing s deterministic variables (such as a time trend, a constant, and any other exogenous variables with *I(0)* property) for each dependent variables;

ε_t is a (4×1) vector of disturbance terms normally distributed with zero means and constant variances;

A captures the short-run effects of ΔX_t; and

B represents the long-run effects of ΔX_t.

Similar to the ARDL cointegration approach, a number of steps are followed under Johansen approach to examine the long- and short-run effects among the variables. The data series are tested for stationarity, i.e., Augmented Dickey Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests followed by the VECM to investigate the direction of causality by estimating a VECM derived from the long-run cointegrating relationship (Engle & Granger, 1987; Granger, 1988). Secondly, the Johansen procedure estimates the test statistics for cointegration, i.e., trace test (there are at most *r* cointegrating vectors) and the maximum eigenvalue test (tests for *r*+1 cointegrating vectors versus the hypothesis that there are *r* cointegrating vectors), see Johansen (1988) and Johansen and Juselius (1990).

Following Stock and Watson (2001), Chebbi (2010), the four-variable VAR model with the cointegrating ranks are identified for the output growth of agriculture, manufacturing, non-manufacturing industry and services sectors as follows:

$$\Delta LAG_t = \mu_1 + \alpha_{11} ECT_{1,t-1} + \alpha_{12} ECT_{2,t-1} + \sum_{j=1}^{p} \varpi_{1j} \Delta LAG_{t-j} + \sum_{j=1}^{p} \vartheta_{1j} \Delta LMAN_{t-j}$$
$$+ \sum_{j=1}^{p} \omega_{1j} \Delta LIND_{t-j} + \sum_{j=1}^{p} \psi_{1j} \Delta LSER_{t-j} + \varepsilon_{1t} \quad (3.9a)$$

$$\Delta LMAN_t = \mu_2 + \alpha_{21} ECT_{1,t-1} + \alpha_{22} ECT_{2,t-1} + \sum_{j=1}^{p} \varpi_{2j} \Delta LAG_{t-j} + \sum_{j=1}^{p} \vartheta_{2j} \Delta LMAN_{t-j}$$
$$+ \sum_{j=1}^{p} \omega_{2j} \Delta LIND_{t-j} + \sum_{j=1}^{p} \psi_{2j} \Delta LSER_{t-j} + \varepsilon_{2t} \quad (3.9b)$$

$$\Delta LIND_t = \mu_3 + \alpha_{31} ECT_{1,t-1} + \alpha_{32} ECT_{2,t-1} + \sum_{j=1}^{p} \varpi_{3j} \Delta LAG_{t-j} + \sum_{j=1}^{p} \vartheta_{3j} \Delta LMAN_{t-j}$$
$$+ \sum_{j=1}^{p} \omega_{3j} \Delta LIND_{t-j} + \sum_{j=1}^{p} \psi_{3j} \Delta LSER_{t-j} + \varepsilon_{3t} \quad (3.9c)$$

$$\Delta LSER_t = \mu_4 + \alpha_{41} ECT_{1,t-1} + \alpha_{42} ECT_{2,t-1} + \sum_{j=1}^{p} \varpi_{4j} \Delta LAG_{t-j} + \sum_{j=1}^{p} \vartheta_{4j} \Delta LMAN_{t-j}$$
$$+ \sum_{j=1}^{p} \omega_{4j} \Delta LIND_{t-j} + \sum_{j=1}^{p} \psi_{4j} \Delta LSER_{t-j} + \varepsilon_{4t} \quad (3.9d)$$

where ECT is the long-term lagged error-correction terms derived from the long-run cointegrating vectors;

$ECT_{1,t-1} = AG_t + (\beta_{21}/\beta_{11}) MAN_t + (\beta_{31}/\beta_{11}) IND_t + (\beta_{41}/\beta_{11}) SER_t$;

$ECT_{2,t-1} = AG_t + (\beta_{22}/\beta_{12}) MAN_t + (\beta_{32}/\beta_{12}) IND_t + (\beta_{42}/\beta_{12}) SER_t$;

$\varepsilon_{1t}, \ldots, \varepsilon_{4t}$ are error terms with mean zero and finite covariance matrix.

The coefficients of ΔLAG_t (agriculture), $\Delta LMAN_t$ (manufacturing), $\Delta LIND_t$ (non-manufacturing industry), and $\Delta LSER_t$ (services) are influenced by both the long-term error-correction terms (i.e., ECTs) and short-term difference lagged variables of ΔLAG_{t-j}, $\Delta LMAN_{t-j}$, $\Delta LIND_{t-j}$ and $\Delta LSER_{t-j}$.[30] The short- and long-run Granger causality test requires a joint test of all the coefficients of the lagged difference variables. The long-run causality test is estimated by long-term error correction terms (Maddala & Kim, 1998).[31]

The following equations (i.e., the three-variable VAR model with cointegrating rank) are established to capture the casual linkages between the output growth of agricultural crops, food manufacturing, and hotels and restaurants:

[30] For example, in equation (3.9d), in order to test ΔAG_t does not Granger-cause ΔSER_t in the short-run, it requires to evaluate the statistical significance of the lagged dynamic terms using the Wald-test (follows a chi-square distribution) by testing the null hypothesis (H_0) of ϖ_{4j} equals to zero.

[31] For instance, in equation (3.9d), the long-run causal relationships between agricultural and services sectors can be determined by the joint significance of the respective cointegrating vectors (β) and the error correction coefficients (α).

$$\Delta LCROP_t = u_1 + a_{11}ECT_{1,t-1} + a_{12}ECT_{2,t-1} + \sum_{j=1}^{P} w_{1j}\Delta LCROP_{t-j} + \sum_{j=1}^{P} \vartheta_{1j}\Delta LFDMAN_{t-j} + \sum_{j=1}^{P} \psi_{1j}\Delta LHTLRES_{t-j} + e_{1t} \quad (3.10a)$$

$$\Delta LFDMAN_t = u_2 + a_{21}ECT_{1,t-1} + a_{22}ECT_{2,t-1} + \sum_{j=1}^{P} w_{2j}\Delta LCROP_{t-j} + \sum_{j=1}^{P} \vartheta_{2j}\Delta LFDMAN_{t-j} + \sum_{j=1}^{P} \psi_{2j}\Delta LHTLRES_{t-j} + e_{2t} \quad (3.10b)$$

$$\Delta LHTLRES_t = u_3 + a_{31}ECT_{1,t-1} + a_{32}ECT_{2,t-1} + \sum_{j=1}^{P} w_{3j}\Delta LCROP_{t-j} + \sum_{j=1}^{P} \vartheta_{3j}\Delta LFDMAN_{t-j} + \sum_{j=1}^{P} \psi_{3j}\Delta LHTLRES_{t-j} + e_{3t} \quad (3.10c)$$

where *LCROP* is natural log of agricultural crop production value added, *LFDMAN* is natural log of food manufacturing output value added, *LHTLRES* is natural log of hotels and restaurants values added, *ECT* is long-term lagged error-correction terms, and *e* are error terms with mean zero and finite covariance matrix. The empirical results are discussed next.

3.4 Empirical Results

The estimated results of the agriculture-economic growth nexus are presented first, followed by the agricultural and non-agricultural causality results. The aggregate-level for the inter-sectoral relationships between these sectors are investigated for the four-variable VAR model. Third, the results show the three-variable VAR model causality linkages between the outputs of agricultural crops, food manufacturing, and hotels and restaurants. Overall, the stationarity tests and model diagnostics indicate no concerns, and the models provide a good fit to the data and have a relatively high explanatory power of the models.

3.4.1 Unit Root Test

The results for unit root (stationarity) using the ADF, PP and KPSS tests indicate the stationarity of the variables in the level and first difference (see Appendix Table 3.1A). The variables are gross domestic product, labour force, physical capital stock, agricultural production output, manufacturing production output, non-manufacturing industry production output, output of services sectors, and trade openness. The results of ADF and PP tests at the levels indicate that all the series are non-stationary, while KPSS test reject the null hypothesis of all the series are stationary at the 1 percent significance level. The rejection of stationarity at the levels of the series leads to testing of the first differences of variables.

3.4.2 Cointegration Test: ARDL Approach

Since all the variables in the model are integrated to order one, i.e., I(1), the ARDL technique first establishes the existence of a long-run relationship. The variables *LY*, *LAG*, *LMAN*, *LIND*, *LSER*, *LF*, *LCAP*, *LOPEN*, *COUP*, *DISASTER*, *GCROP*, *LTRACLAND*, *LTRACNO*, *IRRI*, *TELE*, *AGLF* and *GXAG* in equations (3.6a), (3.7a) and (3.8a) are examined using the bounds test for long-run relationship, and the ARDL bounds F-test establishes the long-run relationship between agriculture and economic growth in each equation. The computed F-statistic and the critical values provided by Pesaran et al., (2001) at the different levels of significance are presented in Table 3.2. For equation (3.6a) the calculated F-statistic of 6.96 exceeds the upper bound value of 3.45 at the 5 percent level of significance implying a long-run relationship among the variables.

Table 3.2 Bounds Tests Results for Agriculture-Economic Growth Nexus

	K-DOF			5% Critical Value Bounds Intercept and No Trend		10% Critical Value Bounds Intercept and No Trend	
Model		F-statistic	Pass/Fail	I(0)	I(1)	I(0)	I(1)
Equation (3.6a)	8	6.96	Pass	2.27	3.45	1.96	3.09
Equation (3.7a)	10	6.32	Pass	2.01	3.27	1.84	2.96
Equation (3.8a)	7	3.36	Pass	2.37	3.55	2.04	3.15

Notes: The critical values are from Pesaran et al. (2001). K is the number of regressors, and DOF stands for degree of freedom.

The computed F-statistic for equation (3.7a) is 6.32, which is greater than the critical value of 3.27, therefore the null hypothesis of no long-run relationships amongst the variables of interest is rejected.[32] Likewise, the result of the computed F-statistic confirms the existence of long-run relationship in equation (3.8a).

3.4.3 Empirical Results: Agriculture-Economic Growth Nexus

The equations (3.4) and (3.5) are estimated employing ARDL approach to cointegration for the agriculture-economic growth nexus for the period 1960 to 2012, and the results are presented in Table 3.3. The model diagnostic tests of serial correlation, functional form, normality of the residuals, structural stability and heteroscedasticity are not subject to any

[32] To check the probability of endogeneity between agriculture (*LAG*) and GDP growth (*LY*), the current study uses the methodology developed by Pesaran and Pesaran (1997) to re-estimate equations (3.6a) and (3.7a) by setting up the variable *LAG* as the dependent variable and LY as the independent variable in each equation. The values of calculated F-statistic are 1.42 and 1.16 for equations (3.6a) and (3.7a), respectively. Both the calculated values of F-statistic remain below the lower bound of the critical values of 1.96 and 1.84 at the 10 percent significant level. This provides an empirical evidence to support that there is only one co-integration vector from agriculture to GDP growth for the case of Fiji during the period of 1960 to 2012.

problem. The CUSUM and CUSUMSQ statistic indicate no evidence of misspecification and structural instability for the estimated period (see Appendix B for illustration).

Table 3.3 Long-run and Short-run Agriculture-Economic Growth Model, 1960-2012

Variables	ARDL Estimates Coefficient		Long-Run Estimates Coefficient		Variables	ECM Short-Run Coefficient	
	(3.4)	(3.5)	(3.4)	(3.5)		(3.6b)	(3.7b)
LY_{t-1}	0.397 (4.228)***	0.407 (4.249)***					
LAG	0.165 (7.213)***	0.163 (7.036)***	0.140 (3.789)***	0.132 (3.278)***	ΔLAG	0.165 (7.213)***	0.163 (7.036)***
LAG_{t-1}	-0.081 (-2.671)**	-0.085 (-2.732)**					
LMAN	0.023 (1.585)	0.020 (1.248)	0.039 (1.466)	0.033 (1.189)	ΔLMAN	0.023 (1.585)	0.020 (1.248)
LIND	0.247 (9.389)***	0.253 (9.104)***	0.219 (5.210)***	0.226 (5.136)***	ΔLIND	0.247 (9.389)***	0.253 (9.104)***
$LIND_{t-1}$	-0.115 (-3.237)***	-0.119 (-3.277)***					
LSER	0.448 (14.430)***	0.451 (14.287)***	0.486 (25.56)***	0.485 (24.88)***	ΔLSER	0.448 (14.29)***	0.451 (14.28)***
$LSER_{t-1}$	-0.155 (-2.912)***	-0.163 (-2.966)***					
LCAP	0.046 (3.999)***	0.048 (4.021)***	0.022 (1.485)	0.027 (1.614)	ΔLCAP	0.046 (3.999)***	0.048 (4.021)***
$LCAP_{t-1}$	-0.033 (-3.134)***	-0.032 (-2.936)***					
LF	0.055 (0.498)	0.057 (0.515)	0.091 (0.499)	0.096 (0.516)	ΔLF	0.055 (0.498)	0.057 (0.515)
LOPEN	-0.045 (-0.265)	-0.121 (-0.588)	0.682 (2.655)**	0.515 (1.379)	ΔLOPEN	-0.045 (-0.265)	0.121 (-0.588)
$LOPEN_{t-1}$	0.456 (2.763)***	0.426 (2.471)**					
COUP		-0.003 (-0.665)		-0.005 (-0.651)			-0.003 (-0.665)
DISASTER		-0.009 (-2.679)**		-0.046 (-3.588)***			-0.009 (-2.679)**
$DISASTER_{t-1}$		-0.016 (-4.168)***					
Constant	0.421 (2.37)**	0.525 (2.20)**	0.698 (2.09)**	0.886 (1.93)*	ECM_{t-1}	-0.603 (-6.42)***	-0.593 (-6.19)***
R^2	0.57	0.66				0.76	0.75
$F_{(8,42)}$	4.23***						
$F_{(10,41)}$		3.31***					
LM: $x^2(1)$	0.06	0.26					
RESET: $x^2(1)$	0.01	0.04					
JBN: $x^2(2)$	2.67	1.83					
ARCH: $x^2(1)$	2.11	2.43					

Notes: ***, **, * significance at 1, 5, and 10%, respectively of the t-ratios are presented in parentheses. The long-run and short-run ARDL (1,1,0,1,1,1,0,1) estimates of equation (3.4) and ARDL (1,1,0,1,1,1,0,1,0,1) estimates of equation (3.5) are selected based on Schwarz Bayesian Criterion (SBC). Critical values of for the various diagnostic tests are as follows: $x^2(1) = 6.63$, $x^2(2) = 9.21$. The diagnostic tests are as follows: LM is Lagrange multiplier test for serial correlation; RESET is Ramsey test for functional form; JBN is Jarque-Bera test for the normality of the residuals; ARCH is Engle's autoregressive conditional heteroscedasticity test. ECM stands for error correction model.

All equations in Table 3.3 have a relatively high explanatory power in terms of R^2 ranging between 57 percent to 76 percent, and the *F*-statistics are statistically significant at the one

percent level. As indicated by the estimated value of R^2, equation (3.4) explains about 57 percent of the variations in the contribution of agricultural and non-agricultural sectors to Fiji's economic growth. The coefficient of the lagged error correction term (ECM_{t-1}) is negative and significant at the one percent level, which confirms the expected convergence process in the long-run dynamics of agricultural and non-agricultural sectors and economic growth. The ECM_{t-1} coefficient indicates that about 60.3 percent of last year's disequilibria are corrected in the current year, suggesting a good speed of adjustment in the relationship process following a shock.

As seen in Table 3.3, most of the explanatory variables representing the growth-improving factors are found to be positive and statistically significant at the 1 percent level. As expected, the growth in the agriculture sector generates positive effect on the country's economic growth. The coefficient *LAG* is positive and significant at the 1 percent level both in the long-run and short-run. This provides the evidence that an increase in the agriculture sector by 1 percent will lead to 14 percent and 17 percent increase in real GDP (*LY*) in the long-run and short-run, respectively. The finding supports the general agriculture-economic growth hypothesis that the improvement and growth in the agricultural sector leads to a higher level of economic growth (see studies by Chebbi, 2010; Christiaensen et al., 2006; Jatuporn et al., 2011 Katircioglu, 2006; Mellor, 1976; Triffin & Irz, 2006).

In examining the long-run and short-run impacts of non-agricultural sectors (i.e., equations 3.4 and 3.6b), the manufacturing (*LMAN*) coefficient is positive and shows a weak significance level at the 15 and 12 percent, respectively. The estimated long-run and short-run non-manufacturing (*LIND*) and services (*LSER*) coefficients indicate a positive and significant impact on economic growth. A one-percent increase in the non-manufacturing sector will lead to 22 percent rise in real GDP in the long-run. This is also the case for the services sector which contributes 49 percent increase in real GDP growth in the long-run. In the short-run, the services and non-manufacturing sectors contribute 45 and 25 percent increase in real GDP, respectively. The magnitude of the long-run and short-run effects of services sector on growth is found to be relatively higher in comparison to other sectors, which is consistent with the fact that services sector has grown significantly and has outperformed the agriculture and manufacturing sectors since 1963 (see also Figure 3.1). In particular, tourism has expanded rapidly since the early 1980s and is the leading economic activity in Fiji. Although the industry has been sensitive in the wake of political upheavals, tourism has been the largest foreign-exchange earner over the years, earning more than

F$713.3 million in 2009, an amount far exceeding the revenue from two largest goods exports, i.e., sugar and garments (Ministry of Tourism, 2009).

In both the long-run and short-run estimates *LF* is positive but not significant. This result supports that Fiji experienced a substantial outflow of skilled labour since 1987 due to the coups. As noted by Mohanty, Reddy, and Naidu (2005) that the loss of skilled labour force has a profound negative impact on social, cultural, economic and political implications which weaken the very foundation of sustainable development in Fiji. A similar conclusion in regard to the contribution of labour force to Fiji's economic growth is also highlighted in Gounder (2001). The estimated long-run total physical capital stock (*LCAP*) coefficient shows a positive effect on growth, however, the variable is not significant. There is a positive and significant relationship between the *LCAP* and *LY* in the short-run. The estimated short-run coefficient indicates that a one percent increase in physical capital contributes to a rise in real GDP by 4.6 percent. This finding is in line with the view of the neoclassical growth theory that capital stock is an important determinant of economic growth (Lucas, 1987; Mankiw et al., 1992).

The estimated long-run effect of trade openness (*LOPEN*) on growth is positive and significant, it implies that a one percent increase in trade openness raises real GDP growth by 0.628 percent in the long-run. The estimated short-run trade openness coefficient is negative and insignificant. The empirical literature notes on the inconclusive debate on the relationship between trade openness and economic growth. For example, studies by Grossman and Helpman (1991), Lucas (1988), Young (1991) and Rivera-Batiz and Xie (1993) suggest that trade openness has negative effect on the individual country. On the other hand, cross-country studies by Harrison (1996), Miller and Upadhyay (2000), and Yanikkaya (2003) show that trade openness has a significant positive impact on economic growth.

The equation (3.4) has been re-estimated by including the variables *COUP* and *DISASTER*, to capture the impact of the civil unrest and political strife and natural disasters on Fiji's economic growth. The estimated equation shows a good fit of the model in terms of the value of the value of R^2, and the significant F statistic. The estimated *ECM* coefficient is negative and statistically significant at the 1 percent level implying that the relationship is error correcting and the model is dynamically stable. The coefficient value of -0.593 indicates that a deviation from the long-run growth rate in the current period is corrected by about 40.7 percent in the next period.

The civil unrest and political strife caused by a series of military coups is measure by the dummy variable (*COUP*) for the period 1987 onwards. The estimated *COUP* coefficient has the expected negative sign and is insignificant in both the long-run and short-run. Similar to the negative impact of political crisis on the country's economy, natural disasters (*DISASTER*) have adversely affected Fiji's economic growth both in the long-run and short-run. A one percentage point increase in natural disasters is associated with a decrease of real GDP growth rate of 0.05 percent and 0.01 percent in the long-run and short-run, respectively. Although the estimated coefficient for agriculture sector is positive and statistically significant, the size of the *LAG* coefficient declined considerably from 0.14 in equation (3.4) to 0.132 in equation (3.5) in the long-run and decreased from 0.165 (equation 3.6b) to 0.163 (equation 3.6d) in the short-run. This result shows that variations in agricultural production is directly affected by the weather conditions, while agricultural risks and uncertainties caused indirectly by political instability.

3.4.3.1 Empirical Results: Agriculture-Production Growth Model

The agriculture-production growth model (equation 3.8) is estimated using the ARDL cointegration approach for the period 1980 to 2011, the estimation results are presented in Table 3.4. The model diagnostic tests indicate no concerns, and the estimated models have high explanatory power in terms of R^2 values, and the *F*-statistics are significant at the five percent level.[33] The CUSUM and CUSUMSQ statistic show no trace of misspecification and structural instability for the period estimated (see Figure 3.3B, Appendix B).

The coefficient of the lagged error correction term (ECM_{t-1}) is negative and significant at the one percent level, which confirms the expected convergence process in the long-run dynamics of agricultural and non-agricultural sectors and economic growth. The ECM_{t-1} coefficient indicates that about 138.65 percent of the last year's disequilibria are corrected in the current year, suggesting a rapid speed of adjustment in the relationship process following a shock.

As seen in Table 3.4, most of the explanatory variables representing agricultural-production growth improving factors are positive and statistically significant at various significance levels. As expected, the growth in the number of tractors per 100 square kilometres of arable land has a positive impact on the agricultural crop production growth. The coefficient *LTRACLAND* is positive and significant at the 5 percent for the long-run estimate. This

[33] The estimated value of R^2 explains about 82 percent of the variations in the contribution of production inputs (i.e., labour force, agricultural machinery and irrigation), infrastructure and communication facilities (i.e., telecommunication) and government efforts (i.e., government expenditures in agricultural sector) to the agricultural crop production growth for the period 1980 to 2011.

implies that increase in the number of tractors per 100 square kilometres of arable land by 1 percent will generate a growth rate of 2.94 percent increase in crop production in the long run. In the short run, the contribution of tractors per 100 square kilometres of arable land is also positive and significant at the 1 percent level.

Table 3.4 Long-run and Short-run Agriculture-Production Model, 1980-2011

Variables	ARDL Estimates Coefficient	Long-Run Estimates Coefficient	Variables	ECM Short-Run Coefficient
	(3.8)	(3.8)		(3.8b)
$GCROP_{t-1}$	-0.387			
	(-3.005)**			
LTRACLAND	-5.893	2.941	ΔLTRACLAND	5.893
	(-2.948)**	(2.349)**		(2.948)***
$LTRACLAND_{t-1}$	9.971			
	(4.258)***			
LTRACNO	8.719	1.383	ΔLTRACNO	19.938
	(1.681)	(1.234)		(3.049)***
$LTRACNO_{t-1}$	-26.74			
	(-2.639)**			
$LTRACNO_{t-2}$	19.938			
	(3.049)***			
IRRI	1.119	2.117	ΔIRR	1.119
	(1.862)*	(3.746)***		(1.862)***
$IRRI_{t-1}$	0.167		ΔIRR_{t-1}	1.648
	(0.276)			(3.252)***
$IRRI_{t-2}$	1.648			
	(3.252)***			
AGLF	0.591	0.426	ΔAGLF	0.591
	(1.174)	(1.239)		(1.174)
TELE	0.124	0.093	ΔTELE	0.124
	(1.414)	(3.763)***		(1.414)
$TELE_{t-1}$	0.38			
	(2.751)**			
$TELE_{t-2}$	0.126			
	(1.294)			
LGVTXAG	1.369	1.348	ΔLGVTXAG	1.369
	(4.071)***	(4.198)***		(4.071)***
$LGVTXAG_{t-1}$	1.099		$\Delta LGVTXAG_{t-1}$	0.599
	(3.182)***			(2.062)*
$LGVTXAG_{t-2}$	-0.599			
	(-2.062)*			
Constant	-54.193	-39.086	ECM_{t-1}	-1.387
	(-2.687)**	(-2.414)**		(-10.779)***
R^2	0.82			0.96
$F_{(16,12)}$	3.46**			
LM: $x^2(1)$	0.50			
RESET: $x^2(1)$	0.69			
JBN: $x^2(2)$	0.74			
ARCH: $x^2(1)$	1.48			

Notes: ***, **, * significance at 1, 5, and 10%, respectively of the t-ratios are presented in parentheses. The long-run and short-run ARDL (1,1,2,2,0,2,2) estimates of equation (3.8) are selected based on Schwarz Bayesian Criterion (SBC). Critical values of for the various diagnostic tests are as follows: $x^2(1) = 6.63$, $x^2(2) = 9.21$. The diagnostic tests are as follows: LM is Lagrange multiplier test for serial correlation; RESET is Ramsey test for functional form; JBN is Jarque-Bera test for the normality of the residuals; ARCH is Engle's autoregressive conditional heteroscedasticity test.

The coefficient *LTRACNO* as a proxy for the fixed capital stock is positive and significant for the short-run estimate but insignificant for the long-run estimate. The short-run coefficient indicates that a one percent increase in physical capital contributes a rise in the crop cultivation by 19.94 percent. This finding highlights the important role of capital stock to enhance economic growth (as seen in the agriculture-economic growth model) and also for in agriculture development.

Irrigation has a crucial role in increasing agricultural productivity and food security. The benefits of irrigation include higher land productivity and increased yields, a lower risk of crop failure, and increased seasonal farm and nonfarm employment (Hussain & Hanjra, 2004). To capture the effect of irrigation on agricultural productivity, the variable *IRRI* is included in equation 3.8, the estimated coefficients are positive and significant both for the long-run and short-run estimates. In the long run, a one percent increase in the agricultural irrigated land leads to 2.12 percent increase in the agriculture production. In the short run, the coefficient *IRRI* for both the current and previous time periods predict a positive return through expansion of agricultural irrigated land to agricultural production.

Labour force in agriculture sector (*AGLF*) is positive but insignificant both in the long- and short-run. The coefficient *TELE* as proxy for infrastructure and communication facilities is positive and significant at the 1 percent level in the long run. This implies that a one point increase in the telephone lines per 100 people benefits the growth in agricultural crops production by 0.09 percent.

The government expenditure in the agricultural sector (*GXAG*) generates a positive and significant impact on the growth of agricultural production output. The estimated coefficient *GXAG* implies that one percent increase in government expenditure in agricultural sector would improve output growth by 1.35 percent in the long-run. The short-run estimated *GXAG* coefficient shows a positive and direct effect from government expenditures in the agricultural sector and its production output.

The estimated results reflects that economic growth dynamics are vital in the case of Fiji as the important factor of economic growth highlights the need for agricultural development and innovation. On the one hand, the empirical results reveal that agricultural sector can be regarded as a pivotal channel to boost economic growth. Capital and non-agricultural sectors such as services and non-manufacturing sectors are other important determinants of economic growth. On the other hand, factors such as agricultural machinery and irrigation, infrastructure

and communication facilities, government expenditures in agricultural sector are crucial that increases Fiji's agriculture production capacity. The next section examines the sectoral causality interactions between the agricultural and non-agricultural sectors in Fiji.

3.4.4 Empirical Results: Agricultural and Non-agricultural Causality Results

The short-run causal relationship is determined by the joint significance of the lagged difference terms, and the long-run causality is examined by the joint significance of the error correction terms (ECTs) and the lagged difference variables. In this section, two sects of causality results are presented. First, the short- and long-run causality between the agricultural and non-agricultural sectors (i.e., value added of agricultural, manufacturing, non-manufacturing industry, and services sectors) followed secondly with the causal relationship between the disaggregated agricultural sector outputs (i.e., valued added of farming of crop cultivation, food manufacturing, and hotels and restaurants).

The Johansen's procedures for cointegration ranks show the presence of two cointegrating vectors (i.e., $r = 2$) significant at the 5 percent level in the four-variable VAR model, as well as in the three-variable VAR model (see Table 3.5). In other words, the presence of two cointegrating vectors provides evidence that there are two processes that separate the long-run from the short-run responses in the VAR models.

Table 3.5 Four-variable Sectoral and Three-variable Disaggregate Agricultural Cointegration Results

Four-variable Sectoral VAR Model				
Endogenous Variables: LAG_t, $LMAN_t$, $LIND_t$, $LSER_t$.				
No.CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
r = 0*	64.47	47.86	31.59	27.58
r <= 1*	32.88	29.80	23.33	21.13
r <= 2	9.55	15.49	8.84	14.26
Three-variable Disaggregate Agricultural VAR Model				
Endogenous Variables: $LCROP_t$, $LFDMAN_t$, $LHTLRES_t$.				
No.CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
r = 0*	211.46	29.80	191.61	21.13
r <= 1*	19.85	15.49	16.98	14.26
r <= 2	2.87	3.84	2.87	3.84

Notes: The optimal lag length is set to equal 2 based on the Akaike's Information Criterion (AIC). CE stands for cointegrating equations. Max-Eign is maximal eigenvalue. * denotes rejection of the hypothesis at the five percent significance level. The cointegration rank is estimated by Eview 6 econometric package.

According to Kanwar (2000), such cointegrating linkages (as presented in Table 3.5) does not imply that some of the sectors did not outpace the others, but only that economic forces at work functioned in such a way so as to tie together these sectors in a long-run structural

equilibrium. Once the order of integration is determined, the VAR representation is used to further examine the number of long-run relationships among the variables of interest. Lastly, the number of cointegrating relationships is confirmed to capture the VECM model to examine the long-run Granger causality relationships among the variables.[34]

The estimated Granger-causality results for equations (3.9a) to (3.9d) are presented in Table 3.7. The Granger-causality tests show the direction of causal relationships between the variables as bidirectional (or feedback), unidirectional and no causality. For the results (Column 1) where LAG is the dependent variable (i.e., equation 3.9a), the coefficient LSER is significant at the 10 percent level. The causality test rejects the null hypotheses that "LSER does not Granger-cause LAG", which suggests that growth in services sector Granger-causes agricultural sector to grow.

Table 3.6 Granger Causality Tests: Four-variable Sectoral VAR Model

Dependent Variables	ΔLAG_t (Column 1)		$\Delta LMAN_t$ (Column 2)		$\Delta LIND_t$ (Column 3)		$\Delta LSER_t$ (Column 4)	
	Chi^2	Prob	Chi^2	Prob	Chi^2	Prob	Chi^2	Prob
ΔLAG_t			8.75	0.01**	7.59	0.02**	0.88	0.64
$\Delta LMAN_t$	1.80	0.41			0.70	0.70	11.07	0.004***
$\Delta LIND_t$	2.04	0.36	14.52	0.001***			14.75	0.001***
$\Delta LSER_t$	4.92	0.09*	8.80	0.01**	2.60	0.27		
ECT_{t-1}	5.31	0.02**	3.34	0.07**	0.004	0.95	0.81	0.37
Causality Indication	SER→AG		AG→MAN IND→MAN SER→MAN		AG→IND		MAN→SER IND→SER	
Causality Conclusion	AG→MAN AG→IND		MAN↔SER		IND→MAN IND→SER		SER→AG	

Notes: Hypothesis of non-causality is rejected at 1% (***), 5% (**) and 10% (*) levels of significance. Prob stands for probability.

Legend: LAG is natural log of agricultural sector value-added; LMAN is natural log of manufacturing sector value-added; LIND is natural log of non-manufacturing sector value-added; LSER is natural log of services sector value-added.

For the manufacturing sector impact, the variable LMAN (dependent variable in column 2, Table 3.6), the hypothesis of non-causality between the agricultural sector and manufacturing sector is rejected at the 5 percent significance level. This indicates that agriculture Granger-causes manufacturing. The null hypotheses of "LIND does not Granger-cause MAN" and "LSER does not Granger-cause MAN" are rejected at the 1 percent and 5 percent significance level, respectively. The estimated results suggest that growth in the non-manufacturing industry and services sectors will spillover to manufacturing sector. In column 3, with the

[34] Since the cointegration is a property of the long-run equilibrium, and Granger causality is a short-run phenomenon, therefore the Granger causality test in a cointegrated system involves estimation of the cointegration relationship and followed by testing for non-causality in an ECM framework (Engle & Granger, 1987; Granger, 1988).

non-manufacturing industry as the dependent variable, the null hypothesis that "LAG does not Granger cause LIND" is rejected at the 5 percent significance level implying the direction of causality is from the agricultural sector to non-manufacturing industry. In column 4 where the services sector (LSER) is the dependent variable, a unidirectional causal relationship is found from manufacturing sector to services sector, and non-manufacturing sector to services sector, respectively.

The overall empirical Granger-causality test results (Table 3.6) imply that growth in agricultural sector would benefit non-agricultural sectors such as manufacturing and non-manufacturing industry, whereas the improvement in services sector would provide positive spillovers to the agricultural sector. The bidirectional causality is found between non-manufacturing and manufacturing sector, which suggesting a spontaneously mutual benefit gained through the growth in these two sectors. The growth in non-manufacturing industry also benefits the manufacturing and services sectors.

The estimated long-run lagged error correction term (ECT_{t-1}) in Column 1 (LAG) is statistically significant at the 5 percent level. This indicates that in the long-run the coefficients of LMAN, LIND and LSER Granger-cause LAG. The result suggests that long-run causal sectoral linkage runs interactively through the error correction term from the growth in non-agricultural sectors to agricultural sector. The long-run Granger causality is also seen from the sectoral growth of agriculture, non-manufacturing and services to manufacturing sector (see Column 2, Table 3.6). This implies that the improvement in the agricultural, non-manufacturing and services sectors benefit the performance of manufacturing sector in the long-run. The overall finding is similar to other country-specific studies. For instance, Matahir (2012) finds a one-way causality direction from industrial to agricultural sectors both in the short- and long-run in Malaysia for the period 1970 to 2009. He concludes that industrial sector might improve the output growth of agricultural sector in Malaysia, given that the right economic policy is installed. Rahman, Rahman, and Wu (2011) also find a unidirectional Granger causality from industrial sector to agricultural sector from 1972 to 2008 for Bangladesh. The implications from these studies are that the contribution of agricultural and industry sectors to the country's economic growth cannot be taken lightly.

The next step reports the causality results for the three-variable VAR model (i.e. equations 3.10a, 3.10b, and 3.10c) for the disaggregated agricultural crops, food manufacturing and hotel and restaurants are presented in Table 3.7.

Table 3.7 Granger Causality Test: Three-variable Disaggregate Agriculture VAR Model

Dependent Variables	$\Delta LCROP_t$ (Column 1)		$\Delta LFDMAN_t$ (Column 2)		$\Delta LHTLRES_t$ (Column 3)	
	Chi^2	Prob	Chi^2	Prob	Chi^2	Prob
$\Delta LCROP_t$			7.18	0.03**	1.20	0.55
$\Delta LFDMAN_t$	13.65	0.001***			1.29	0.53
$\Delta LHTLRES_t$	3.54	0.17	0.02	0.99		
ECT_{t-1}	9.29	0.002***	2.18	0.14	8.52	0.003***
Causality Indication	LFDMAN→LCROP		LCROP→LFDMAN			
Causality Conclusion	LFDMAN↔LCROP					

Notes: Hypothesis of non-causality is rejected at 1% (***), 5% (**) and 10% (*) levels of significance. Prob stands for probability.

Legend: LCROP is log of the crop cultivation that contains the growing of sugarcane, taro, marketing gardening, subsistence, and horticulture; LFDMAN is log of the manufacturing of food products that includes sugar, coconut oil, sharps, flour, imported butter content and butter; LHTLRES includes log of national income of hotels, camping sites and other provision of short-stay accommodation and restaurants.

As shown in Table 3.7, a unidirectional (one way) causal relationship is found from agricultural crops to food manufacturing (i.e., LCROP is the dependent variable, column 1), the hypothesis of "LFDMAN does not Granger-cause LCROP" is rejected at the 1 percent level. This means that growth in the food manufacturing sector Granger-causes the demand for agricultural crops production. In column (2) LFDMAN is the dependent variable, the result shows that LCROP Granger-causes LFDMAN, thus a rapid demand for agricultural crops Granger-causes the growth of food manufacturing and, especially, the varieties of food dishes offered by the hotels and restaurants.

The overall short-run Granger-causality test result shows a bidirectional causal relationship between the agricultural crop production and food manufacturing sector. This suggests that a mutual benefit is gained between the two sectors through short-run growth. Also, the causality results imply that growth in one sector benefits other sectors in the long run. The estimated long-run ECT_{t-1} (in column 1) is statistically significant implying that food manufacturing and hotels and restaurants (LHTLRES) sectors Granger-causes the growth for agricultural crops production. The growth in the hotels and restaurants sector encourages the growing of crops as demand for food increases in the long run. The long-run (ECT_{t-1}) causal relationship is also found from the agricultural crops production and food manufacturing sectors to the hotels and restaurants sector. The finding suggests that an increase in demand for agricultural crops and food manufacturing could provide for the tourism sector and its contribution to economic growth. Moreover, the results are contextualised within the wider international debate relating to the linkages of the agriculture and tourism sectors. As tourists possess relatively higher disposable income than the average national resident, the food demand from tourists can be

considered a high-end market with much potential to stimulate local cultivation (Kirsten & Rogerson, 2002; Ashley & Haysom, 2008; Mitchell & Ashley, 2010; Torres & Momsen, 2011).

The overall empirical findings support the view of forward- and backward-linkages between the agricultural and non-agricultural sectors in the sense that non-agricultural sectors generate forward production linkages when agricultural outputs are supplied as inputs to non-agricultural production. Moreover, the growth in non-agricultural sectors contribute to industrial expansions in agro-processing and food manufacturing, which in turn provides new engines for growth and opportunities to substitute for imports. The finding is consistent with the results of previous studies by Matahir (2012), Jatuporn et al. (2011), Chebbi (2010), and Chaudhuri and Rao (2004), which supports the notion that growth in the agricultural sector not only benefits non-agricultural sectors in the economy but also contributes to overall economic growth.

3.5 Conclusion

This chapter empirically examines various agriculture-growth nexuses in the case of Fiji for the period 1960 to 2012. Several contributions are made in terms of agricultural development-growth nexus based on non-agricultural sectors, agricultural demand-led industrialisation, disaggregated crops production and other sectoral impact as well as the causality linkages in the long- and short-run among agriculture and non-agricultural sectors. The contributions of production inputs for innovation and efficiencies (i.e., agricultural labour force, agricultural machinery and irrigation), infrastructure and communication facilities, and government efforts (i.e., government agricultural expenditures) to the agricultural production growth provide some implications given that agricultural development has been the core of Fiji's strategic vision since independence in 1970.

The empirical findings show that the agricultural sector is far from playing a passive and supporting role in the process of economic development. In Fiji, the evidence shows that growth in the agricultural sector leads to a higher level of economic growth, and the result shows that a one percent increase in the agricultural sector leads to 0.14 percent increase in real GDP in the long-run. The links between the non-manufacturing industry and service sectors are also statistically significant in supporting economic growth in the long-run, while a weaker link is seen in the manufacturing sector. The findings highlight the importance of trade openness in the long-run as a key driver of economic growth suggesting that a highly open economy is important during the early stages of economic development as it stimulates

growth in different sectors, thus leading to higher economic growth. The adverse effects of natural disasters both in the short-run and long-run, decrease economic growth rate by 0.05 percent and 0.01 percent, respectively. The estimated impact of civil unrest and political strife caused by a series of military coups tend to depress growth, however its effect is not statistically significant in the short- and long-run.

Factors for productivity and innovation enhancement through growth in capital stock (such as tractors, the number of tractors per 100 square kilometres of arable land), expansion of agricultural irrigated land, improvement in infrastructure and communication facilities, and growth in the government agricultural expenditure are crucial factors that contribute to improving agricultural production capacity in Fiji.

The Granger-causality test results show that the agricultural, manufacturing, and non-manufacturing industries and services sectors are linked in the short- and long-run, thus their growth in these sectors are interdependent. The findings highlight the contributions of the agricultural sector to manufacturing and non-manufacturing sectors, while a unidirectional relationship is found between the services and agricultural sectors. Apart from the contribution of the agricultural sector to economic growth and its interaction with other sectors, the growth in the non-manufacturing industry also benefits the manufacturing and services sectors. The interdependent relationships are seen in crop production, food manufacturing, and hotel and restaurant sectors. These findings are vital, therefore, suggesting the need to support these related sectors in determining the appropriate development strategy to realise higher levels of benefits through expansion of output in these sectors. The overall impact could create employment opportunities as this increases the demand for employment in the agriculture, manufacturing, and non-manufacturing industry sectors, which also generates other cycles of spending, consumption, and investment.

In terms of policymaking, the government policies should take into account the possible short- and long-run interdependence and linkages between agricultural and non-agricultural sectors. This can be achieved by accelerating sectoral output growth through technological, institutional, and tax credit and price incentive schemes designed to raise the productivity of smallholder famers, business owners, and entrepreneurs. In this regard, rural labour could be absorbed only as agricultural productivity increases. Supporting the private-public initiatives to strengthen agricultural, manufacturing and non-manufacturing industry sectors, and availing finance and credit are crucial in enabling smallholder farmers and entrepreneurs generate agriculture-led growth. In the context of growth in food and agriculture production,

emphasis should be placed on productivity and conservation in existing farmlands, because scope for the expansion of arable land is very limited due to its land ownership, unique geographical, socioeconomic, and environmental circumstances. The fertility of farmlands and wide access to irrigation water, both have a crucial role in agricultural productivity and food security, therefore the expansion of irrigated agricultural land should be encouraged. The empirical findings in this study renders strong support that the agricultural sector can be the focal point for development in Fiji. The next chapter examines the set of household characteristics with varying farm types to evaluate the contribution to the economy.

Appendix 3A

Appendix Table 3.1A presents the unit root tests for the agriculture-economic growth nexus, and the agricultural and non-agricultural sectoral nexus.

Appendix Table 3.1A Stationarity Test Results

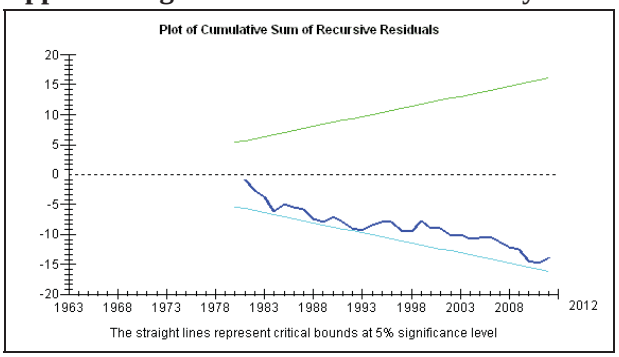
	ADF Test		PP Test		KPSS Test	
Variables	Levels	First Difference	Levels	First Difference	Levels	First Difference
LGDP	-1.464	-7.881***	-1.477	-7.839***	0.856***	0.145
LF	-2.222	-8.029***	-2.215	-7.971***	0.968***	0.253
LCAP	-1.806	-7.678***	-1.711	-7.442***	0.644**	0.097
LAG	-1.403	-12.446***	-1.357	-12.655***	0.871***	0.069
LMAN	-0.723	-10.938***	-0.713	-11.133***	0.944***	0.086
LIND	-1.026	-8.301***	-0.981	-8.392***	0.929***	0.067
LSER	-2.293	-17.001***	-1.663	-18.159***	0.874***	0.228
LOPEN	-2.053	-12.167***	-1.631	-11.56***	0.93***	0.072
The Agriculture-Production Growth Model						
GCROP	-7.913***	-8.165***	-8.924***	-43.724***	0.373	0.222
LTRACLAND	-1.325	-4.403***	-1.299	-4.442***	0.567**	0.228
LTRACNO	-1.447	-4.788***	-1.426	-2.276**	0.301	0.178
IRRI	-1.198	-5.393***	-1.207	-5.395***	0.586**	0.095
TELE	-0.395	-4.104***	-0.315	-4.088***	0.629**	0.250
AGLF	-5.624***	-6.494***	-16.641***	-27.846***	0.253	0.162
GXAG	-2.181	-8.081***	-2.034	-15.053***	0.567**	0.5**
Three-variable VAR Model						
LCROP	-2.089	-8.466**	-2.068	-13.524***	0.648**	0.005
LFDMAN	-1.322	-6.07***	-1.089	-16.809***	0.724**	0.179
LHTLRES	-1.276	-5.989***	-1.209	-5.989***	0.594**	0.062

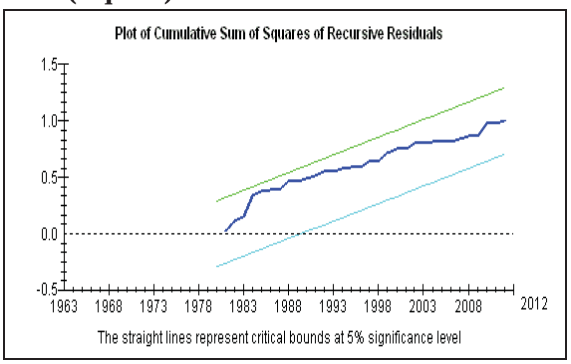
Notes: ***, and ** denote significance at 1%, and 5%, respectively. The critical values for the ADF test (with a constant and no trend) are -3.571 and -2.922 at 1% and 5% significance levels. The critical values for the PP test (with a constant and no trend) are -3.565 and -2.919 at 1% and 5% significance levels. As oppose to the ADF and PP unit root tests, the null hypothesis of KPSS test is the series is stationary. The critical values of the KPSS test (with a constant and no trend) are 0.739 and 0.463 at 1% and 5% significance levels.

Appendix 3B

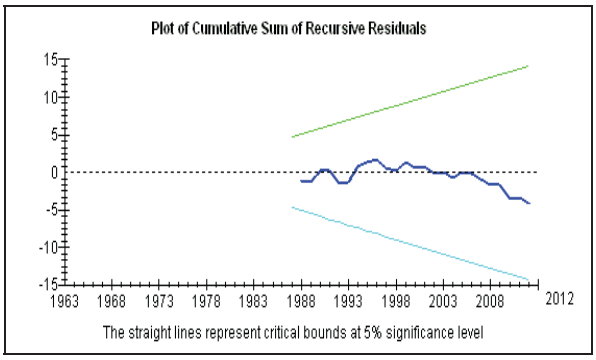
Appendix Figures 3.1B, 3.2B and 3.3B present the cumulative sum (CUSUM) and CUSUM of squares tests of structural stability tests for equation for agriculture-growth nexus. The plots of CUSUM and CUSUMSQ statistics are well within the critical bound indicating that all coefficients in the error correction model are stable.

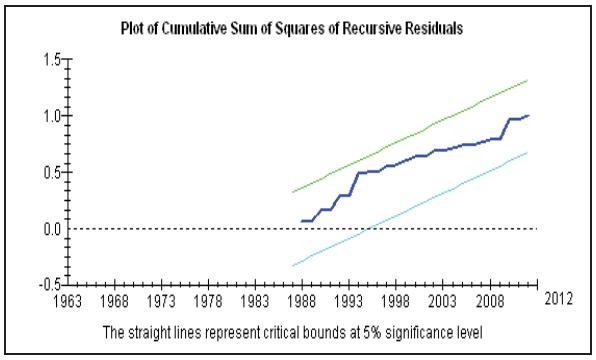
Appendix Figure 3.1B Results for Stability of the Model (Eq. 3.4)



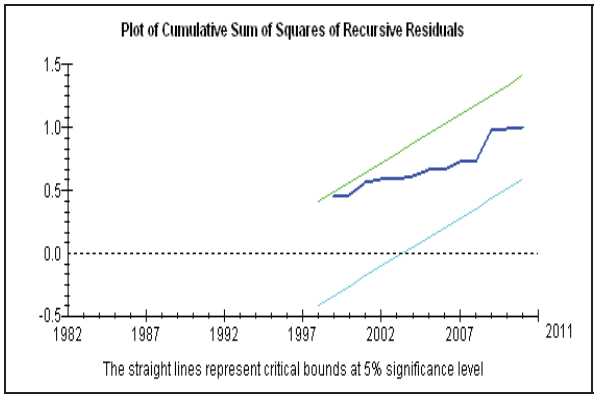


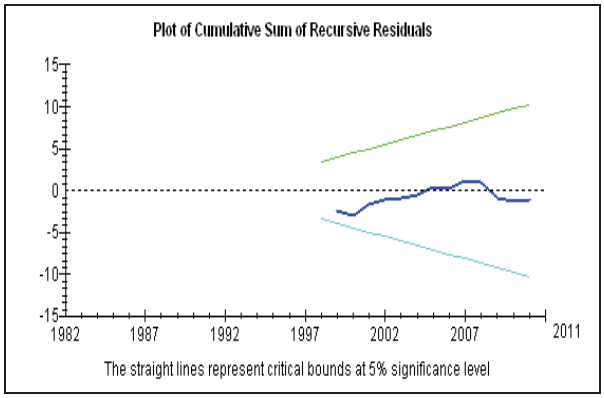
Appendix Figure 3.2B Results for the Stability of the Model (Equation 3.5)





Appendix Figure 3.3B Results for the Stability of the Model (Equation 3.8)





Appendix 3C

Appendix Table 3.1C presents the descriptive statistics for the variables used in the agriculture-economic growth nexus as well as the four-variable VAR model from 1960 to 2011. Appendix Table 3.2C presents the descriptive statistics for the time series variables used in the agriculture-production model from 1980 to 2011. Appendix Table 3.3C presents the descriptive statistics for the value-added of agricultural crops (CROP), food manufacturing (FDMAN), and hotels and restaurants (HTLRES) used in the three-variable VAR model from 1980 to 2011.

Table 3.1C Descriptive Statistics by Sectors (1960-2011)

	LY	LAG	LMAN	LIND	LSER	LF	LCAP	LOPEN
Mean	21.840	19.992	19.458	2.968	21.111	0.025	20.202	0.447
Median	21.9	20.1	19.4	2.963	21.3	0.030	20.2	0.432
Maximum	22.4	20.3	20.3	3.012	21.9	0.047	21.1	0.714
Minimum	20.9	19.6	18.5	2.920	20	0.006	19.2	0.251
Std. Dev.	0.465	0.263	0.574	0.029	0.599	0.008	0.477	0.087
Skewness	-0.645	-0.410	0.104	0.065	-0.742	-0.614	-0.090	0.439
Kurtosis	2.318	1.540	1.663	1.655	2.377	3.4	2.599	3.415
Probability	0.099	0.048	0.138	0.138	0.061	0.158	0.811	0.360

Legend: LY is the log of real GDP, LAG is the log of agricultural sector value-added, LMAN is the log of manufacturing sector value-added, LIND is the log of non-manufacturing sector value-added, LF is the annual growth of labour force, LCAP is the total physical capital stock, LOPEN is the log of the sum of exports and imports to GDP ratio.

Table 3.2C Descriptive Statistics, Equations 3.8-3.8b (1980-2011)

	GCROP	LTRACLAND	LTRACNO	IRRI	TELE	AGLF	GXAG
Mean	0.055	2.591	3.607	0.542	8.926	-0.009	7.05
Median	0.009	2.567	3.596	0.69	8.637	-0.001	6.971
Maximum	0.923	2.684	3.793	0.70	16.05	0.182	7.419
Minimum	-0.579	2.521	3.453	0.24	3.76	-0.154	6.724
Std. Dev.	0.251	0.056	0.081	0.202	4.151	0.078	0.214
Skewness	1.30	0.491	0.11	-0.546	0.254	0.503	0.472
Kurtosis	7.351	1.638	2.461	1.344	1.646	3.095	1.753
Probability	0.000	0.153	0.798	0.073	0.248	0.506	0.196

Legend: GCROP is the annual growth of crop cultivation, LTRACLAND is the log of tractors per 100 sq. km of arable land, LTRACNO is the natural log of the number of tractors, IRRI is the percentage of total agricultural land, TELE is the telephone lines per 100 people, AGLF is the annual growth of labour force in the agriculture sector, LGXAG is the natural log of government expenditure in agricultural sector.

Table 3.3C Descriptive Statistics, Equations 3.12-3.14 (1980-2011)

	LCROP	LFDMAN	LHTLRES
Mean	19.479	18.609	18.783
Median	19.642	18.691	18.774
Maximum	19.992	18.999	20.044
Minimum	18.903	17.683	17.749
Std. Dev.	0.352	0.314	0.594
Skewness	-0.101	-1.150	0.036
Kurtosis	1.450	3.978	2.095
Jarque-Bera	3.258	8.325	1.098
Probability	0.196	0.016	0.578

Chapter 4

Off-farm Labour Participation and Supply Allocation Decisions in the Agricultural Households

4.1 Introduction

Agriculture is the main source for food, income, and employment for majority of the low-income households in Fiji, where over 50 percent live in rural areas. The latest poverty report shows that the percentage of rural households experiencing poverty increased from 35 percent in 2002-03 to 37 percent in 2008-09 (Narsey, Raikoti, & Waqavonovono, 2010). Growth in agriculture is therefore critical in reducing poverty as majority of the poor are smallholder farmers. It has been seen that the agriculture sector to GDP has declined from 12.3 percent in 2001 to 10.5 percent in 2008 and a further drop to 8 percent in 2011 (Fiji Islands Bureau of Statistics, 2012). The conventional wisdom is that low productivity in agriculture is primarily due to subsistence-oriented farming which involves the application of traditional methods for cultivation and the wide use of low-yield varieties of seeds. Agricultural productivity is also affected by limited expansion of arable land due to Fiji's land tenure system and its geographical, socioeconomic and environmental circumstances (Asafu-Adjaye, 2008; de Boer & Chandra, 1978; Haszler, Hone, Graham, & Doucouliagos, 2010; Ward, 1960).

Technology transfer is seen to be a pre-condition for increasing productivity, as well as for making a shift from subsistence to commercial farming to achieve poverty reduction. However, it is a common phenomenon that farmers like any other kind of entrepreneurs do not adopt innovations simultaneously as they appear on the market (Rogers, 1995).[35] Consequently some farmers choose to be innovators (first users) while others prefer to be early adopters, late adopters, or non-adopters (Rogers, 1995).

In the case of Fiji, adoption of innovative agricultural practices and newly-developed high yield seeds have been found to have little success and are difficult to implement, given that agriculture has been a risky business and the farmers encounter a number of risks and uncertainties. The studies by Tavola (1992), Ewins (1992), Kinsey, Burger, and Gunning (1998), Gounder (1999) and Firth (2001) note the uncertainties and impacts of both market

[35] It is observed that innovation diffusion normally takes a number of years, seldom reaches a level of 100 percent of population of potential adopters, and mostly follows some sort of S-shaped curve in time (Mahajan & Peterson, 1985).

related risks such as fluctuations of input and output prices as well as non-market-related risks such as climatic shocks, crop diseases, and pest attacks on agricultural output. Uncertainty also stems from land tenure issues which cause racial tensions amongst the major ethnic groups. As a result, fluctuations in farm income may lead to consumption instability and this can be highly undesirable, especially when an agriculture-dependent household is poor.

Since the credit and insurance markets do not often exist and/or function perfectly in developing countries, the rural households have developed alternative mechanisms for dealing with uncertainties and unseen risks (Newbery & Stiglitz, 1981; Alderman & Paxson, 1992; Morduch, 1995; Dercon, 2002). In the absence of credit and insurance markets, the households in developing countries tend to smooth income by choosing less risky activities or diversifying their portfolio of activities (Besley, 1995).

It has been observed that one of the common and realistic situations faced by the agriculture-dependent households in Fiji is to engage in off-farm income-generating activities as a means of diversifying farm income and creating favourable conditions to reduce risks and uncertainties (Anderson, 1968; Low, 1984, 1985; Barbour & McGregor, 1998). Non-farm income, therefore, has a significant input to the rural households and contributes to food security by enabling better access to food (i.e., consumption smoothing). It also has positive spin-offs shown in the agricultural performance thus providing cash for productivity enchanting inputs, thus easing credit constraints. This, in turn, creates a more dynamic agricultural sector that is capable of further enhancing the scope and scale of the non-farm sector (Ellis, 1998, 2000; Matshe & Young, 2004; Isgut, 2004; FAO, 2011).

This chapter identifies the determinants of off-farm labour participation and allocation decisions of adult members of agricultural households in Fiji. This is estimated using a set of various demographic and socio-economic variables for 6,094 persons in 1,201 agriculture-dependent households derived from the Household Income and Expenditure Survey (HIES) 2008-09 dataset. The analysis will provide a better understanding of rural household behaviour (especially those agriculture-dependent households) to indicate the effects of government policies and initiatives on the rural economy, rural livelihoods, agricultural production, and rural development. As household labour is often a crucial factor input in the production process, the rural households consume at least a small portion of their agricultural output products. In addition, increasing their off-farm income work is vital because of its potential to compensate for the effects of low agricultural productivity and low agricultural incomes, which is pertinent to reduce the rural poverty levels.

The double-hurdle econometric approach has been applied to investigate the factors that influence off-farm labour supply decisions of the agricultural households. This approach allows joint modelling of the decision on whether or not to participate in the off-farm labour market (the first hurdle), and the amount of working days the participant allocates to off-farm work (the second hurdle). The hypothesis examined in this study is that off-farm participation and labour time allocation behaviours are not necessarily based on the same set of decision-making processes. The rest of the chapter is set out as follows: section 4.2 provides a brief literature review related to the theoretical framework to analyse non-farm activities. Section 4.3 discusses the selection of data, methodology, and model specifications utilised in the empirical estimation. Section 4.4 presents the empirical results followed by the conclusion in the final section.

4.2 A Brief Literature Review

The agricultural business is often exposed to many risks and the sources of such uncertainty starts from the stage of planting to post-harvest and marketing. According to the report by the Organisation for Economic Co-operation and Development (OECD) (2009), the major risks in agriculture can be classified as production risk, prices or market risk, financial risk, institutional risk, and human or personal risk. The human or personal risk is associated with the problems of human health or personal relationships which can affect the farm business. This risk includes accidents, illnesses, deaths, localised wildlife damage or pest infestation, and events such as fire or theft that can also affect farm activities. The institutional risk arises from uncertainties of government policies and actions, whereas the financial risk refers to the risk facing a farm business that borrows money thus creating an obligation to repay the loan (for example, interest rates, credit constraints, and other hidden costs for acquiring loans from lenders). The price or market risk is the risk related to price fluctuation of both produced commodities and inputs used for production that may vary from country to country or commodity to commodity. The production risk may occur from the uncertainty in the natural growth processes of crops and livestock, such as weather, disease, pest, and other factors (OECD, 2009). The impact of these types of risk is in the quantity and quality of agricultural products produced.

Farmers, especially the smallholder farmers in developing countries, face a high degree of income instability and risk (Alderman & Paxson, 1992; Bliss & Stern, 1982; Dercon, 2002; Morduch, 1995; Townsend, 1994). This stems from the variability of weather, yields, prices,

government policies, global markets, and individual-specific shocks where farming is undertaken. Many empirical studies have reported that a high degree of farm income variability is associated with risks of various forms in both the less-developed and developing countries. For instance, Townsend (1994) finds high yearly fluctuations in output value of major agricultural crops per unit of land based on the 10-year panel data for one of the three International Crops Research Institute for Semi-Arid Tropics (ICRISAT) villages in India. In addition, Bliss and Stern (1982) estimate that a two-week delay in the onset of production is associated with a 20 percent decline in yields in Palanpur, India.

Studies by Newbery and Stiglitz (1981), Alderman and Paxson (1992), Morduch (1995), and Dercon (2002) provide many comprehensive examples of how rural households in developing countries mitigate income risks. They show that agricultural-dependent households cope with income risk in two ways. First, households can smooth income by making conservative production or employment choices and diversify the economic activities by engaging in off-farm employment or nonfarm sectors. In this way, the households take steps to protect themselves from such adverse income shocks before they occur. Second, the households can smooth consumption by borrowing and saving, depleting and accumulating non-financial assets, adjusting the labour supply, and employing formal and informal insurance arrangements. These mechanisms reduce the impact of the aftershocks that occur and help insulate households' consumption patterns from income variability.

The literature dealing with farm household income diversification, off-farm work, and participation in employment have focused on various factors that affect one's participation behaviour. Benjamin and Guyomard (1994) investigate the factors that influence the off-farm work decisions of husbands and wives from French agricultural households. They find that factors such as household members' age and education, household composition, and farm characteristics have contributed to off-farm labour participation. They also note that young wives are more likely to engage in off-farm work than their older counterparts. However, the number of children decreases the likelihood of a wife's participation in the off-farm labour market which in turn increases her reservation wage. The higher level of general education for both farm operators and spouses are reflected in higher off-farm labour participation, and the male farm operators seem to be more responsive to farm characteristics than their wives.

In a study on the role of off-farm activities in rural households in Mexico, de Janvry and Sadoulet (2001) find that education, ethnic origin, and regional availability of off-farm employment are the primary determinants of participation in off-farm activities. In particular,

a higher level of education enables the members of farm households to participate in the more remunerative off-farm activities. The empirical results indicate that participation in off-farm income-generating activities help to reduce poverty and income inequality. Corpal and Reardon (2001) also show that the effect of education is found to be different depending on the type of off-farm activities in the case of Nicaragua. Similarly, land scarcity and access to roads have an effect on the households' participation decision in non-farm employment. In Pakistan, a study by Fafchamps and Quisumbing (2003) indicates that education raises off-farm productivity and induces rural households to shift labour resources from farm to off-farm activities. They estimate that one additional year of schooling for all adults raises the household income by 8.9 percent. The other human capital variable such as health is also found to be positive and significant for male participants involved in off-farm activities, but not for the females in rural Pakistan.

Using a bivariate Probit approach, Abdulai and Delgado (1999) analyse the determinants of cash-income-oriented non-farm work participation decisions of farm households (husband and wife) in Northern Ghana. The authors find that age has a positive effect on the probability of labour supply to the non-farm sector at younger ages and at older ages the probability of participating in non-farm work decreases as age increases. The finding suggests that human capital as embodied in education and experience is essential in raising non-farm earnings, influencing time allocation of rural families, and diversifying the rural economy away from agriculture. Using the same econometric approach, Beyene (2008) investigates the impact of individual, household, and locational characteristics on the off-farm participation decisions of male and female members of farm households in Ethiopia. The results show that the education level of the household head has no effect on off-farm work decisions as most of the off-farm activities do not require formal education. The health condition of the household is found to be an important factor that affects the time allocation decision of the household. Similar results are also found in Western Ethiopia (Bedemo, Getnet, Kassa, & Chaurasia, 2013).

Other country-specific off-farm labour participation studies of smallholder farmers in Zimbabwe (Matshe & Young, 2004), rural households in Shandong province of China (Huang, Wu, & Rozelle, 2009), rice farmers in Taiwan (Chang & Wen, 2010), agricultural households in Kyrgyz Republic (Atamanov & van den Berg, 2012), and households in rural Poland (Falkowski, Jakubowski, & Strawinski, 2014) indicate that individual characteristics (such as gender and education), household and farm characteristics, and location characteristics (such as access to infrastructure and markets) contribute to either stimulating or discouraging off-farm activities.

The review of off-farm participation literature suggests that a participant's characteristics, farm characteristic, and his or her farm/family's characteristics, and off-farm employment related spatial-factors are possible covariates which explain the off-farm labour participation and allocation decisions. In the case of Fiji, however, the significant part of this aspect has not yet been empirically examined. Previous studies on the rural economy of Fiji have been concentrated on the characteristics of farms and rural villages, qualifying the share of non-farm in total income and employment to show the range of non-farm activities at the household level. For instance, a survey of 227 farms among the Indo-Fijian farmers conducted in 1966 by Anderson (1968) showed that income from outside of farm was obtained by 71 percent of these farm households. The study indicates that the amount of off-farm income and employment is more dependent on employment opportunities and the distance from urban centres rather than on the economic conditions of the households surveyed. Anderson (1968) further adds that off-farm earnings are more likely to be used for consumption rather than investment.

Low (1984) uses the Gini coefficient to analyse the inequality impact of non-farm income distribution for a sample of Fiji's sugarcane farms. He finds that non-farm income improves income inequality amongst these farmers. In particular, lower income farmers benefit from off-farm employment more than the higher income farmers. Another study by Low (1985) for the off-farm employment in two sugarcane farming sectors in Olosara and Cuvu (western division in Fiji) found that income from off-farm employment and off-farm economic activities not only improved a household's standard of living but also reduce the level of risk of their total portfolio in income earning assets. To fill the research gap, this study uses the double-hurdle econometric model to examine the determinants of off-farm participation and labour supply allocation decisions of male and female adult members of Fiji's agricultural households. The next section highlights model specifications, methodology, and data.

4.3 Data, Methodology and Model Specification

This section examines the farm income diversification strategy by examining the households participating in off-farm income-generating activities among the members of Fiji's agricultural households. The methodological approach, assumptions and the associated econometric issues are discussed in detail including the variables used for the analysis.

4.3.1 Model Specification: Theoretical Representation

The theoretical framework of off-farm labour participation and allocation decisions are based on the agricultural household model which assumes that these households make joint decisions over consumption, production, and time (labour versus leisure) allocation for work (Singh, Squire, & Strauss, 1986; Taylor & Adelman, 2003). The agricultural household model was initially developed and applied by Chayanov and Nakajima in 1923 and 1957, respectively, based on the behaviour of farm households, which can be best understood in a household-farm framework (Ellis, 1993). This model formalised by Becker (1965) notes that the time allocation of household members occurs when labour has an opportunity cost and that household utility is not only determined by market goods but also by household-produced goods and total household time endowment. The model has been expanded further by Barnum and Square (1979) that indicate various aspects of the agricultural households, known as new-classical farm household model (see Singh et al., 1986). This model has been further developed under the assumption of missing or incomplete markets by de Janvry, Fafchamps and Sadoulet (1991).

The agricultural household model based on the assumption of perfect markets is called the separable household model. This is formed through the combination of the consumer and producer models into a single model where the production decisions of the farm household are independent from consumption decisions (Singh et al., 1986). Under this assumption, the household decides (based on its resources and prices) how much total labour would be used on own farm in order to maximise the profits from farm production. The household then maximises the utility by choosing between different levels of consumption and leisure depending on the profits to be made. The members of the agricultural households are also willing to participate in off-farm employment activities as long as the off-farm wage rate is greater than the marginal value of farm labour. However, in the presence of market imperfections, the separability assumption collapses and consumption decisions are affected by production decisions of the household (Taylor & Adelman, 2003). This implies that households maximise utility given their resources, available technology, and the household-specific market access and prices.

Benjamin and Guyomard (1994) note that an individual will participate in off-farm work when his or her reservation wage is lower than the off-farm wage rate. In line with the findings of Benjamin and Guyomard (1994) and Matshe and Young (2004), this study utilises the theoretical model that considers a farm household in which an adult male and female

jointly decide the household consumption (C), their time endowment (T) between farm work, off-farm work, and leisure (l). The household produces agricultural products on fixed land using labour, seeds, and other inputs such as fertilisers and pesticides. The household maximisation problem is derived from the utility function based on production, time constraint and income constraints (Matshe & Young, 2004) defined as follows:

$$MaxU = U(l_m, l_f, V_m, V_f, V_h, A) \quad (4.1)$$

where l_m and l_f are leisure time of adult male and female, V_m and V_f are vectors of individual characteristics, V_h is a vector of household characteristics and A is other farm fixed inputs.

Equation (4.1) is subjected to the following constraints:

(i) production constraint: $Q = Q(L_F^j, X)$, $(j = m, f)$ (4.2)

(ii) time constraint: $T^j = L_F^j + L_{OF}^j + l^j$, $(L_F^j \geq 0, L_{OF}^j \geq 0, l^j \geq 0)$ (4.3)

(iii) income constraint: $P_c C = P_q Q + w(T - l) + K$ (4.4)

where Q is the quantity of farm outputs;
X is a vector of production inputs except labour;
T is time endowment between farm work (L_F), non-farm work (L_{OF}) and leisure (l);
P_c and P_q are the prices of consumptions goods and farm outputs;
Q_c is the quantity of goods and services consumed by the household;
w is wage rate and *K* represents the non-labour income; and
m and *f* refer to male and female participant, respectively.

Taking the time constraint (equation 4.3), income constraint (equation 4.4), and substituting equation (4.3) into equation (4.4), the agricultural household income is obtained as:

$$P_c C = P_q Q + w(L_F - L_{OF}) - P_x X + K \quad (4.5)$$

Combining equations (4.5) and (4.2), the expression of equation (4.1) can be maximised subject to full household income constraint of equation (4.5) as follows:

$$\omega = U(l_m, l_f, V_m, V_f, V_h, A) - \lambda\{P_c Q_c - P_q Q - w(L_F - L_{OF}) - P_x X + K\} - \varphi Q(L_F, X) \quad (4.6)$$

where λ and φ are Lagrange multipliers associated with income and production constraints. The first order conditions (FOCs) for consumption constraint are:

$$\frac{\partial \omega}{\partial C} = U_c - \lambda P_c = 0 \quad (4.7) \qquad \text{and} \qquad \frac{\partial \omega}{\partial l} = U_l - \lambda w = 0 \quad (4.8)$$

The FOCs of farm household models provide a system of supply and demand functions that permits formulating labour allocation decision between different agricultural and non-agricultural activities (de Janvry et al., 1991). Equations (4.7) and (4.8) show the marginal rate of substitution between consumption and leisure is equal to the ratio of wage rate and the price of consumption goods. For an individual household member, the off-farm labour participation decision is based on the comparison of market wage rate (w) and the individual's reservation wage (w_r^j). That is, a person may participate in off-farm work if the difference of expected off-farm labour income between the off-farm wage rate and reservation wage is greater than zero, which is given as:

$$L_{OF}^j > 0 \text{, if } E(w - w_r^j) \geq 0 \ \ (j = m, f) \quad (4.9) \text{ and } L_{OF}^j = 0 \text{, if } E(w - w_r^j) < 0 \ \ (j = m, f) \qquad (4.10)$$

Equations (4.9), (4.8) and (4.6) imply that the reservation wage is an endogenous variable influenced by other exogenous variables in the model. Variables that raise the reservation wage tend to reduce the probability of off-farm labour participation, while variables that raise the off-farm wage rate increase the probability of seeking off-farm employment. For the variables that increase both the likelihood of off-farm participation and the amount of off-farm working days allocated, the outcome is a priori uncertain.

4.3.2 Estimated Models for Off-farm Labour Participation

To investigate what motivates an individual household member to participate in off-farm work and what factors influence the amount of days allocated to off-farm work, the double-hurdle regression model is used. The model, first introduced by Cragg (1971), has been used extensively in the empirical studies of labour decisions of rural agricultural households in developing countries (Matshe & Young, 2004; Beyene, 2008; Atamanov & van den Berg, 2012; Bedemo et al., 2013).

The dependent variable takes the value of one if an individual participates in off-farm work, and zero otherwise in the first-hurdle decision process. Once the first-hurdle is crossed, a truncated regression describes the amount of working days an individual allocates in the off-farm work. Thus the dependent variable in the second-hurdle decision process is the number of working days an individual allocates to the off-farm work. Standard regression analysis (such as the Ordinary Least Square regression) can be misleading in these circumstances. Zero observations of off-farm labour days may arise for a number of reasons. First, it is possible that an individual may not be a participant in the labour market because of personal preferences, inadequate qualifications or other disabilities. Second, some individuals may be

off-farm employment participants (potential workers) who chose not to work at the current level of economic climate and incentives. Third, it is possible that an adult member of the agricultural household undertakes the off-farm work on an infrequent basis due to other household commitments, and did not provide for the amount of off-farm working days in the survey. Such "non-participation" decisions have to be considered in addition to the corner solution outcomes. Therefore, a model that may be applied if the participation decision and the level of dependent variable are determined by different stochastic process is the double-hurdle model (Cragg, 1971).

The double-hurdle model allows for separate "hurdles" that reflect the (binary) participation decision and the (continuous) off-farm working days. It assumes that the error terms of the stochastic processes of level and participation decisions are uncorrelated and leads to the independent double-hurdle model. On the other hand, the dependent double-hurdle model accounts for the possible correlation between the two error terms. As a result of the presence of continuous observations for the dependent variable (i.e., the amount of days individuals had worked in the off-farm work), the exclusion restrictions are not required for a separate identification of stochastic process of independent double-hurdle model (Blundell & Meghir, 1987). To derive the double-hurdle model with independent error terms, the modelling undertaken here closely follows the studies by Cragg (1971), Blundell and Meghir (1987), and Matshe and Young (2004) which consider the latent participation *d** and level *y** as linear functions of the first-hurdle regressor x_1 and the second-hurdle regressor x_2 as follows:

$$d^* = x_1'\beta_1 + \varepsilon_1,\ \varepsilon_1 \sim N(0,1) \quad (4.11) \qquad \text{and} \qquad y^* = x_2'\beta_2 + \varepsilon_2, \varepsilon_2 \sim N(0,\sigma^2) \quad (4.12)$$

where β_1 and β_2 are the parameter vectors to be estimated. Since the double-hurdle model is based on the assumption that the error terms are normally distributed, the inverse hyperbolic sine (IHS) transformation (Burbidge, Magee, & Robb, 1988) of the observed dependent variable is frequently applied (Yen & Jones, 1997). The IHS transformation is given by:

$$T(y) = \frac{\log[\lambda y + (\lambda^2 y^2 + 1)^{\frac{1}{2}}]}{\lambda} = \frac{\sinh^{-1}(\lambda y)}{\lambda} \quad (4.13)$$

where λ represents an additional parameter. The IHS transformation approximates $\log(y)$ for large values of y in the empirical analysis, which is assumed that λ equals to one. The IHS double-hurdle model considers two aspects of the decision making process, i.e., participation in the decision making and the allocation of time of the off-farm employment or economic activities.

The likelihood function of the independent IHS double-hurdle model takes the following form:

$$L = \prod_{i\in\Omega_0}\{1-\Phi(x_1^{'}\beta_1)\Phi(\frac{x_2^{'}\beta_2}{\sigma})\}\times\prod_{i\in\Omega_1}\{\frac{1}{\sqrt{1+\lambda^2 y^2}}\Phi(x_1^{'}\beta_1)\frac{1}{\sigma}\phi[\frac{T(y)-x_2^{'}\beta_2}{\sigma}]\} \quad (4.14)$$

where $\Omega_0 = \{i|y_i = 0\}$, $\Omega_1 = \{i|y_i \neq 0\}$ and $\Omega_0 \cup \Omega_1 = \{1,2,...,N\}$. In equation (4.14), it is said that when λ equals to zero, the likelihood function reduces to that of the independent double-hurdle model (Cragg, 1971; Blundell & Meghir, 1987). The marginal effects of IHS double-hurdle models are given by the derivation of unconditional mean with respect to the explanatory variables. The marginal effect estimation takes the following form:

$$E(y|y>0) = \Phi(\frac{x_2^{'}\beta_2}{\sigma})^{-1}\int_0^{\infty}\frac{y}{\sigma\sqrt{1+\lambda^2 y^2}}\phi[\frac{T(y)-x_2^{'}\beta_2}{\sigma}]dy \quad (4.15)$$

Equations (4.14) and (4.15) have been utilised to estimate the determinants of off-farm participation and labour supply allocation decisions in the farm household. The estimated joint maximum likelihood estimation results of the independent double-hurdle model (i.e., equation 4.14) explain the probability of participating and the days of off-farm work and equation (4.15) indicates its associated marginal effects (see Hamilton, 2013). The first hurdle is represented by the Probit model[36] and the second hurdle is represented by the Truncated regression model (Cragg 1971; Greene, 2008).

4.3.3 Data and Methodology

The dataset utilised in this study is based on the latest Household Income and Expenditure Survey (HIES) 2008-09 provided by Fiji Island Bureau of Statistics (FIBOS). A total of 3,573 households (consists of 16,815 persons) from each of the 15 provinces are included in the survey.[37] This large sample survey provides credibility to the results at the overall and regional levels and also at the household level, which is useful to analyse the agricultural household behaviour.

A total of 6,094 persons in 1,210 agricultural dependent households is taken from the HIES dataset for the analysis of off-farm participation and labour supply allocation decisions. Within this household sample, the households produce more than one agricultural product and at least one member engages in some form of off-farm paid employment. Figure 4.1 presents

[36] Probit model is $\Pr(y_i \neq 0|x_j) = \Phi(x_i b)$, where x_i is the explanatory variables, Φ is the standard cumulative normal distribution with mean zero and variance one, and the term $x_i b$ is the Probit index (Wooldridge, 2009).

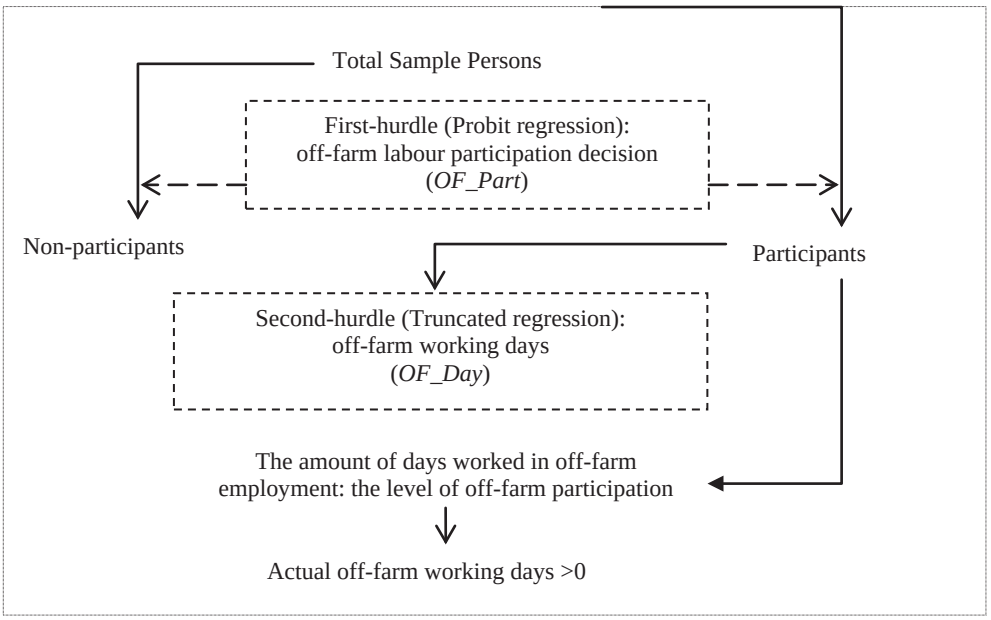
[37] A pilot survey tested the questionnaire and the administrative arrangements in place, leading to improvements in questionnaire and fieldwork arrangements (FIBOS, 2010).

the nested structure of double-hurdle decision-making process. The total number of persons is identified as either off-farm participants or non off-farm participants.

Under the double-hurdle regression approach (see Figure 4.1 below), an individual needs to cross two hurdles in order to report off-farm working days greater than zero. That is, the individual has decided to participate in the off-farm labour markets (the first hurdle), and has allocated some amount of days to work off-farm (the second hurdle). Hence, nonlinear regressions are applied using equation (4.14) with two different dependent variables to capture the factors that influence one's decisions on off-farm participation (OF_Part) and the level of off-farm participation (OF_Day).

The alternative approach to double-hurdle model is said to be Tobit regression model in the context of off-farm activities. However, the model developed by Tobin (1958) makes a strong assumption that the same probability mechanism generates both the zero and positive values. Therefore, it is more flexible to allow for the possibility that the zero and positive values are generated by different decision mechanisms. Many applicators have shown that as an alternative model, the double-hurdle model also provides a better fit by relaxing the Tobit model assumptions (see for example, Atamanov & van den Berg, 2012).

Figure 4.1 A Nested Structure of the Double-hurdle Decision Process



For a more robust identification and estimation of equation (4.14), three model adequacy tests are used to examine the two-part model. The Heckman model selection test (Heckman, 1979) is employed to test for model robustness of off-farm participation, i.e., the second-hurdle decision process. This requires that the participation equation has an exogenous variable that

is excluded from the off-farm labour allocation equation. It is suggested that the excluded variable could have a substantial impact on the probability of off-farm participation decision.

It is not easy to identify the variable that does not directly affect the level of off-farm participation and the likelihood of off-farm participation. In this study, an individual's disability status (Disable) and socio-economic status (i.e., Decile3 and Rooms) are excluded in the off-farm labour allocation equation. The rationale is that from the social perspective an individual may be excluded from off-farm labour participation because of his or her disability and low socio-economic status. Barry (1998, cited in Stewart, Saith, & Harriss-White, 2007, p.76) notes that "groups be considered socially excluded if they are denied the opportunity of participation, whether they actually desire to participate or not." The second test that examines the relevance of double-hurdle model is the Tobit restriction likelihood ratio (LR) test.[38] The Pseudo R-square is the third measure of the goodness of fit for the participation (binary) model, which shows the possible deviation for the underling fitted distribution.

4.3.4 Variable Definitions and Descriptive Statistics

Based on the literature, there are various socio-economic and demographic indicators for the off-farm labour participants in the 2008-09 HIES dataset to investigate the determinants of off-farm labour participation and allocation decisions in the case of Fiji. Several socio-economic indicators are also included in the analysis based on the hypotheses and uniqueness of Fiji's farm households. The list of variables and definitions are presented in Table 4.1. The dependent variables in the two hurdles of decision process model are off-farm participation (OF_Part) and days worked on the off-farm (OF_Day) activities. The coefficient OF_Part takes the value for the individuals of 1 or 0 for participation and non-participation, respectively, while the off-farm working days (OF_Day) are actual number of days reported by the participants.

The individual characteristics include age, age square, ethnicity, marital status, education (level of schooling), and being the head of household. Human capital is measured by the individual's level of schooling which plays an important role in labour time allocation of the agricultural households (Huffman, 1992; de Janvry & Sadoulet, 1997). The farm household is characterised by its size and composition, health status of household head, level of household

[38] The value of the LR test can be computed by the formula as: $\lambda = 2(\ln L_{TR} + \ln L_P - \ln L_T)$, where λ is distributed as chi-square with N degrees of freedom, and N represents the number of independent variables including a constant. The variables of $\ln L_{TR}$, $\ln L_p$ and $\ln L_T$ stand for the log likelihood of the Truncated regression model, Probit model and Tobit model, respectively. The Tobit model will be rejected in favour of the double-hurdle model if λ is greater than the critical value of the chi-square (Greene, 2008).

consumption and household's assets (i.e., non-labour income, farm income, availability of remittances, and welfare payments), and household living conditions. The farm characteristics are types of agricultural products a farm household grows and ownership of the land.

Table 4.1 Variable Description and Definitions

Variables	Definition
Dependent Variables	
OF_Part	Off-farm labour participation (Yes = 1, No = 0)
OF_Day	Off-farm labour time allocated (Completed Days)
Explanatory Variables	
Individual Characteristics	
Age	Age of the household member (Completed years)
Age^2	Age squared
Fijian	The household member is Fijian (Yes = 1, No = 0)
Indo_Fijian	The household member is Indo-Fijian (Yes = 1, No = 0)
Married	The household member is married (Yes = 1, No = 0)
Schooling	Number of years of schooling of individual member (Completed years)
Hhld_Head	The household member is the household head (Yes = 1, No = 0)
Household and Farm Characteristics	
Size	Household size
Infant	Proportion of children below the age of 5 in the household
Female	The person is female (Yes = 1, No = 0)
Female×Infant	The interaction of gender and the number of infants in the household
Child	Proportion of children between the age of 5 and 10 in the household
Youth	Proportion of children between the age of 11 and 17 in the household
Elderly	Proportion of the adults aged 60 and above in the household
Disable	The member of household is disabled (Yes = 1, No = 0)
Decile3	Household in the bottom three income deciles (Yes = 1, No = 0)
Hhld_Exp	Household expenditure per Adult Equivalent (AE) (in F$ per annum)
Income_NL	Household non-labour income (in F$ per annum)
Income_Farm	Household farm income per adult equivalent (in F$ per annum)
Remittances	Household receives remittances either from overseas or within the country (Yes = 1, No = 0)
Welfare	Household receives government welfare (Yes = 1, No = 0)
Rooms	Ratio of the number of rooms per AE in the household
FFV	Household grows fresh fruit and vegetables (FFV) (Yes = 1, No = 0)
Rootcrops	Household grows root cops (Yes = 1, No = 0)
Livestock	Household rears livestock (Yes = 1, No = 0)
Rice	Household grows rice (Yes = 1, No = 0)
Sugar	Household grows sugar crops (Yes = 1, No = 0)
Ownership	Household owns the dwelling (Yes = 1, No = 0)
Wage	Non-agricultural daily wage rates (in F$ per day)
Location Characteristics	
Central	The member lives in the Central division (Yes = 1, No = 0)
Northern	The member lives in the Northern division (Yes = 1, No = 0)
Western	The member lives in the Western division (Yes = 1, No = 0)

Notes: FFV includes banana, pineapples, watermelon, beans, cabbage, cucumber, copra, eggplant, pumpkin, tomato, and yams. The Rootcrops include cassava, dalo and yagona, and the Livestock includes for fish farming, rearing of cattle, pig and goat, poultry farming.

The non-agricultural daily mean wage rates (Wage) is used based on 2007 non-agricultural daily mean wage rates (latest available data), ranging from F$24.39 for manufacturing sector to F$33.58 in the utility sector (FIBOS, 2013). The location variable included in the study is by province: Central, Northern and Western. These variables are expected to influence off-farm participation decision as suggested by Reardon, Berdegue and Escobar (2001).

Out of 6,094 persons from the agricultural households in the HIES 2008/09 dataset, a total of 1,845 persons are identified as off-farm labour participants. Within that group, there are 1,439 male and 406 female adults. Descriptive statistics for the explanatory variables in the second-hurdle decision model (Table 4.2), confirm the general consensus that gender plays a significant role in the off-farm labour participation and labour allocation decisions. On average, most of the participants are married, have over 9 years of schooling, and are 40 years of age. In the male-participant group, a total of 75 percent are Fijians and 21 percent are Indo-Fijians in the male-participant group, while 81 percent are Fijians and 14 percent are Indo-Fijians in the female-participant group.

Table 4.2 Descriptive Statistics of Adult Participants

Variable	Overall Participants (1845)		Male (1439)		Female (406)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age	39.81	13.68	39.80	13.83	39.87	13.15
Age^2	1772.06	1181.31	1774.90	1193.90	1761.98	1136.92
Fijian	0.76	0.42	0.75	0.43	0.81	0.39
Indo_Fijian	0.20	0.40	0.21	0.41	0.14	0.35
Married	0.70	0.46	0.71	0.45	0.67	0.47
Schooling	9.90	3.79	9.83	3.77	10.18	3.85
Hhld_Head	0.51	0.50	0.62	0.49	0.12	0.33
Size	5.64	2.48	5.64	2.48	5.61	2.46
Infant	0.08	0.12	0.08	0.12	0.08	0.12
Child	0.11	0.14	0.11	0.14	0.12	0.14
Youth	0.13	0.15	0.12	0.15	0.14	0.16
Elderly	0.08	0.15	0.08	0.15	0.08	0.16
Disable	0.01	0.10	0.01	0.10	0.005	0.07
Decile3	0.40	0.49	0.41	0.49	0.35	0.48
Hhld_Exp	2661.89	1983.55	2557.04	1780.23	3033.51	2546.31
Income_NL	1195	1174.03	1147.95	1082.32	1361.77	1442.48
Income_Farm	1032.53	1084.50	1072.34	1129.86	891.40	892.63
Remittances	0.26	0.44	0.25	0.43	0.30	0.46
Welfare	0.08	0.27	0.07	0.26	0.09	0.28
Rooms	0.71	0.55	0.72	0.52	0.72	0.66
FFV	0.39	0.49	0.38	0.48	0.44	0.50
Rootcrops	0.53	0.50	0.55	0.50	0.48	0.50
Livestock	0.33	0.47	0.31	0.46	0.38	0.49
Rice	0.02	0.15	0.02	0.15	0.03	0.16
Sugar	0.12	0.32	0.13	0.34	0.06	0.24
Ownership	0.92	0.27	0.92	0.27	0.91	0.28
Wage	27.46	1.57	27.53	0.73	27.21	3.04
Central	0.24	0.43	0.22	0.41	0.32	0.47
Northern	0.27	0.44	0.29	0.45	0.20	0.40
Western	0.30	0.46	0.30	0.46	0.29	0.45

Notes: Values in parentheses are numbers of observation used in the Truncated second-hurdle model.

The mean of household size (Size), number of children (Infant, Child, and Youth), number of elderlies (Elderly) and number of rooms (Room) are quite evenly distributed, which confirm that agricultural households are homogenous. Distribution of the participants who are disabled (Disable) is relatively higher in the male-participant group than female group. A total of 32 male and 14 female participants (out of 1,845 participants) are reported as having some

degree of disability. Also, 41 percent male participants and 35 percent female participants are from the bottom three household income deciles (Decile3). The mean annual household consumption (Hhld_Exp) and non-labour income (Income_NL) are relatively higher for females than males, whereas the farm income per adult equivalent (Income_Farm) is higher for males at F$1072.34 compared to females at F$891.40.

In terms of receiving financial assistance, 25 percent male and 30 percent of the female participants are from the remittance-recipient households, while seven percent male and nine percent female participants are the government welfare-recipient households. Moreover, majority of the participants own the dwelling (Ownership). Most male participants live in the Western and Northern divisions, whereas most of the female participants are from the Central division. As for the farm characteristics, a larger proportion of male participants are from households with sugarcane farms and root crops than the female counterpart, whereas more female participants belong to the households which grow fresh fruit and vegetables, livestock, and rice crops. The mean non-agricultural daily wage (Wage) shows that a male participant is paid slightly more (F$27.53 per day) than the female participant (F$27.21 per day). The next section presents the estimated results for off-farm labour participation and time allocation determinant models.

4.4 Empirical Results

The empirical results for the probability of engaging in the off-farm work and the level of off-farm labour supply among the individuals from Fiji's agrarian households are presented in Table 4.3. First, the estimated results are for all off-farm participants (hurdle one), followed by the level of participation, that is the amount of days allocated for off-farm work (hurdle two). In the penultimate section, the estimation identifies if there is any differential impact on the participation and off-farm labour allocation behaviours by male and female adults. A two-step regression procedure has been undertaken in the double-hurdle model approach. The Probit regression technique is used in the estimation of first hurdle to analyse the determinants of all off-farm participation (dependent variable OF_Part) and the Truncated regression is used for the estimation of off-farm labour allocation (dependent variable OF_Day) in the second hurdle. The estimated Heckman selection model (based on a full maximum likelihood estimator) examines the possibility of an individual suffering from some form of discrimination or social exclusion. The marginal effects highlight the likelihood impact due to a unit change in the explanatory variables.

4.4.1 Results for Off-farm Labour Participation and Allocation: All Participants

The estimated coefficients for the analysis of all off-farm work participation and the level of off-farm labour supply allocation are presented in Table 4.3. To check the relevance of the double-hurdle model, the computed Tobit restriction likelihood ratio (TRLR) value strongly rejects the hypothesis of the participation and off-farm labour supply allocation decisions are based on the same set of decision process (i.e., TRLR = 622.162, with a critical $\chi^2_{(0.05,30)}$ value of 43.77).[39] The result indicates the preference of independent double-hurdle mode over Tobit model.[40] The Heckman model selection LR test result also indicates that off-farm participation and the level of labour time allocation are two independent decisions that an individual makes. The computed value of Heckman model selection LR (0.11) test is lower than the critical chi-square value at the five percent significance level ($\chi^2_{(0.05,1)} = 3.81$). Thus, we do not reject the hypothesis of off-farm participation and labour allocation are two independent decision making process.

The age and age square (Age^2) of the member of the farm household plays an important role in both the hurdle decision-making process. In terms of participation, the probability of off-farm work participation increases with younger age, while the Age^2 captures the opposite effect in the first hurdle. The negative and statistically significant Age^2 coefficient in the second-hurdle labour supply time allocation decision process implies that, at older age, the days of off-farm work decrease as the participant's age increases. Ethnicity does not affect one's off-farm participation decision, though the Fijian participant tends to have less off-farm labour time allocated compared to Indo-Fijian participants. Marital status (Married) has a significant negative impact on both the participation and labour allocation decisions. Due to domestic commitment, being married is highly unlikely in engaging in off-farm work. However, those who are already engaged in the off-farm income-generating activities have fewer working days allocated than these who are single.

The Schooling coefficient is positively significant in participation decision model. However, the years of schooling do not have a significant impact on the amount of labour days worked in off-farm (second decision-making hurdle). The literature notes that education plays a vital role in off-farm economic activities this is not the case for Fiji. This may be because most of the off-farm jobs do not require high educational levels as their average years of schooling is

[39] The value of the Tobit restriction likelihood ratio is computed based on the following formula:
$\lambda = 2(\ln L_{TR} + \ln L_P - \ln L_T) = 2(-6149.926-1127.048+7588.055) = 622.162$ (see Table 4.3).

[40] The estimation results of Tobit model for all participants, male participants, and female participants are presented in the Appendix A.

about 10 years (Table 4.2). Also, the level of formal education for the individuals' provides them more adaptability and capable in the range of tasks they perform in the off-farm work.

Table 4.3 Double-hurdle Models for Overall Participants, HIES 2008-09

	Hurdle One		**Hurdle Two**			
	Off-farm Participation		Level of Participation			
	Probit Regression		Truncated Regression		Heckman Regression	
Explanatory Variable	Z-Statistic	Marginal Effect	Z-Statistic	Marginal Effect	Z-Statistic	Marginal Effect
Age	8.04***	0.0070	1.34	0.1127	1.07	0.0865
Age^2	-8.74***	-0.0001	-2.0455	-0.0020	-1.7*	-0.0016
Fijian	-0.16	-0.0018	-2.72***	-2.6212	-2.84***	-2.4927
Indo-Fijian	1.24	0.0191	0.11	0.1206	0.18	0.1863
Married	-2.53**	-0.0148	-2.28**	-1.1462	-2.12**	-0.9825
Schooling	1.72*	0.0011	-0.76	-0.0377	-0.74	-0.0339
Hhld_Head	11.99***	0.1367	0.7	0.3576	0.43	0.2313
Size	3.53***	0.0042	3.02***	0.2883	2.27**	0.1935
Infant	1.5	0.0430	0.83	1.5753	0.79	1.3724
Female×Infant	-3.6***	-0.1245	-1.69*	-5.3004	-1.56	-4.4679
Child	-2.52**	-0.0435	-1.27	-1.8038	-1.21	-1.5567
Youth	-1.33	-0.0229	1.47	1.9662	1.27	1.5571
Elderly	1.06	0.0166	0.29	0.4147	0.28	0.3543
Disable	0.16	0.0050	0.61	1.1541		
Decile3	-2.75***	-0.0147	-3.22***	-1.3894		
Hhld_Exp	1.35	0.0001	2.87***	0.0004	3.99***	0.0005
Income_NL	-1.56	0.0001	-0.73	-0.0002	-0.65	-0.0001
Income_Farm	-2.52**	-0.0001	-2.33**	-0.0005	-1.77*	-0.0003
Remittances	0.57	0.0030	-3.52***	-1.5047	-3.39***	-1.3010
Welfare	0.95	0.0082	-0.98	-0.7099	-1.12	-0.7188
Rooms	-1.41	-0.0068	1.31	0.5192		
FFV	3.2***	0.0161	-3.05***	-1.1720	-3.18***	-1.1207
Rootcrops	-1.71*	-0.0092	0.33	0.1428	0.29	0.1165
Livestock	0.56	0.0030	-3.26***	-1.3929	-3.14***	-1.2075
Rice	0.29	0.0064	2.39**	2.9895	2.22**	2.6053
Sugar	-0.79	-0.0083	2.02**	1.4925	2.38**	1.6374
Ownership	-1.32	-0.0143	-0.79	-0.5371	-0.86	-0.5386
Wage	24.24***	0.0095	3.27***	1.0089	2.91***	0.3869
Central	-0.33	-0.0020	0.01	0.0031	0.21	0.1087
Northern	6.72***	0.0619	4.32***	2.5523	4.14***	2.3085
Western	8.96***	0.1053	7.24***	4.3541	6.56***	3.9036
Constant	-14.18***		-1.37		1.18	
Rho:					-0.33	
Pseudo-R^2:	0.6984					
No. Observation:	6094		1845			
Log-likelihood:	-1127.048		-6149.926		-7318.591	
Log-likelihood of Tobit Model:			-7588.055			
Tobit Restriction Likelihood Ratio (LR) Test:			622.162**			
Heckman Model Selection Likelihood Ratio (LR) Test:					0.11 (0.741)	

Notes: ***, **, * significant at 1, 5 and 10% level, respectively. Critical values for z-statistic at the 1, 5 and 10% are: 2.58, 1.96 and 1.65. Critical value of $x^2_{(30)=43.77}$ at the 5% significance level. Value in parenthesis is *p*-value.

Being the head of the household (Hhld_Head) increases one's likelihood of engagement in off-farm work, though it does not affect the level of participation (i.e., amount of days worked in the non-farm activities). Larger household size (Size) contributes positively to the probability of participation in off-farm work as well as the participation level. The Size

coefficient, in the second-hurdle decision-making model, shows that the participant from a larger family is likely to have more labour time allocated to off-farm work compared to one from a smaller family. In other words, larger household size increases the farm household's need to diversify household income. The effect of number of infants (Infant) and youth (Youth) in the household does not affect one's decision of taking up off-farm work or the level of participation. However, the households having a larger proportion of older children between the age of 5 and 10 (Child) are less likely to engage in off-farm work. This may reflect the greater time commitment of the participants, especially women in the household. The estimated interactive term Female×Infant has a negative and significant impact on the probability of engaging in off-farm work and the level of participation implying that domestic commitments are an important determinant of female participation.

The estimated Elderly and Disable coefficients are positive and not statistically significant in the two-hurdle decision marking models. Farm households ranked in the bottom three income deciles (Decile3) as proxies for socio-economic status in the society, has a negative impact on both the likelihood of off-farm work participation and on the labour days worked. Individuals from these households are relatively worse-off and less likely to participate in off-farm work. However, when they take part in off-farm income-generating activities their off-farm working days are less than those from the relatively wealthy households.

In the Heckman selection model, the coefficients for Disable, Decile3, and Rooms are excluded from the off-farm labour time allocation decision model to estimate the possibility if an individual suffers from some form of discrimination or social exclusion. Only the Decile3 coefficient is negative and significant implying that individuals may be discouraged or excluded from participating in the off-farm economic activities due to their current socio-economic status. On the same token, it is possible to argue that because of being economically disadvantaged, there are fewer opportunities available to those who are in poverty. The coefficient (Hhld_Exp) is positive and insignificant for the participation decision model; however, the increasing level of household expenditure increases the participant's off-farm labour time. The marginal effect shows that a 10 percent increase in the household consumption would contribute a 0.04 percent rise in off-farm labour time. The non-labour income (Income_NL) is negative and insignificant. The coefficient of farm income per adult equivalent (Income_Farm) is statistically significant and negative for both the likelihood of off-farm participation and the level of participation. For instance, as the farm income increased by 10 percent (or by one unit), it reduces to the probability of taking part in the off-farm income-generating activities by 0.01 percent (or a decrease in the Probit index by 0.001

standard deviations).[41] It also contributes negatively to the likelihood of reducing labour time in off-farm work by 0.04 percent. The finding is consistent with Matshe and Young (2004) rendering support to the argument that the probability of off-farm income participation is induced by the inability of household to increase agricultural output and therefore agricultural income.

Although the coefficient for the remittance recipient households (Remittances) is positive, it is insignificant for the participation decision-making process. The off-farm results partially imply that there is less labour time allocated in off-farm employment in the remittance recipient households compared to participants from the non-recipient households. This is because, by easing the constraint on farm household's income, remittance income reduces the need to undertake off-farm work. Moreover, the result is in line with the general consensus that remittance flows to rural households have been contributing directly to the household's income and indirectly to crop production and diversification (Adams, 1996; de Brauw, Taylor, & Rozelle, 2001).

Government financial support (Welfare) has a positive impact but is not significant in the off-farm participation. For the level of participation, Welfare coefficient is negative and insignificant. This may be due to the lower level of government welfare assistance provided to the households to ease financial constraints. According to the HIES 2008/09, only 517 persons in the agricultural households out of 1,201 reported to have received government welfare in the forms of scholarship, pension and worker accident compensation. The coefficient Rooms, as a proxy for household's living standard, is not statistically significant, which does not affect the participation and off-farm labour allocation decisions.

The farming system adopted by the household is represented by the production mix of cash crops of fresh fruit and vegetables (FFV), root crops (Rootcrops), livestock (Livestock), rice (Rice) and sugar (Sugar). It is noted that most of the FFV cash crops are labour intensive with a relatively short interval time between sowing and harvesting. These households have family members seeking for off-farm work in the off-season, and pull these participants back when the harvesting season is on. The household member with traditional root crops is less likely to engage in off-farm work, this suggests that households that grow root crops tend to generate cash income from market sales from this source rather than the off-farm work. Households involved in livestock farming do not have an effect on the likelihood of their off-farm

[41] The interpretation of the marginal effects of Probit regressors suggest that a one unit increase in a given variable leads to an increase in the Probit index by standard deviation equal to the magnitude of the coefficient (Wooldridge, 2009).

participation. However, their participation level in off-farm work spent less labour days compared to other participants. The estimated Rice and Sugar coefficients are not statistically significant implying that these households are not affected by their off-farm participant level decision. However, for members of farm households who have already participated in off-farm activities tend to have more labour time allowed for off-farm work.

The impact of household ownership (Ownership) on one's off-farm participation and the level of allocation decisions are negative and insignificant. The non-agricultural daily wage (Wage) result is an important determinant for both off-farm participation and labour supply allocation decisions, which is consistent with the findings by Bedemo et al., (2013). The Wage coefficient contributes positively to the probability of off-farm participation by about 0.01 percent (or an increase in the Probit index by 0.001 standard deviation) and the likelihood of rising off-farm labour time by 1.08 percent as the non-agricultural wage rate increases by one percent (or one unit increase in the Probit regression).

As for the location characteristics, the members of farm-households located in the Northern and Western divisions participate in off-farm income-generating activities and have allocated more days. This is due to more farm allocations in these divisions, the availability of more farm jobs, and the level of rural development taking place in these divisions over the years. According to Narsey et al., (2010), during the period of 2003 and 2009, an estimated 42 percent share of poverty alleviation resources were injected to the Western division followed by Northern division (28 percent) and Central division (24 percent). The Central coefficient is negative though insignificant. In order to gain a better understanding of the households' participation and labour allocation behaviours, the next section discusses the results of the double-hurdle decision-making process by gender disaggregation.

4.4.2 Results for Off-farm Participation and Labour Allocation: by Gender

The literature on the determinants of non-farm earnings in the agrarian households have noted the disaggregation along the gender lines between and within the households to explain the differential in labour allocation behaviour (Abdulai & Delgado, 1999; Matshe & Young, 2004). The computed LR tests confirm the relevance of separate double-hurdle model estimations by male and female adults (see Appendix 4B). The detailed results by gender (see Tables 4.1B and 4.2B) indicate differential impacts on households. A decision on whether or not to participate in the off-farm income-generating activities and how many working days an individual spends on these generating activities and how many working days an individual spends on these activities is therefore not based on the same set of decision-making process.

Table 4.4 reports the double-hurdle estimation results of male and female adults. In regard to the characteristics of individuals, the variables Age and Age^2 have a significant impact on the participation decisions of both male and female adults. The off-farm work participation level for older females (Age^2) declines significantly compared to male. The results show that being male or female does not significantly increase the likelihood of engaging in off-farm work. For the level of participation, the male adult of Fijian households tends to work less (fewer days) in off-farm income-generating activity. On the other hand, Indo-Fijian males are found to significantly increase their likelihood to engage in off-farm work. For the Indo-Fijian females, the coefficients are negative and insignificant for the participation decision-making hurdle, and positive and insignificant for the level of participation decision-making. The marginal effects to capture female behaviours on the aspect of off-farm participation and labour supply allocation show that the participation level (off-farm labour time allocation) is relatively higher for the Indo-Fijian female (0.78) than for the male participants (0.73).

Beyond the empirical explanation, Indo-Fijian women tend to work only in the home or family setting. According to a gender assessment study, females from Indo-Fijian societies are more likely to be "influenced by the various traditional cultural values originating from South Asia, …emphasise formal male authority in decision-making…Some Indo-Fijian communities place restrictions on women's mobility and some, particularly rural, communities consider it more socially acceptable or prestigious for women to work only in the home and family compound. …Among the urban middle-class gender values have become more liberal" (Asian Development Bank, 2006, p. 4).

The results for married male adults show that they have a higher likelihood of participating in the off-farm work than married female adults, which confirm that domestic commitments are an important determinant of female participation. The decline in the off-farm marginal effect on the level of participation is relatively higher for females than males, although both the Married coefficients are significant. In terms of decision-making within the household, male and female household heads (Hhld_Head) indicate positive impacts on decision-making process to diverse their income-generating activities, however, female adults with higher education (Schooling) are more likely to engage in off-farm work.

Table 4.4 Off-farm and Level of Participations for Male and Female Adults, HIES 2008-09

	Hurdle One				Hurdle Two			
	Off-farm Participation (Probit Regression)				Level of Participation (Truncated Regression)			
	Male		Female		Male		Female	
Variable	Z-Statistic	Marginal Effect	Z-Statistic	Marginal Effect	Z-Statistic	Marginal Effect	Z-Statistic	Marginal Effect
Age	7.36***	0.0197	4.38***	0.0010	0.86	0.0771	1.33	0.3043
Age2	-7.77***	-0.0002	-4.36***	-0.0001	-1.32	-0.0013	-1.69*	-0.0045
Fijian	1.18	0.0374	-1.12	-0.0032	-2.05**	-2.2138	-1.15	-2.4464
Indo-Fijian	2.82***	0.1535	-1.01	-0.0023	0.61	0.7301	0.31	0.7797
Married	2.03**	0.0467	-2.02**	-0.0029	-1.43	-0.8770	-1.11	-1.4168
Schooling	0.05	0.0001	2.56***	0.0004	-0.94	-0.0503	0.15	0.0190
Hhld_Head	2.01**	0.0580	3.99***	0.0377	-0.5	-0.3492	-0.61	-1.1254
Size	0.08	0.0003	2.81***	0.0007	2.66***	0.2884	1.11	0.2536
Infant	0.13	0.0101	0.05	0.0002	1.12	2.1193	-1.02	-4.1841
Child	-0.24	-0.0142	-1.72*	-0.0061	-0.43	-0.6599	-1.96**	-7.0226
Youth	-0.54	-0.0308	-0.22	-0.0008	2.19**	3.2261	-0.14	-0.4408
Elderly	0.08	0.0042	0.36	0.0012	-0.52	-0.8144	1.59	5.4044
Disable	0.03	0.0021	0.2	0.0028	1.07	2.0519	-0.04	-0.2317
Decile3	-2.04**	-0.0356	-2.19**	-0.0025	-3.47***	-1.6076	-0.73	-0.7795
Hhld_Exp	-1.06	-0.0001	2.98**	0.0001	2.5**	0.0005	1.73*	0.0005
Income_NL	-0.92	-0.0001	-1.39	-0.0001	-0.86	-0.0002	-0.42	-0.0002
Income_Farm	-3.87***	-0.0001	-0.57	-0.0001	-1.58	-0.0004	-2.37**	-0.0014
Remittances	-0.81	-0.0135	1.6	0.0020	-2.96***	-1.3632	-1.95*	-1.9734
Welfare	0.54	0.0148	0.48	0.0009	-1.13	-0.8803	-0.35	-0.6084
Rooms	-2.31**	-0.0362	0.21	0.0002	2.62***	1.1913	-0.83	-0.7267
FFV	2.47	0.0400	2.49**	0.0028	-1.47	-0.5985	-3.85***	-3.6696
Rootcrops	-0.9	-0.0158	-1.79*	-0.0021	-0.83	-0.3976	1.94*	2.0200
Livestock	-0.71	-0.0121	1.64*	0.0020	-3.07***	-1.4121	-1.47	-1.5251
Rice	-1.88*	0.0000	1.33	0.0001	0.41	0.0002	2.16**	0.0019
Sugar	-0.3	0.0000	-1.56	-0.0001	0.79	0.0001	-1.44	-0.0006
Ownership	-0.59	-0.0192	-1.95*	-0.0060	0.11	0.0818	-1.55	-2.3925
Wage	11.96***	0.0254	17.74***	0.0012	1.45	1.3645	2.7***	1.0106
Central	-2.55**	-0.0471	2.94***	0.0049	0.77	0.4992	-1.42	-2.0155
Northern	2.8***	0.0678	6.2***	0.0221	5.47***	3.4083	-0.25	-0.3895
Western	4.63***	0.1378	7.72***	0.0347	8.09***	5.1279	1.69*	2.5250
Constant	-9.76***		-9.29***		-0.89		-0.84	
Pseudo-R^2:	0.7233				0.6202			
No. Observation:	3204		2890		1439		406	

Notes: ***, **, * significance at the 1, 5 and 10% level, respectively. Critical values for the z-statistic significance levels at the 1, 5 and 10% are as follows: 2.58, 1.96 and 1.65. See Appendix 4B for the detailed model diagnostic results.

For the household composition (Size) coefficient (Table 4.4), a female adult from a large family has the tendency towards off-farm participation than the male counterpart, while male participants in larger households are more likely to allocate more days to off-farm work. The variable Infant does not alter male and female adults' behaviour on off-farm work participation and labour time allocation. The number of older children aged between 5 and 10 (Child) has a negative impact on both female off-farm participation and the labour supply time allocation. The likelihood of having more days allocated on off-farm work for the male group increases as the number of older children aged between 11 and 17 increases. Younger adults and fewer dependents in the family increase the capacity of the household to diversify their labour hours on non-farm income-generating activates. The Elderly coefficient is positive and not statistically significant for both male and female participation. As for the level of participation, the coefficient Elderly is insignificant and negative for male participant and positive for female participant. Disability of male or female adults does not affect their decisions either for off-farm participation or the level of participation. However, both gender groups in the lower income bracket are relatively worse-off (Decile3) when participating in off-farm work but when they do participate in an off-farm income-generating activity the male participants spend less time in this activity than those from relatively wealthy households. The household living standard (Rooms) does not increase male participation but raises male labour supply time allocation.

The Hhld_Exp coefficient shows female participation increases as the level of household expenditure increases. The level of household consumption also raises its time allocation to off-farm participation. The marginal effect shows that a 10 percent increase in household consumption contributes to a 0.05 percent increase in off-farm labour time. The household's non-labour income (Income_NL) does not influence either the male or female adult's decision on off-farm participation and labour supply allocation.

The significantly negative coefficient of farm household income per Adult Equivalent (Income_Farm) of male participation suggests that as farm income increased by 10 percent it reduces the likelihoods of engaging in off-farm work by 0.01 percent. It also reduces the female's off-farm labour allocation by 0.04 percent. The magnitude of remittance flows (Remittances) reduces the need to undertake off-farm work is greater for females (-1.97) than males (-1.36), as remittances provide extra financial support to ease the constraint on farm household income. Government welfare (Welfare) does not significantly affect either the male or female adults' decision on both off-farm participation and labour time allocation.

The female adults from households producing fruits and vegetable (FFV) crops participate in off-farm income-generating activities but tend to allocate lesser labour time on this activity than their counterparts. The female adult from households with traditional crops (Rootcrops) is less likely to engage in off-farm work than the male adult from the same household type. However, when these female adults do participate in off-farm income-generating work, they allocated more working days to generate income from off-farm activities. Female adults from households involved in livestock farming increase their off-farm participation. The male participants, on the other hand, allocate less off-farm working time. The coefficient Rice is negatively significant for female participation in the first hurdle, and is significantly positive in the second hurdle of decision-making process. The estimated Sugar coefficients are not significant for off-farm work and the level of participation for both male and female groups. The properties owning characteristics (Ownership) does not affect one's decisions on off-farm participation nor the level of participation.

The non-agricultural daily wage (Wage) is an important determinant for both male and female off-farm participation. A one percent increase in non-farm daily wage rate increases the probability of male and female adults' off-farm participation by 0.254 percent (or 0.0254 standard deviations) and by 0.012 percent (or 0.0012 standard deviations), respectively. The females allocate more labour time for off-farm work. In terms of the location characteristic, female adults in the Central division are more likely to find off-farm income-generating activities than the males. Both male and female adults from the Northern division are more likely to engage in off-farm work. For those who participated in off-farm work, the male participants allocate higher levels of off-farm labour time than females. Both male and female adults from the Western division take part in off-farm work and work significantly longer hours on this activity.

4.5 Conclusion

Given the importance of non-farm income in reducing the problem of low agricultural productivity, poverty, and food insecurity, the empirical findings suggest that policy makers and the government should identify and remove the barriers that hinder the development of low-income farming households and enhance their participation in off-farm income-generating activities. This could be improved through investments in key infrastructure and public transportation which are vital not only for individuals to gain access to off-farm economic activities but most importantly for the growth of such activities. The findings from

this study confirm that farmers can benefit from policies that target broader rural development support programmes. Therefore, development aimed at increasing accessibility to rural areas and economic diversification in rural areas can offer significant advantages for growth in these areas and the wellbeing of households. In this chapter, the possible factors that influence the off-farm labour participation and supply allocation decisions among members of agricultural households in Fiji are examined. The theoretical frameworks for analysing the behaviour of individuals within and between households integrate off-farm income-generating activities and the amount of labour allocation decisions are based on these households.

The double-hurdle (a two-stage) econometric approach adopted for the joint modelling of the decision-making process shows that labour decisions in the off-farm income-generating activities are not necessarily same as the determinants of level of participation. The individual's age and work experiences (Age^2) have a significant impact on off-farm income participation decision for both male and female adults, and the level of participation is only significant for female participants.

Ethnicity and gender do not significantly increase the likelihood of engaging in off-farm work for both Fijian male and female adults. Fijian male participants in off-farm activities work fewer days less than Fijian females. The Indo-Fijian males are observed in the off-farm activities, but it is not the case for Indo-Fijian females in respect of the probability of off-farm participation and level of participation. Other factors such as individual's marital status, formal education, household head status, and family size have different levels of impact on off-farm participation and labour supply allocation decision-making process. Individuals from lower income households are more likely to be excluded from off-farm income-generating activities.

The results for households involved in various types of agricultural products show that involvement in the production of fresh fruit and vegetables, root crops, livestock, rice and sugar crops have differential impact on their decisions on off-farm participation and the amount of labour time allocation. The results for females in the fresh fruit and vegetables cash crops who participate in off-farm work show that they have less amount of labour time allocated to such activities, while the female households in the traditional root crops are less likely to engage in off-farm work compared to males. The male household members involved in the livestock products allocate less amount of labour time to off-farm work. These may be due to other factors such as the agricultural production risk, inter-year variations, and seasonal

constraints on grain and cash holdings which can have implications on the number of labour time allocated to off-farm income-generating activities.[42]

The results also indicate that farm income per Adult Equivalent affect the off-arm participation and the level of participation, which is triggered (partially) by the farm household's inability to increase its agricultural output and therefore agricultural income. The non-agricultural daily wage rate has a profound impact on the probability of one's off-farm participation decision. Therefore, the likelihood of participating in off-farm work increases as the daily wage increases, and in particular, female participants allocate more of their labour time to off-farm work.

The location characteristics of the agricultural households indicate higher incidence of participation in off-farm income-generating activities in the Northern and Western divisions compared to the Central division. In comparing the off-farm labour allocation behaviour between male and female participants by divisions, the results show that in the Western division both male and female participants spend a greater amount of their time on off-farm activities than their counterparts in other divisions. The remittance flows to the farm households reduce the need to undertake off-farm work, thus, easing the constraints on farm household income, and confirming the benefits or developmental impact of migrant remittances.

Policies that provide incentives for households to participate in rural non-farm activities, as well as increasing their capacity to take advantage of such opportunities are therefore crucial. In terms of agricultural production, agriculture diversification and cash crop production should be encouraged through target agricultural policies and schemes which provide necessary technical support and financial assistances for these regions and households. Aid donors can also play a substantial role in addressing the rural constraints and enhancing capacity building of the rural households. The next chapter provides an in-depth analysis of remittances in the agricultural sector and welfare development.

[42] Due to the nature of HIES 2008-09 dataset, these factors could not be incorporated in a single season cross-section study.

Appendix 4A

The Tobit estimates of the determinants of off-farm participation and labour supply allocation decisions among the members of Fiji's agricultural households for the period of 2008-09 are presented in Table 4.1A.

Appendix Table 4.1A Tobit Regression Results, HIES 2008-09

Dependent Variable: Amount of total off-farm working days allocated in 2008-09

	All Sample		Male		Female	
Explanatory Variable	TC	t-statistic	TC	t-statistic	TC	t-statistic
Age	0.81	8.61***	0.78	7.99***	0.10	4.38***
Age^2	-0.01	-9.46***	-0.01	-8.36***	0.00	-4.36***
Fijian	-1.89	-1.62	-0.07	-0.05	-0.27	-1.12
Indo-Fijian	1.43	1.04	4.09	2.9***	-0.29	-1.01
Married	-2.54	-4.09***	0.28	0.37	-0.30	-2.02**
Schooling	0.06	0.99	-0.04	-0.56	0.04	2.56***
Hhld_head	6.17	10***	0.88	1.03	1.02	3.99***
Size	0.62	5.23***	0.25	1.89*	0.08	2.81***
Infant	3.47	1.39	1.80	0.77	0.02	0.05
Female×Infant	-15.60	-4.32***				
Child	-5.75	-3.32***	-1.68	-0.9	-0.63	-1.72*
Youth	-2.15	-1.29	0.21	0.12	-0.09	-0.22
Elderly	2.28	1.36	0.04	0.02	0.12	0.36
Disable	1.28	0.51	1.51	0.63	0.21	0.2
Decile3	-2.21	-4.12***	-2.17	-3.86***	-0.26	-2.19**
Hhld_Exp	0.00	3.07***	0.00	0.62	0.00	2.98***
Income_NL	0.00	-2.04**	0.00	-1.41	0.00	-1.39
Income_Farm	0.00	-0.03	0.00	1.79*	0.00	-0.57
Remittances	-1.02	-1.95*	-1.49	-2.69***	0.18	1.6
Welfare	-0.04	-0.05	-0.47	-0.51	0.08	0.48
Rooms	-0.07	-0.14	0.11	0.19	0.02	0.21
FFV	0.51	1.08	0.53	1.07	0.26	2.49**
Rootcrops	-0.71	-1.31	-0.53	-0.92	-0.21	-1.79*
Livestock	-0.81	-1.54	-1.44	-2.61***	0.19	1.64*
Rice	2.96	1.74*	0.00	-0.96	0.00	1.33
Sugar	0.89	0.91	0.00	-0.2	0.00	-1.56
Ownership	-1.44	-1.64	-0.47	-0.51	-0.39	-1.95*
Wage	1.48	26.92***	1.48	13.58***	0.12	17.74***
Central	-0.10	-0.15	-1.18	-1.6	0.38	2.94***
Northern	6.04	8.51***	4.35	5.93***	1.02	6.2***
Western	8.78	12.02***	6.91	9.15***	1.29	7.72***
Constant	-48.39	-16.38***	-45.18	-11.42***	-5.91	-9.29***
Pseudo-R2	0.2795		0.2531			0.6202
No. Observation	6094		3204			2890
Log-likelihood	-7588.0546		-5577			-445.44014

Notes: ***, **, * significance at the 1, 5 and 10%, respectively. Critical values for the t-statistic significance levels at the 1, 5 and 10% are as follows: 2.58, 1.96 and 1.65. TC is Tobit coefficient.

Appendix 4B

Tables 4.1B and 4.2B present the double-hurdle models for male and female adults' off-farm participation and labour supply allocation decisions for the period of 2008-09. The independent double-hurdle model is preferred over the Tobit model as the likelihood ratio (LR) test results reject the hypothesis of the participation and off-farm labour supply allocation decisions are based on the same set of decision process for both male and female adults.

Appendix Table 4.1B Double-hurdle Models for Male Adults, HIES 2008-09

	Hurdle One		Hurdle Two			
	Off-farm Participation		Level of Participation			
	Probit Regression		Truncated Regression		Heckman Regression	
Explanatory Variable	Z-Statistic	ME	Z-Statistic	ME	Z-Statistic	ME
Age	7.36***	0.0197	0.86	0.0771	0.89	0.0807
Age^2	-7.77***	-0.0002	-1.32	-0.0013	-1.31	-0.0013
Fijian	1.18	0.0374	-2.05**	-2.2138	-2.23**	-2.2574
Indo-Fijian	2.82***	0.1535	0.61	0.7301	0.78	0.8835
Married	2.03**	0.0467	-1.43	-0.8770	-1.34	-0.7682
Schooling	0.05	0.0001	-0.94	-0.0503	-0.8	-0.0402
Hhld_Head	2.01**	0.0580	-0.5	-0.3492	-0.51	-0.3323
Size	0.08	0.0003	2.66***	0.2884	1.6	0.1563
Infant	0.13	0.0101	1.12	2.1193	1.08	1.9037
Child	-0.24	-0.0142	-0.43	-0.6599	-0.53	-0.7463
Youth	-0.54	-0.0308	2.19**	3.2261	1.92*	2.6542
Elderly	0.08	0.0042	-0.52	-0.8144	-0.46	-0.6579
Disable	0.03	0.0021	1.07	2.0519		
Decile3	-2.04**	-0.0356	-3.47***	-1.6076		
Hhld_Exp	-1.06	0.0000	2.5**	0.0005	3.96***	0.0007
Income_NL	-0.92	0.0000	-0.86	-0.0002	-0.93	-0.0002
Income_Farm	-3.87***	-0.0000	-1.58	-0.0004	-0.88	-0.0002
Remittances	-0.81	-0.0135	-2.96***	-1.3632	-2.72***	-1.1599
Welfare	0.54	0.0148	-1.13	-0.8803	-1.26	-0.9026
Rooms	-2.31**	-0.0362	2.62***	1.1913		
FFV	2.47	0.0400	-1.47	-0.5985	-1.68*	-0.6411
Rootcrops	-0.9	-0.0158	-0.83	-0.3976	-0.91	-0.4026
Livestock	-0.71	-0.0121	-3.07***	-1.4121	-2.97***	-1.2626
Rice	-1.88*	0.0000	0.41	0.0002	0.29	0.0001
Sugar	-0.3	0.0000	0.79	0.0001	0.85	0.0001
Ownership	-0.59	-0.0192	0.11	0.0818	0.04	0.0311
Wage	11.96***	0.0254	1.45	1.3645	2**	0.5369
Central	-2.55**	-0.0471	0.77	0.4992	0.92	0.5461
Northern	2.8***	0.0678	5.47***	3.4083	5.75***	3.2857
Western	4.63***	0.1378	8.09***	5.1279	8.11***	4.8568
Constant	-9.76***		-0.89		0.01	
Rho:					0.03	
Pseudo-R^2:	0.7233					
No. Observation:	3204		1439			
Log-likelihood:	-609.913		-4759.232		-5398.614	
Log-likelihood of Tobit Model:			-5576.526			
Tobit Restriction Likelihood Ratio (LR) Test:			414.762**			
Heckman Model Selection Likelihood Ratio (LR) Test:					0.0001 (0.9787)	

Notes: ***, **, * significance at the 1, 5 and 10% level, respectively. Critical values for the z-statistic significance levels at the 1, 5 and 10% are as follows: 2.58, 1.96 and 1.65. The critical value of $x^2_{(30)=43.77}$ at the 5% significance level. Value in parenthesis is *p*-value.

Table 4.2B Double-hurdle Models for Female Adults, HIES 2008-09

	Hurdle One		Hurdle Two			
	Off-farm Participation		Level of Participation			
	Probit Regression		Truncated Regression		Heckman Regression	
Explanatory Variable	Z-Statistic	ME	Z-Statistic	ME	Z-Statistic	ME
Age	4.38***	0.0010	1.33	0.3043	0.83	0.1757
Age^2	-4.36***	-0.0001	-1.69*	-0.0045	-1.15	-0.0028
Fijian	-1.12	-0.0032	-1.15	-2.4464	-1.03	-1.8954
Indo-Fijian	-1.01	-0.0023	0.31	0.7797	0.39	0.8584
Married	-2.02**	-0.0029	-1.11	-1.4168	-1.06	-1.1809
Schooling	2.56***	0.0004	0.15	0.0190	-0.2	-0.0225
Hhld_Head	3.99***	0.0377	-0.61	-1.1254	-1.05	-1.8317
Size	2.81***	0.0007	1.11	0.2536	0.95	0.1905
Infant	0.05	0.0002	-1.02	-4.1841	-0.98	-3.3963
Child	-1.72*	-0.0061	-1.96**	-7.0226	-1.59	-4.8008
Youth	-0.22	-0.0008	-0.14	-0.4408	-0.1	-0.2839
Elderly	0.36	0.0012	1.59	5.4044	1.45	4.1343
Disable	0.2	0.0028	-0.04	-0.2317		
Decile3	-2.19**	-0.0025	-0.73	-0.7795		
Hhld_Exp	2.98**	0.0001	1.73*	0.0005	1.24	0.0003
Income_NL	-1.39	-0.0001	-0.42	-0.0002	-0.25	-0.0001
Income_Farm	-0.57	-0.0001	-2.37**	-0.0014	-2.34**	-0.0011
Remittances	1.6	0.0020	-1.95*	-1.9734	-2.17**	-1.8758
Welfare	0.48	0.0009	-0.35	-0.6084	-0.52	-0.7409
Rooms	0.21	0.0002	-0.83	-0.7267		
FFV	2.49**	0.0028	-3.85***	-3.6696	-4***	-3.3209
Rootcrops	-1.79*	-0.0021	1.94*	2.0200	2.1**	1.9100
Livestock	1.64*	0.0020	-1.47	-1.5251	-1.59	-1.4032
Rice	1.33	0.0001	2.16**	0.0019	2.13**	0.0017
Sugar	-1.56	-0.0001	-1.44	-0.0006	-1.15	-0.0004
Ownership	-1.95*	-0.0060	-1.55	-2.3925	-1.39	-1.9848
Wage	17.74***	0.0012	2.7***	1.0106	1.06	0.2500
Central	2.94***	0.0049	-1.42	-2.0155	-1.56	-2.0489
Northern	6.2***	0.0221	-0.25	-0.3895	-0.76	-1.3601
Western	7.72***	0.0347	1.69*	2.5250	0.59	1.1384
Constant	-9.29***		-0.84		1.23	
Rho:					-0.69	
Pseudo-R^2:	0.6202					
No. Observation:	2890		406			
Log-likelihood:	-445.44		-1357.65		-1821.349	
Log-likelihood of Tobit Model:			-1894.423			
Tobit Restriction Likelihood Ratio (LR) Test:			182.665**			
Heckman Model Selection Likelihood Ratio (LR) Test:					0.43 (0.5097)	

Notes: ***, **, * significance at the 1, 5 and 10% level, respectively. Critical values for the z-statistic significance levels at the 1, 5 and 10% are as follows: 2.58, 1.96 and 1.65. The critical value of $x^2_{(30)=43.77}$ at the 5% significance level. Value in parenthesis is *p*-value.

Chapter 5
Remittances in Agriculture and Rural Development

5.1 Introduction

Millions of people have migrated to other countries and it is estimated that the number of people living outside their country of birth is over 215.8 million or 3.2 percent of the world's population in 2010 (World Bank, 2011, p.18). Migration generates significant economic benefits for migrants, their families back home, and their adopted countries. For example, remittance (i.e., the portion of a migrant worker's earnings sent back from the destination of employment to the origin of the migrant) flows to developing countries amounted to $406 billion in 2012, more than three times that of official development assistance (ODA) (World Bank, 2012b).

Remittance flows to rural areas have been an important financial resource necessary for rural development and family support, providing a safety net during periods of stress and are utilised for productive and social purposes (Lucas & Stark, 1985; Rosenzweig, 1988; Lucas, 1987, 2006; Stark, 1984; World Bank, 2006c, 2012b). Remittances also contribute to the development of local agricultural economies and improvement in the welfare and livelihood of the receiving households, by providing basic necessities such as food, clothing, better health, and education thereby building human and social capital and to a smaller extent contributing towards savings or business investments (Adams, 1996; Mitra & Gupta, 2002; Rogaly & Coppard, 2003; Mendola, 2005).

Understanding how remittances affect the monetary resources allocated to certain expenditure categories, especially those measuring physical and human capital investments is thus important in explaining the levels of welfare achieved by the migrant households. This is particularly seen in the case in Fiji where the episodic events of the military coups have led to a significant outflow of a large proportion of skilled professionals. The United Nations Department of Economic and Social Affairs (UNDESA) (2005, p.1) reports that 60 percent of Fiji's skilled workers have either emigrated and/or gone abroad as guest workers, and this loss of skilled workers has been the world's fourth highest, behind Guyana, Jamaica, Haiti, and Trinidad and Tobago. The Fiji Island Bureau of Statistics (FIBOS) (2012) estimates that 84,711 residents left Fiji between the period 1995 and 2010, of which over 80 percent are skilled professionals (i.e., civil servants, doctors, lawyers, accountants, teachers, business

people, entrepreneurs, engineers, and skilled people in trades of all kinds). Referred to as the "brain drain", this reduction in knowledge and abilities undermines Fiji's potential to achieve success in sustainable economic growth and development. In the case of the health sector, for instance, a total of 190 or 41 percent of physicians trained in Fiji have immigrated to other countries (World Bank, 2011, p.116).

Migrants' remittance flows are seen in both urban and rural households in Fiji. In the case of Latin American countries, as noted in various studies, these households utilise remittances for food, durable and nondurable goods, housing, health, education, purchase of land, and improving farming performance and output (Acosta, Fajnzylber, & Lopez, 2008). For example, Pakistani rural farm households use remittances to facilitate the accumulation of land and agricultural capitals, while migration and remittances partially compensate for lost labour, contributing directly to the household income and indirectly to crop production and diversification (Adams, 1996; de Brauw, Taylor, & Rozelle, 2001).

This chapter examines various hypotheses based on the welfare impact of remittance flows, which is that remittances improve the economic and social wellbeing of the receiving household, by analysing the impact of remittances on household consumption patterns and the agricultural sector at the household level in Fiji. In analysing the remittances-household consumption nexus, the study employs the seemingly unrelated regression (SUR) technique (see Shonkwiler & Yen, 1999). This technique is also useful to estimate the marginal effects of remittances and other variables on the household expenditures for each category of consumable goods and services such as food, housing, durable and non-durable goods, education and health. The remittances-agriculture nexus hypothesis is evaluated next, using the Logit regression model to explore the possible linkage between remittance income and crop selection, while the Poisson regression model is used to examine the likelihood of crop diversification among the recipient and non-recipient households.

The chapter is organised as follows. Section 5.2 provides a brief literature review on the linkages between remittances, household consumption, and agricultural crop diversification. The model specifications of the remittances-consumption and remittances-agriculture relationships and the methodologies are discussed in section 5.3. The study highlights the use of specific socioeconomic and demographic variables based on the analysis by ethnicity, and rural and urban areas for the households. The data utilised in the analysis are based on the Household Income and Expenditure Survey (HIES) 2008/2009 for 3,573 households. The empirical results are presented in section 5.4 with conclusions noted in the final section.

5.2 A Brief Literature Review

This section presents the literature on the two hypotheses of remittances-welfare impact. The first part of the literature discusses the remittance-household consumption nexus and its welfare impact. The second section 5.2.2, presents the literature on remittances-agricultural production relationships.

5.2.1 Remittances-Household Consumption Nexus

The analysis of the variation in remittance flows can be approached from the most popular and widely used framework outlined by Lucas and Stark (1985) who explored the motivations underlying the remittance flows. The motivations to remit can be explained as a combination of economic and social motivations, such as self-interest, altruism, investment, loan repayment, and bequest motives, which determine the transfer of resources between the migrants and the household members at home (Stark, 1984; Lucas & Stark, 1985; Stark & Lucas, 1987). It has been noted that these transfers can serve various purposes for the households, particularly for meeting the family's basic needs; serve as payments for services rendered to migrants; payoffs as an insurance scheme that protects recipients from income shocks; provide returns on the investments made by the household in the migrant's human capital; and enable migrants to invest in inheritable assets (Stark, 1984; Lucas & Stark, 1985).

In the literature examining the remittances-household consumption nexus, several studies have rejected the assumption that a dollar increase in remittance income has the same effect as a dollar increase of wage or farm income (de Brauw, Taylor, & Rozelle, 2001; Duflo & Udry, 2004). Instead, the studies have shown that households can distinguish the nature of different income sources attributing them to different uses. For example, Taylor (1992) finds that in the case of rural Mexico, the remittance-receiving households tend to invest more in farm assets. Similarly, for Guatemala, the households devote remittances more on durable goods, housing, education and health, and less on food and other nondurable goods (Adams, 2005). Durand and Massey (1992) point out that under the right circumstances, a significant percentage of remittances and savings can be devoted to productive enterprises. Their study in the case of Mexico shows that households residing in urban or rural communities with access to urban markets tend to use remittances for setting up small or medium size businesses. They also find that remittance recipient households in rural communities with favourable agricultural conditions tend to spend more on agricultural inputs.

Remittances also can play an important role on the development of human capital such as education and health. In the case of education, the study by Acosta et al., (2008) examines the

impact of remittances on the share of household expenditures allocated to education. They find that remittances not only have a positive impact on educational expenditures among the middle- and upper-class households but also play a positive role on the educational spending on children in the households with low parental schooling. Similar results found by Yang and Martinez (2006) confirms that remittances are positively correlated with school attendance. Cox-Edwards and Ureta (2003) find that remittances have a significantly positive impact on school attendance, especially compared with other sources of income in El Salvador. The overall results from these studies support the view that remittances can help relax credit constraints in low-income households and raise children's educational attainment.

In the case of health outcomes, Acosta et al., (2008) examine the impact of remittances on child health using detailed household-level data from Nicaragua and Guatemala. They find that remittance recipient households in Guatemala tend to have better health outcomes (child's weight for age and height for age) and inputs (child delivery by a doctor and vaccinations) than non-recipient households. The estimated coefficients of health effects are positive but only the doctor-assisted delivery input is found to be significant in Nicaragua.

5.2.2 Remittances-Agricultural Production Nexus

Given the significant flows of remittances to developing countries, various studies, undertaken since the 1980s, have examined the impact of remittances on agricultural households. The literature, in general, notes that international migration and remittances have a beneficial influence on rural well-being and agricultural production. For instance, Lucas and Stark (1985) find that remittances sent to Botswana allowed rural poor households to survive hardships imposed by the severe droughts, while remittances helped rural poor households in Ghana mitigate the effects of high inflation periods (Lucas, 2006). In the case of rural farm households in Pakistan, Adams (1996) finds that external remittances have a significant effect on the accumulation of land, while internal remittances have a positive and significant effect on the accumulation of agricultural capital. It has been found that in Botswana, Lesotho, Malawi, and Mozambique, labour migration to South African mines reduced crop production in the subsistence sectors in the short-run, but over time remittances enhanced both crop productivity and cattle accumulation in these countries, except in Lesotho (Lucas, 1987).

In the case of Bangladesh, while international migration allows the home-country households of migrants to increase production and income, internal migration does not have significant beneficial effects on rural well-being (Mendola, 2005). In rural China, remittances partially

compensate for lost labour, contributing directly to household incomes and indirectly to crop production (de Brauw, Taylor, & Rozelle, 2001).

In Ghana, migration from rural areas has negative effects on household farm income initially, although over time, remittances tend to fully compensate for lost labour, and contribute to household incomes (Tsegai, 2004). Miluka, Carletto, Davis and Zezza (2010) find that in Albania, rural remittance recipient households are more likely to shift their on-farm investment from crop to livestock production, and work significantly fewer hours in agricultural production. Despite the reductions in labour force, agricultural income does not seem to decline as a result of migration and that total income rises partially due to higher investments in livestock production. They also note that migration has no impact on farms' technical efficiency, and the recipient households invest less in productivity-enhancing and time saving farm technologies for crop production.

In western Mali, while migration has fostered the adoption of improved technology, migrant households do not show better agricultural performance than the non-migrant households due to the fact that a reduction in the labour effort tends to offset any investments and improved technologies from remittance receipts (Azam & Gubert, 2006). Jokisc (2002) finds that remittances have not been dedicated to agricultural improvements, but have been used for housing in the case of Ecuador. The labour shortage and natural and economic factors related to migration have a negative impact on agriculture. It has been observed that in a context of high migration, lack of innovative production techniques, reduction of plant and animal biodiversity, and a decrease or abandonment of farming activities tend to experience a rising trend in Mexico's rural farming sector (Nave-Tablada & da Cloria Marroni, 2003).

The ways in which migration and remittances affect agricultural production and income go beyond their direct impact on farm activities (Taylor & Stamoulis, 2001). Stahl and Habib (1991) note that in the South and South-East Asia, each migrant created an average of three jobs through remittances. In a study of Mexico, Taylor and Lopez-Feldman (2007) find that remittances create "second-round" income effects that favour poor people, both inside and outside the rural economy. The study concludes that both remittance recipient households and non-recipient households benefit from remittance transfers, although it takes several years to experience the positive effects of migration.

In terms of poverty effects, there are growing evidences that remittances reduce poverty among the recipient households. For instance, international remittances significantly reduce

poverty in a sample of 74 developing countries (Adams & Page, 2005). Their study suggests that on average, and after controlling for the possible endogeneity of international remittances, a 10 percent increase in per capita remittances lead to a 3.5 percent decrease in the incidence of poverty. In Guatemala, Adams (2004) finds that remittances reduce the level, depth, and severity of poverty among receiving households. Similar results have also been found by Brown and Jimenez (2008) that the impact of migration and remittances on poverty reduction are statistically significant in both Fiji and Tonga, although it has a much stronger effect in Tonga than in Fiji.

The literature examined above, implies that there is a significant link between remittances and improvement in the welfare and livelihood of the receiving households in developing countries. However, the impact of remittances on agriculture is rather mixed and highly contextual. In some cases, migration and remittances foster household farm investment and agricultural production, while in others, the opposite occurs. Based on the findings of various studies for the positive impact of remittances in the agriculture sector this study examines if remittances alter the expenditure patterns of the receiving households. The further evaluation includes the analysis of the decision making process of crop choice and diversification between the remittance recipient and non-recipient households. The methodological approach, assumptions, and the associated econometric issues are discussed next followed by the empirical evaluation in the penultimate section.

5.3 Model Specifications, Data and Methodology

This section presents the models to explore the linkages between remittances and household consumption patterns, followed by the role of remittances in the agricultural production in Fiji. The model specifications and methodologies of remittances-household consumption and remittances-agriculture nexus highlight the key variables and their likely impact for improving wellbeing.

5.3.1 Remittances-Household Consumption Nexus: Models and Methodology

To examine the contribution of remittances on welfare, the household consumption expenditures on food, housing, education, health, and consumer goods are used as a proxy for welfare indicators. The underlying household consumption model used in the present study is associated with the Working-Leser specification of household utility-maximisation (Working, 1943; Leser, 1963). This Working-Leser framework relates to the household budget shares linearity to the logarithm of total household expenditure, and takes the following form:

$$w_{ij} = \alpha_j + \beta_j \ln(E_i) + \varepsilon_{ij} \quad (5.1)$$

where w_{ij} is the ratio of expenditure on good *j* to total household expenditure in household *i*, $\ln(E_i)$ is the logarithm of total household expenditure and ε_{ij} is an error term. In line with Deaton (1997), equation (5.1) has been extended to include other variables assumed to affect the budget shares allocated to different types of goods. The underlying remittances-household consumption model is expressed as follows:

$$w_{ij} = \alpha_j + \beta_{1j} \ln(E_i) + \beta_{2j} X_i + \beta_{3j} Z_i + \beta_{4j} R_i + u_{ij} \quad (5.2)$$

where X_i is a vector of the characteristics of the head of household *i*, Z_i is a vector of the characteristics of the household *i*, R_i represents the remittance receiving households, μ is a random error term that captures unobserved characteristics, and *i* is 1,…N, households.

In the case of education and health expenditure categories, the zero consumption problem is particularly high, i.e., a large number of zeroes are observed in the 2008-09 HIES dataset. This could be the case as education and health services are provided by the government in the rural and urban areas whereby expenditures for these public goods may be very low. Also, many households in the sample for both rural and urban areas do not send their children to private schools. It is known that estimates of coefficients are inconsistent when only the observed positive purchase data are used (or censored by an observable latent variable) to estimate consumption behaviour using the Ordinary Lest Squares (OLS) regression. In such circumstances, it could be argued that the standard Tobit model is a suitable model to estimate the impact of remittances on household expenditure patterns (Tobin, 1958).

However, it has been argued by Heien and Wessells (1990), Shonkwiler and Yen (1999), Perali and Chavas (2000), Lazaridis (2003), Jabarin (2005) that in a system approach, censored regressions have correlated error terms and estimation must be done jointly. Consequently, applying the Tobit technique to estimate the equation (5.2) separately would lead to inefficient estimators since it fails to take into account the interrelations across the remittances-household consumption equations.

In this study, Lee's (1978) generalisation of Amemiya's (1974) two-step procedures are adopted to cope with the problem of large number of zero observations seen in the health and education expenditure categories. As a first step, the Probit models are used to calculate a set of Inverse-Mills ratios for each of the expenditure category in which the censorship is likely to be a problem (i.e., health and education). In the second step, the Inverse-Mills ratios of

health and education expenditure categories are included in equation (5.2) for correcting the censorship, as expressed in the following form:

$$w_{ij} = \alpha_j + \beta_{1j}\ln(E_i) + \beta_{2j}X_i + \beta_{3j}Z_i + \beta_{4j}R_i + \beta_{5i}IMR_j + u_{ij}^{*} \qquad (5.3)$$

where $IMR_j = -\frac{\overbrace{\phi(K_j)}^{Normal\_Density\_Function}}{\underbrace{\Phi(K_j)}_{Normal\_Distribution\_Function}}$; and K_j is a vector containing E_i, X_i, Z_i and R_i.

The specification of equation (5.3) is further classified indicating the household head and household characteristics into the following form that estimates the effects of remittances on the household consumption patterns:

$$w_{ij} = \alpha_j + \beta_{1j}\ln(Exp_i) + \beta_{2j}Top3_i + \beta_{3j}\ln Hhsize_i + \beta_{4j}Age_i + \beta_{5j}Female_i + \beta_{6j}Hheduc_i + \beta_{7j}Child_i + \beta_{8j}Youth_i + \beta_{9j}Elderly_i + \beta_{10j}\mathrm{Re}m_i + \beta_{11j}Rural_i + \beta_{12j}IMR_j + u_{ij}^{*} \qquad (5.4)$$

where w represents the budget share of good that is taken as food, housing, durable and non-durable goods, education and health;
lnExp is the logarithm of total household expenditure;
Top3 is the dummy variable for household in the top 3 income deciles;
lnHhsize is the logarithm of household size;
Age is the household head's age;
Female is the dummy variable that represents the female household head;
Hheduc is the average education of the adults (aged 18 and above) in the household;
Child is the proportion of children below the age of 5 in the household;
Youth is the proportion of children between the age of 6 and 17 in the household;
Elderly is the proportion of the adults aged 65 and above in the household;
Rem is the dummy variable for the remittance receiving households;
Rural is the dummy variable for the households that live in rural areas;
IMR is the Inverse-Mills ratios of healthcare and educational expenditures;
u_{ij}^{*} is the random error term that captures the unknown variation in the *j*th budget share for the *i*th household and for which standard econometric assumptions are made; and
i is 1,…N, households.

To test the impact of remittances on each category of the household expenditure pattern, equation (5.4) is estimated using the seemingly unrelated regression (SUR) technique. This methodology of SUR technique is used for analysing the model with multiple equations and correlated error terms. As the model includes multiple equations which are independent of each other on the surface, however, the equations are estimated using the same data and therefore the error terms may be correlated between the two equations (Zellner, 1962).

The SUR technique is an extension of the linear regression model that allows for the exploitation of information in the correlated errors in order to achieve greater efficiency in the

estimates, which in return yields unbiased and consistent estimates for each separate equation (Greene, 1998). In addition, Lazaridis (2003) notes that the econometric restrictions under the SUR are easily imposed so that it conforms to adding-up the homogeneity and symmetry properties derived from the standard demand theory.

5.3.2 Remittances-Agriculture Nexus: Model Specifications

The logistic regression technique is used to examine the probability of an agricultural household's crop selection, while the Poisson regression techniques is utilised to assess the crop diversification. The normal logistic equation can be expressed as follows:

$$Prob(y^*<1|x) \Rightarrow y^* = 1 \text{ if } y/z < 1 \text{ or } 0 \text{ otherwise} \tag{5.5}$$

where y is the observed dependent variable, z is the threshold level and x is the matrix of various household level characteristics. The following equation (5.6) estimates the probability of each crop selection with a set of demographic and socio-economic variables:

$$Y_i = f(X_{1i}, X_{2i}, ...X_{ki}) \tag{5.6}$$

where Y_i is the dependent variable that represents the different choices of agricultural crops (i.e., root crops, fruits, vegetables, etc.) and take the value of 0 or 1. The X_s are the socioeconomic and demographic indicators that determine the decision making process of choosing one particular crop. Suppose that y^* in equation (5.5) captures a true status of an agricultural household either choosing one type of crop or another, then the estimation can be undertaken by using the following specification:

$$y^* = \alpha + \sum_{j=0}^{k} \beta_j X_{ij} + u_i \tag{5.7}$$

where y^* is (cannot be observed and is a latent variable) variable *y* that can be observed as a dummy variable that takes the value 1 if $y^* > 0$ and takes the value of 0 if otherwise. The β is the vector of parameters and α is a scalar. The error terms are denoted with μ.

In equation (5.8) below, P_i represents the probability of the *i*th household choosing one type of agricultural crop over the other based on the vector of predictors X. Moreover, the study assumes that P_i is a Bernoulli variable, so that:

$$P_i(X) = \frac{e^{\alpha+\beta X}}{1+e^{\alpha+\beta X}} \tag{5.8}$$

Since the β is a row vector of parameters and α is a scalar, then the logistic model to be estimated takes the form as follows:

$$Logit(P_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \alpha + \sum_{j=0}^{k} \beta_j X_{ij} + u_i \quad (5.9)$$

Where P_i is the probability of a household choosing one particular crop and $(1\text{-}P_i)$ is the probability of choosing the other type of crops. The ratio $P_i/(1\text{-}P_i)$ is known as the odds ratio, which simply represents the odds in favour of the household growing one type of agricultural products. The natural log of this odds ratio is called the Logit, and therefore equation (5.9) is called the Logit equation (Gujarati, 1999).

The explanatory variable X_{ij} is a set of characteristics of the household head's and the households. This includes the household head's age, age squared (proxy for experiences in farming and trading), gender; the household characteristics such as household composition, household income from nonfarm activities, average adult education in the household, and social network (i.e. access to internet, a phone or mobile phone, or receive remittances from the abroad and within the country). The β_j represents the logistic regression estimates of the explanatory variables, while μ_i represents error terms.

The equation (5.9) indicates that log of the odds ratio is a linear function of explanatory variables X_{ij} and the slope coefficients β_j provides the change in the log of odds ratio per unit change in the explanatory variables. In addition to that, the marginal effects or elasticities at the mean values of the explanatory variables are also computed to show the change in the probability when there is a unit change in the explanatory variables. The formula for computing the marginal effects, following Gujarati (1995) is as follows:

$$\frac{\partial \log[P_i/(1-P_i)]}{\partial X_j} = -\beta_j \quad (5.10)$$

To model the number of crops a household adopts, the Poisson regression technique is used with the assumption that the conditional means and variances are equal (Wooldridge, 2009). In line with Hellerstein and Mendelsohn (1993), the underlying model can be utilised as follows:

$$P(y_i = h|x) = \frac{e^{-\lambda_i}\lambda^{hi}}{h!} (h = 0,1,2,...,m; i = 1,2,3,...n) \quad (5.11)$$

where h indicates the number of crops adopted by the household *i*, λ_i is both the conditional mean and the variance of the Poisson distribution, and m is the maximum number of crops adopted. For λ_i is greater than zero, the mean and variance of Poisson distribution can be shown as:

$$E(y_i) = \text{var}(y) = \lambda_i = e^{\beta' X} \tag{5.12}$$

where $E(y_i)$ is the expected value of the dependent variable for the *i*th agricultural household, β is a row vector of parameters, and X represents a vector of household's head and household characteristics for the *i*th household. Before estimating the effects of remittances on household consumption patterns and agriculture, the next section defines the data and variables used in this study.

5.3.3 Data and Variable Definitions

Based on the hypotheses tested here, various socioeconomic and demographic indicators are used to estimate the effects of remittances on household consumption patterns, crop production, and diversification. The household level data for the variables are from Fiji's HIES 2008/09 dataset which indicate the level of impact and its marginal effects for the remittances receiving household in particular, on consumption, agriculture, and the overall rural development, by ethnicity and rural-urban areas. The variables and description of each variable used in equations (5.4, 5.9, 5.10 and 5.12) are presented in Table 5.1.

A total of 3,573 households are included in the analysis of the remittances-household consumption nexus, of which 1,104 households receive remittances. The effects of remittances on the consumption pattern have been divided into five consumption categories: food, housing, durable and non-durable goods, health, and education. The health and education categories for the human capital are vital to measure these effects given the flow of remittances for long-term rural development.

To examine the remittances-agriculture nexus, 1,201 households are in the agriculture sector included, of which 348 households receive remittances. Most of the agricultural households sampled in the HIES 2008/09 are producing more than one agricultural product, and at least one member of the household engages in some form of paid employment. For example, a household producing sugarcane or 'dalo' on a commercial basis also grows vegetables and fruit for home consumption.

Table 5.1 Variable Description and Definitions

Variables	Definition
Dependent	
	Remittances-Household Consumption Nexus
Food	Share in total expenditures of expenses for food
Housing	Share in total expenditures of expenses for housing
DND	Share in total expenditures of expenses for durables and non-durables
Education	Share in total expenditures of expenses for education
Health	Share in total expenditures of health
	Remittances-Crop Production Nexus
Banana	Household grows bananas (Yes = 1, No = 0)
Beans	Household grows beans (Yes = 1, No = 0)
Cabbage	Household grows cabbage (Yes = 1, No = 0)
Cassava	Household grows cassava (Yes = 1, No = 0)
Copra	Household grows copra (Yes = 1, No = 0)
Cucumber	Household grows cucumber (Yes = 1, No = 0)
Dalo	Household grows dalo (Yes = 1, No = 0)
Eggplant	Household grows eggplant (Yes = 1, No = 0)
Pineapples	Household grows pineapple (Yes = 1, No = 0)
Pumpkin	Household grows pumpkin (Yes = 1, No = 0)
Rice	Household grows rice (Yes = 1, No = 0)
Sugarcane	Household grows sugarcane (Yes = 1, No = 0)
Tomato	Household grows tomato (Yes = 1, No = 0)
Watermelon	Household grows watermelons (Yes = 1, No = 0)
Yaqona	Household grows root yaqona (Yes = 1, No = 0)
Fish	Household involves in fish farming (Yes = 1, No = 0)
Cattle	Household involves in cattle farming (Yes = 1, No = 0)
Goat	Household involves in goat farming (Yes = 1, No = 0)
Pig	Household involves in pig farming (Yes = 1, No = 0)
Poultry	Household involves in poultry farming (Yes = 1, No = 0)
	Remittances-Crop Diversification Nexus
No_Rootcrops	Number of root crops the household adopted
No_Vegetables	Number of vegetables the household adopted
No_Fruits	Number of fruits the household adopted
No_Livestock	Number of livestock varieties the household adopted
Explanatory	
Top3	Household in the top 3 income deciles (Yes = 1, No = 0)
lnExp	Log of total household expenditure
lnHhsize	Log of household size
Age	Age of the head of the household
Age^2	Age squared
Female	Household head is female (Yes = 1, No = 0)
Hheduc	Average education of the adults (age 18 and above) in the household
Child	Proportion of children below the age of 5 in the household
Youth	Proportion of children between the age of 6 and 17 in the household
Elderly	Proportion of the adults aged 65 and above in the household
Rem	Household receives remittances (Yes = 1, No =0)
lnTREM	Log of total remittances received per annum
lnNFI	Log of total non-farm income per annum
Rural	Household in rural areas (Yes = 1, No = 0)
Network	Social network index =(phone + cellphone + internet)/3

The dependent variables for remittances-agriculture nexus are divided into two groups. The first group of the dependent variables contains 20 agricultural products (i.e., a wide range of fruit, vegetables, root crops and livestock products) to model the production behaviour among

the recipient and non-recipient households. The second group of the dependent variables are count variables for the Poisson regression model to measure the effect on crop diversification.

Table 5.2 presents the average budget shares for each of the five expenditure categories. The household Food expenditure category has the highest proportion of total household budget, with 28.94% for the entire household sample followed by Durable and Non-durable Goods (DND) (27.28%), Housing (23.04%), Education (4.9%) and Health (0.88%).

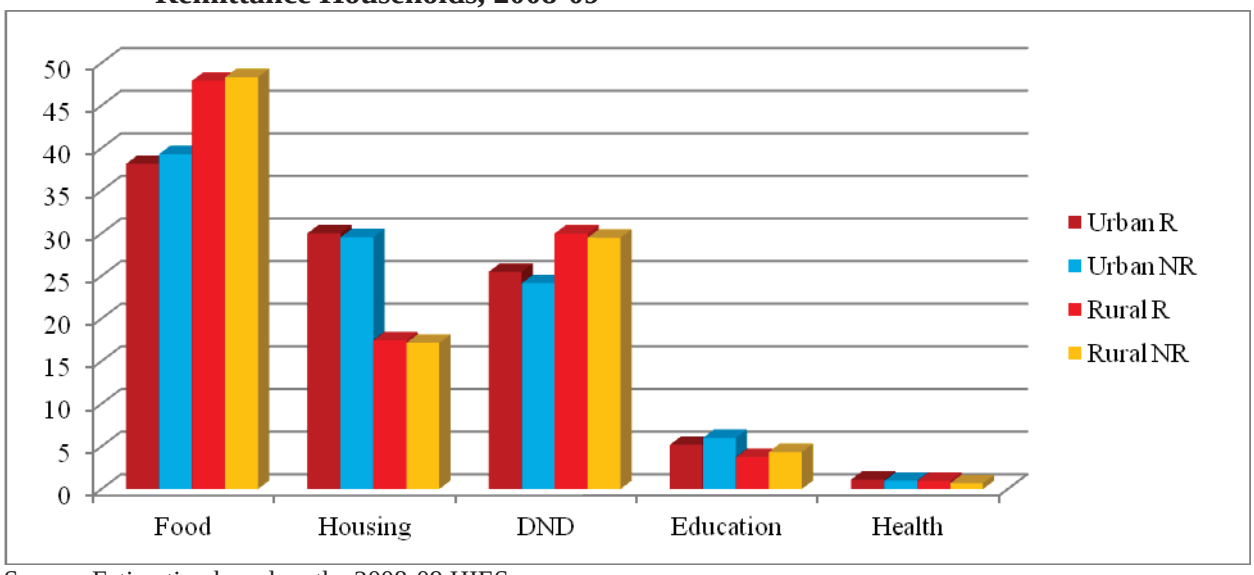
Table 5.2 Average Household Expenditure Shares by Categories: Remittance and Non-Remittance Households, 2008-09

Consumption Expenditure	Total Households (%)	Remittance Recipients (%)	Non-remittance Recipients (%)
Food	28.94	28.76	29.34
Housing	23.04	23.57	22.81
DND	27.28	27.8	27.1
Health	0.88	1.03	0.82
Education	4.9	5.1	4.44
No. of Households	3573	1104	2469

Source: Estimation based on the 2008-09 HIES survey.
Note: DND is Durable and non-durable goods.

By regions, Figure 5.1 shows that urban households allocate more of their expenditure budget on housing, education, and health in comparison with rural households. The non-remittance recipient rural households spend more on food (48.33%), followed by the rural remittance recipient households (47.9%), while the non-recipient urban households spend 39.31% on food compared to the urban remittance recipient households at 38.16% (see Figure 5.1).

Figure 5.1 Household Expenditure Patterns by Regions: Remittance and Non-Remittance Households, 2008-09



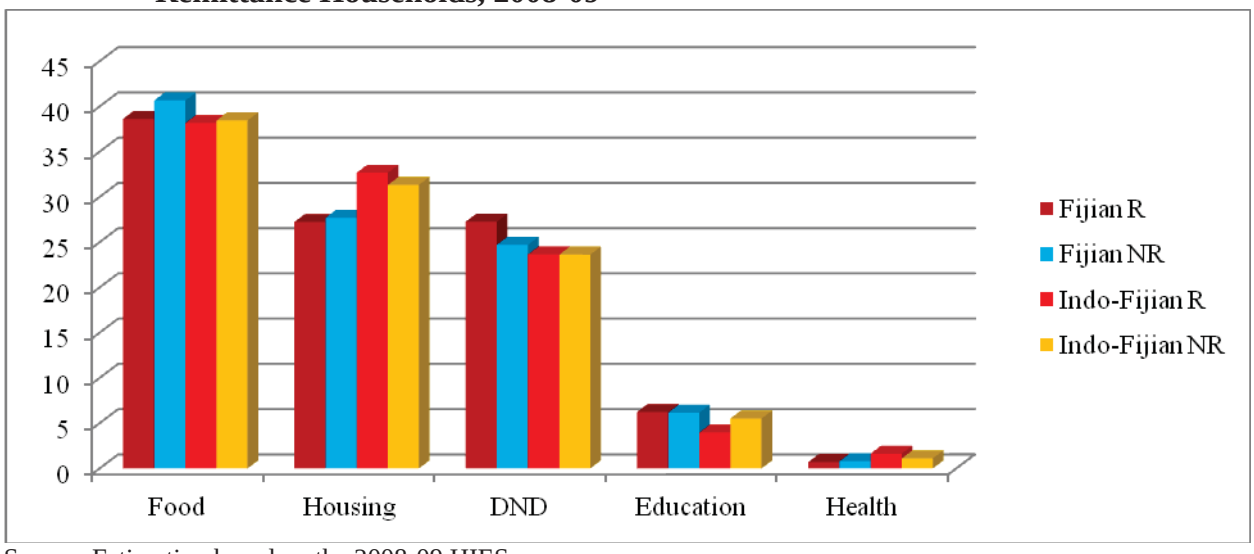
Source: Estimation based on the 2008-09 HIES survey.
Notes: Number of households = 3,573; R is Remittance recipient; NR is Non-remittance recipient; DND is Durable and non-durable goods.

Urban households receiving remittances have the highest expenditure on housing (30%) followed by the urban non-remittance recipient households (29.55%). The rural remittance recipient households spend 17.45% followed by the rural non-recipient households (17.15%) on housing, whereas the rural households receiving remittances have the highest budget share on durable and non-durable goods. In terms of educational and health expenditures, the remittance recipient households in both rural and urban areas tend to spend less on these two categories than the non-remittance recipient households.

By ethnicity classifications, Figure 5.2 indicates that Fijian non-remittance recipient households have the highest budget share on food expenditure category (40%), followed by the Fijian remittance recipient households (38.61%) in the urban sector. The Indo-Fijian non-remittance recipient households spend 38.45% on food and the Indo-Fijian remittance-recipient households have food expenditure of 38.15% (See Figure 5.2).

In the case of housing expenditure category, the urban Indo-Fijian households devote most of their budget on housing compared to the Fijian households. Also the urban Indo-Fijian remittance recipient households have the highest share of their budget on housing. The Fijian remittances households in the urban sector have a relatively higher share of expenditure on durable and non-durable goods in comparison to Indo-Fijian remittances households.

Figure 5.2 Urban Household Expenditure Patterns by Ethnicity: Remittance and Non-Remittance Households, 2008-09



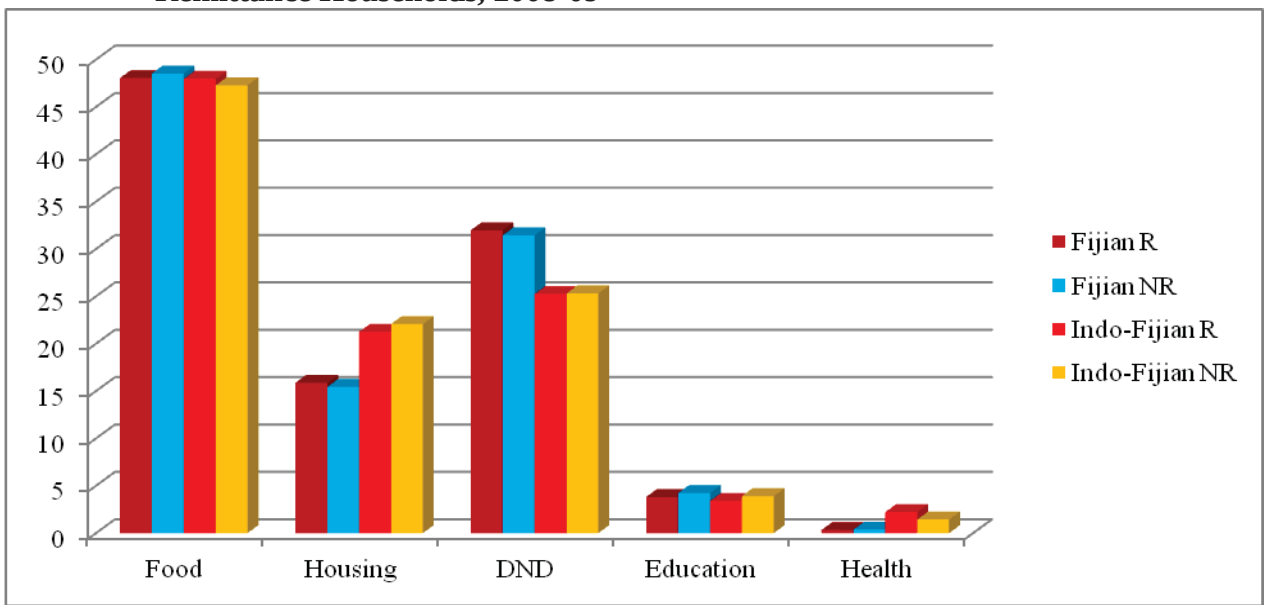
Source: Estimation based on the 2008-09 HIES survey.
Notes: Number of households = 3,573; R is Remittance recipient; NR is Non-remittance recipient; DND is Durable and non-durable goods.

In terms of education and health expenditure categories, the urban Fijian households spend more on education but less on health compared to Indo-Fijian households. The Fijian remittance recipient households (6.22%) tend to spend slightly more on education than the

Fijian non-recipient households (6.16%). The Indo-Fijian urban households that receive no remittances (5.51%) allocate their expenditure budget more to education than the Indo-Fijian remittance recipient households (3.95%). In terms of urban health expenditure category, amongst the Indo-Fijian households, the remittance recipient households tend to spend more on health than the non-recipient households. The opposite health consumption patterns are observed among Fijian households, where the non-recipient households have a relatively higher share of expenditure on health than the recipient households.

Differences in the household consumption patterns are also observed in the case of rural households (Figure 5.3). The Indo-Fijian rural households allocate a higher amount of expenditure on health and housing in comparison to Fijian households. In particular, the rural Indo-Fijian households receiving remittances tend to spend more on housing and health, while the Fijian remittance-recipient households allocate more of their budget toward durable and non-durable goods. Overall, there seems to be some interesting differences in budget shares across remittance recipients and non-remittance recipient households. As mentioned earlier, remittance-receiving households devote slightly more of their total expenditure to housing, durable and non-durable goods, health, and education than non-remittance households but less to Food. These differences suggest that household expenditure behaviour across all categories are affected by households' perceptions of remittances. The next section presents the results of the remittances-household consumption and remittances-agriculture nexus.

Figure 5.3 Rural Household Expenditure Patterns by Ethnicity: Remittance and Non-Remittance Households, 2008-09



Source: Estimation based on the 2008-09 HIES survey.
Notes: Number of households is 3,573; R is Remittance recipient; NR = Non-remittance recipient; DND is Durable and non-durable goods.

5.4 Empirical Results

The estimated results presented here are for the three hypotheses as follows: 1) the remittances and household consumption patterns nexus; 2) the remittances and agricultural production nexus; and 3) the remittances and agricultural diversification relationship. The econometric methodologies applied in the estimation of the models avoid any spurious results based on the SUR and Logit models discussed in sections 5.3.1 and 5.3.2.

5.4.1 Results for the Role of Remittances on Household Consumption Patterns

The empirical results for the OLS specification (equation 5.4), reported in Table 5.3, show the computed estimates for the five dependent variables for all remittance recipient households-consumption relationship. As expected, the explanatory variables that represent the household head's characteristics and household characteristics are found to be significant in several expenditure categories. The households in the top three income quintiles (Top3) are associated with higher levels of expenditure devoted to housing but less on food, education and health categories. A one percent increase in the total household expenditure (lnExp) increases the share spent on education, and durables and nondurables by 9.3 percent and 2.6 percent, respectively with a weak positive significance for health of all remittance receiving households. However, the expenditure shares for food and housing declines when expenditures increase in the other categories.

The estimated household size (lnHhsize) coefficients are positive and significant for the four categories of food, housing, education and health as the expenditure budget increases in these categories with larger household size for the recipient households. However, the durables and nondurables expenditure decreases significantly. Importance is given to improving their living standards through better food and housing consumption as well as enhancing the human capital through education and health of these remittance-recipient households. The age coefficient indicates that age of the household head matters for the remittance-recipient households on the decisions show their expenditure allocations increase in the housing, education, and health category expenditures while the food expenditure category decreases. The female household heads tend to allocate more expenditure shares toward durable and nondurable goods and children's education but less on food category.

Education level is another key variable showing positive impact on the household expenditure budget. A one-year increase in average schooling (Hheduc) of household members increases the share devoted to education by 0.4 percent. However, the total expenditure for food and

durables and nondurables decrease in the budget share by 0.2 percent and 0.5 percent, respectively.

Table 5.3 Remittances and Household Expenditure Category Results

	Food	Housing	Durables & Nondurables	Education	Health
Top3	-0.017***	0.043***	-0.008	-0.026***	-0.037*
	(-2.88)	(5.26)	(-0.71)	(-3.93)	(-1.67)
lnExp	-0.035***	-0.065***	0.093***	0.021***	0.028
	(-7.37)	(-10.02)	(10.51)	(3.95)	(1.58)
lnHhsize	0.015**	0.015*	-0.047***	0.016**	0.052*
	(2.45)	(1.82)	(-4.2)	(2.34)	(1.66)
Age	-0.001**	0.001*	0.001	0.001***	0.001**
	(-2.15)	(1.88)	(0.01)	(2.74)	(1.99)
Female	-0.028***	-0.004	0.027**	0.011*	-0.0004
	(-4.29)	(-0.57)	(2.56)	(1.77)	(-0.37)
Hheduc	-0.002**	0.001	-0.005***	0.004***	-0.0001
	(-2.31)	(1.08)	(-2.58)	(3.93)	(-0.8)
Child	0.069***	-0.042	0.109***	-0.102***	-0.006**
	(3.36)	(-1.43)	(2.75)	(-4.34)	(-2.04)
Youth	0.014	-0.039**	-0.005	0.032**	-0.008***
	(1.02)	(-2.15)	(-0.18)	(1.21)	(-4.02)
Elderly	-0.015	0.035*	-0.028**	0.011	0.005**
	(-0.88)	(1.84)	(-1.1)	(0.76)	(1.97)
lnTREM	-0.001	0.005**	-0.014***	0.007***	0.001
	(-0.81)	(2.1)	(-3.99)	(3.59)	(0.28)
Rural	0.062***	-0.143**	0.076**	0.035***	-0.003**
	(12.63)	(-21.33)	(8.41)	(4.14)	(-1.98)
IMR				6.04***	1.38*
				(5.38)	(1.71)
Root MSE	0.132	0.099	0.134	0.079	0.022

Notes: ln is log form of the variable. Total of 3,573 households are recorded in the HIES 2008/09, of these, 1,401 households receive remittances. ***, **, and * are significant levels at 1, 5 and 10% significant levels, respectively. The t-ratios are in parentheses.

The estimated coefficient for number of children below the age of 5 (Child) in the household increases expenditure shares spent on food by 6.9 percent, and durable and nondurable goods by 10.9 percent. The household number of children between the age of 6 and 17 (Youth) are associated with a 3.2 percent increase in the educational expenditure. Also, the households with elderly people over 65 increases the share devoted to health by 0.5 percent, and housing by 3.5 percent. Remittance income is allocated to housing and education categories while the durable and nondurable category indicates a decline. The households residing in the rural areas have higher expenditure shares on food, durables and nondurables, and education but less on health compared to the households in urban areas.

In the next step, the important role of remittances by individual consumption category is estimated. The computed coefficients with respect to remittances for each consumption

category are presented in Table 5.4. It indicates that the household expenditures on Housing and Education are positive and significant for the remittance recipient households. In other words, remittance income is more likely targeted at household expenditures on housing (i.e., home improvement and renovation), education (i.e. school fees and learning materials), food and health (positive but insignificant), but less on durable and nondurable goods.

The analysis by ethnicity shows that for both Fijian and Indo-Fijian recipient households, the estimated coefficient of remittance income is positive and significant for education expenditure and housing categories at the respective levels. The findings indicate that remittances are specially targeted towards education and housing expenditures by both these ethnic groups. This result is consistent with the study by Acosta et al. (2008), which shows that an important motivation for remittances is to cover education and home improvement expenditures in the case of Mexico, El Salvador, Guatemala, Peru, Jamaica and Dominican Republic. The other positive estimated coefficient of the Indo-Fijian remittance recipient households is the health category; however, it is not significant. The effect of remittances on food category indicates a negative impact for both ethnic groups; however, the estimated coefficients are not significant.

Table 5.4 Access to Remittances and Expenditure Shares, HIES 2008-09

	Food	Housing	Durables & Nondurables	Education	Health
Total Household	0.001	0.005**	-0.014***	0.007***	0.0002
	(0.28)	(2.10)	(-3.99)	(3.59)	(0.28)
Fijian	-0.003	0.009***	-0.01**	0.005**	-0.0004
	(-0.81)	(2.62)	(-2.33)	(1.98)	(-0.98)
Indo-Fijian	-0.004	0.009*	-0.019***	0.014***	0.001
	(-0.64)	(1.70)	(-3.29)	(4.06)	(0.08)
Total Urban	-0.06	0.009**	-0.012**	0.008***	-0.001
	(-1.27)	(2.35)	(-2.41)	(2.59)	(-0.12)
Fijian	-0.004	0.01*	-0.006	0.001	0.001
	(-0.69)	(1.89)	(-0.88)	(0.1)	(0.01)
Indo-Fijian	-0.015**	0.009	-0.013*	0.019***	-0.001
	(-2.03)	(1.49)	(-1.82)	(4.22)	(-0.04)
Total Rural	0.005	0.003	-0.013***	0.005**	0.001
	(1.07)	(0.91)	(-2.8)	(2.15)	(0.49)
Fijian	-0.001	0.002	-0.007	0.006**	-0.001**
	(-0.09)	(0.49)	(-1.19)	(2.21)	(-2.07)
Indo-Fijian	0.019*	-0.004	-0.026***	0.008*	0.002
	(1.85)	(-0.65)	(-2.71)	(1.69)	(0.79)

Note: *** Denotes significance at 1%, ** at 5% and * at 10%; Figures in parentheses are t-statistic.

In the next step, the remittances-household consumption nexus is estimated by urban and rural regions. The total urban remittance recipient households tend to allocate their expenditure

budget share more on housing. The estimated coefficient of remittances for the urban recipient households on housing expenditure category is positive and significant at the five percent significant level. However, the estimated housing category for the rural remittance recipient households is positive but is insignificant. Also, the remittance income received by rural households is allocated to the education category which is positively significant, the urban households coefficients for food and health consumptions although are positive estimated are not statistically significant. The total urban household coefficients for food and health expenditures are negative and not significant.

Further disaggregating the urban households by ethnicity, the estimated coefficient for Indo-Fijian households by categories show a higher share of total remittance income allocated to education expenditure but less on food, durables and nondurables. Moreover, the estimated coefficients of household size (Table 5.3) and remittances (Table 5.4) for Indo-Fijian households in the urban areas, support the view of Engel's law that food expenditures are an increasing function of income and family size, but that food budget shares decrease with income (Leser, 1963).[43] Based on the estimated results (see Table 5.4), it can be said that remittances are specially targeted towards households' education expenditure in the Indo-Fijian households, while urban Fijian households allocate more of their budget share on housing.

In the rural areas, remittance income goes to education category of both Fijian and Indo-Fijian households. Although, the school fees are relatively low and primary education is free in Fiji, the school expenditures for books, uniforms, and the associated schooling expenditures for the rural households are relatively high compared to urban households. It can also be said that both ethnic groups allocate remittances for education, as it is a vital form of investment in human capital. The results also show that the rural Indo-Fijian remittance recipient household tend to allocate more of its expenditure share on food category, while the rural Fijian household receiving remittances tends to allocate less on health. This is consistent with the finding by Narsey (2008) that some 69 percent of the poor live in rural areas, of which Indo-Fijian households are in the poorest category.

As the results indicate a positive impact of remittances on rural food share, in the next section, the study further investigates whether remittances provide a degree of social insurance to the

[43] Proposed by Ernst Engel in 1857 where he investigated the relationship between consumption expenditure and income, he stated that the poorer a household is, the larger is its budget share dedicated to nourishment (cited in Leser, 1963). However, Leser (1963, p.694-96) notes that the proportion of income spent on food decrease as income increases, holding other factors constant.

agricultural households that lack access to insurance and credit markets. The next stage involves the estimation of remittance impact by individual crop category. This provides some understanding on whether the agricultural households are vulnerable to severe declines in income from adverse shocks such as natural disaster, crop failure, and health crisis. The estimated results of remittances on agricultural production nexus is discussed next.

5.4.2 Results for Remittances-Agricultural Production Nexus

Table 5.5 presents the estimated results for the Logit specification (equation 5.9) for the remittance-crop production nexus. Controlling for other socioeconomic and demographic variables shown in equation (5.9) the household heads' characteristics (age and experiences), household characteristics (household size, nonfarm income, average years of schooling, household composition, social network index, and household income deciles), only the estimated remittance income coefficients are reported for the impact of remittances on specific crops in Table 5.5 with its marginal impact and the correctly predicted values.

In the fresh fruits and vegetable (FFV) category (Table 5.5), the estimated remittances coefficients (log of total remittance income received during 2008-09) are positive and significant for banana and cabbage suggesting that remittance income received by the agricultural households are more likely targeted in these two crop production. The results indicate that a one percent increase in remittance income would increase the probability of growing bananas and cabbages by 0.5 percent and 0.3 percent, respectively. The estimated coefficients for other FFV crops such as beans, copra, eggplant, tomato, and watermelon are also positive but not significant at the conventional level, while crops such as cucumber, pineapples, and pumpkin are negative and insignificant signs.

In the case of root crops production, Table 5.5 shows that the remittance recipient households seem to be less motivated in growing dalo and 'yaqona' than the non-remittance recipient households. The estimated coefficient for dalo production is negative and significant at the five percent level implying that the remittance recipient households engaging in dalo production declined and may tend to shift to cash crops production such as fresh fruits and vegetables. The marginal effect of remittances on dalo production indicates a decline in the likelihood of engaging in dalo production by 0.9 percent. It is important to note that this traditional root crop has been severely affected by the floods in 2008-09 (Ministry of Primary Industry, 2009). Hence, the agricultural households sampled in the HIES 2008-09 engaged in dalo farming would have been adversely affected by its substantial decline in the output

Table 5.5 Logit Estimates for Remittances-Crop Choice Nexus

Selected Crops	Remittance Income	Marginal Effect	Correctly Predicted
Fresh Fruits & Vegetables (FFV)			
Banana	0.096**	0.005	93.51%
	(2.44)		
Pineapples	-0.218	-0.001	99.17%
	(-1.25)		
Watermelon	0.077	0.001	97.34%
	(1.29)		
Beans	0.012	0.0002	97.42%
	(0.2)		
Cabbage	0.078*	0.003	94.84%
	(1.82)		
Cucumber	-0.018	-0.0004	97.25%
	(-0.28)		
Eggplant	0.055	0.0014	96.75%
	(1.02)		
Pumpkin	-0.015	-0.0003	97.75%
	(-0.20)		
Tomato	0.056	0.0004	98.92%
	(0.64)		
Root Crops			
Cassava	0.008	0.001	84.93%
	(0.28)		
Dalo	-0.047**	-0.009	72.27%
	(-2.00)		
Yaqona	-0.033	-0.007	70.86%
	(-1.42)		
Other Agricultural Crops			
Rice	-0.036	-0.0004	98%
	(-0.45)		
Sugarcane	0.028	0.002	89.43%
	(0.88)		
Copra	0.035	0.004	86.51%
	(1.21)		
Livestock			
Fish	0.008	0.0014	77.85%
	(0.33)		
Cattle	0.125**	0.004	96.42%
	(2.61)		
Pig & Goat	0.065**	0.004	92.51%
	(1.86)		
Poultry	0.076	0.001	98.33%
	(1.04)		

Notes: From 1,201 agricultural households recorded in the HIES 2008/09, 348 households are identified as remittance recipient households. Critical values for the z-statistic significance levels at 1, 5 and 10% are as follows: 2.58, 1.96 and 1.65, respectively.

The effect of remittance income on sugarcane production is positive but not significant, while the impact of remittance income on rice farming is negative and insignificant. Both these productions have declined over time and also in the 2008-09 period due to the adverse climatic conditions. In the case of households engaging in fishing business, there is a positive impact of remittance flows but the coefficient is not significant. The estimated coefficients are positive and significant for Cattle, and Pig & Goat at the five percent level, except for poultry farming (though it has a positive sign but is not significant at the conventional level). The

marginal effect of remittances on cattle farming suggests that a one percent increase in total remittances received by household would increase the probability of cattle accumulation by 0.4 percent. Remittance income also contributes to pig and goat accumulation by 0.4 percent.

To examine the household's decision on crop diversification given the remittance income, Table 5.6 presents the estimated remittances coefficients based on Poisson model (equation 5.12) for its impacts on crop diversification. Various socioeconomic and demographic indicators are used for the modelling purposes, the results are reported only for the remittances and the incidence rate ratio in Table 5.6. Overall, the results suggest that households' receiving remittances tend to be more diversified in their agricultural production than the non-remittances recipients. The estimated coefficients for remittances are positive and significant for the diversification of fruit and vegetable categories. The incidence rate ratio suggests that the recipient households adopt more than one type of fruits and vegetables which are 1.06 and 1.03 times higher than the non-recipient households, respectively. In terms of livestock farming, the estimated coefficient of remittances is positive and significant indicating that households receiving remittances are 1.03 times likely to add different types of livestock to increase livestock production than the non-recipient households.

Table 5.6 Poisson Results for Remittances-Diversification Nexus

Dependent Variable: Numbers of Crop Production and Livestock				
	No. of Root Crops 1-5	No. of Fruits 1-3	No. of Vegetables 1-7	No. of Livestock 1-6
Remittances	-0.014	0.062**	0.033**	0.032*
z-statistic	(-1.32)	(2.06)	(1.88)	(1.91)
Incidence Rate Ratio	0.99	1.06	1.03	1.03
LR $\chi^2_{(12)}$	68.33***	36.15***	43.70***	23.03**

Note: Critical values for the z-statistic significance levels at 1, 5 and 10% are as follows: 2.58, 1.96 and 1.65. Number of root crops includes cassava, dalo, yams, kamala and yagona. Number of fruits includes banana, pineapples and watermelon. Number of vegetables includes beans, cabbage, cucumber eggplant, pumpkin, tomato and other vegetables. Number of livestock includes fish, cattle, pig & Goat, poultry, other meat and other dairy.

Although, the estimated remittances coefficient for number of root crops production is negative, it is not significant. The results somewhat show a declining trend in root crops production. This is consistent with the report that the output of dalo has declined from 74,009 tonnes in 2008 to 70,500 tonnes in 2009, and the yaqona production has decreased from 3,285 tonnes to 3,150 tonnes during the 2008-09 period (Ministry of Primary Industry, 2009, p. 31). This may has been affected by adverse weather conditions as noted earlier.

The overall results for the remittances-household consumption and remittances-agricultural nexuses support the view that the households with a higher initial consumption level would spend much of the remittances on housing and human capital, and partially for agricultural inputs (Rhoades, 1978; Russell, 1986; Acosta et al., 2008). This study also supports the view that remittances are partially used in the agricultural production and diversification (Upton, 1973; Gladwin, 1979; Saint & Goldsmith, 1980; Arizpe, 1981; Rempel & Lobdell, 1981). In particular, the empirical results for the remittances-agricultural nexus imply that agricultural households in Fiji use remittances to foster agricultural productions in fruits and vegetables (i.e., banana and cabbage), livestock (i.e., cattle, and pig & goat), as well as for the diversification of these commodities.

5.5 Conclusion

This chapter examines the contribution of remittances towards rural development in Fiji by way of testing three hypotheses. First, the first empirical examination tests the impact of remittances on household consumption patterns; second, it analyses the impact of remittances on crop production, and third, it evaluates the possible effect of remittance on crop diversification. The results highlight the potential influential role of remittances in the household expenditure behaviour, and agricultural production and diversification. On the contrary, to the belief that remittances are mostly used for food consumption, the results for Fiji suggest that remittance income has alternative uses in the households.

The findings for the first hypothesis indicate that remittances are especially targeted toward consumption of education and housing. The expenditure patterns differ between urban and rural areas and also between Fijian and Indo-Fijian households. In the urban areas, Indo-Fijian households use remittance income substantially on education related expenditure while remittances received by Fijian households are used for housing.

Similar consumption patterns are also found in the rural areas supporting the view that Fijian and Indo-Fijian households use the remittance income mostly on education expenditure. Findings support the view that recipient households tend to put remittance income for the productive use, as well as the Engle's law that food expenditures are an increasing function of income and family size, but that food budget share decreases with household income increases in Fiji.

In the second hypothesis, the logistic results for the probability of engaging in particular type of agricultural production of remittance households show that remittances have a positive and significant impact in promoting the production of banana, cabbage, cattle, pig and goat. The results imply that remittance income encourages households to grow more cash crops (such as fresh fruits and vegetables) and fewer traditional root crops (such as dalo and yagona). However, the production of these crops has been affected by adverse climatic conditions.

In the third hypothesis, the Poisson regression technique reflects the effects of remittances on crop diversification. The incidence rate ratio results support the view that there is a relatively higher probability for the remittance-recipient households to grow more than one type of fruits and vegetables than the non-remittance recipient households. For livestock farming, the remittance-recipient households add different types of animals to the production than the non-recipient households. Although, the estimated remittances coefficient on the number of root crops production is negative it is not significant, thus there is a somewhat declining trend in the root crop production. The effects of remittances on welfare in the agricultural sector indicate that remittances tend to encourage the households to participate in the cash crop production and diversify their agricultural production.

Overall, the remittances help households to improve or maintain their livelihoods and hence implicate reducing poverty levels in these recipient households. For agricultural households, in particular, remittances play a crucial role in facilitating agricultural investments and diversifying agricultural production. Thus, policies should be aimed at supporting improved agricultural production, skills and vocational trainings, development of rural infrastructure, market integration, and the creation of rural employment opportunities. The resilience of farming systems also needs to be addressed through the adoption of more efficient agricultural technologies and improved access to financial services.

To promote remittances as a tool for rural development and to harvest their full development potentials, the government should provide institutional support to financial services and institutions in Fiji. Also, to increase the volume of remittance transfers by lowering the transaction costs, there is a need to introduce modern communication technology, as well as linking the remittance recipient households to other financial schemes such as savings, credit (credit for productive investments and housing) and insurance (agricultural production insurance) to improve economic and social development.

Chapter 6

Poverty and Income Inequality: Empirical Analysis

6.1 Introduction

There are two key reasons why poverty and inequality should be measured. First, it is vital to monitor and measure the number of poor people based on the Millennium Development Goals (MDGs), and also to help in designing an appropriate monitoring framework for the post-2015 agenda, and the identification of sustainable development goals (United Nations System Task Team, 2013). As argued by Ravallion (1998), the measurement of poverty in particular can provide a powerful instrument for focusing the attention of policymakers on the living conditions of the poor. Second, the analytical results from measuring poverty and inequality not only enable governments and researchers to identify poor people but also to help design appropriate interventions targeted at helping underprivileged households. In doing so, poverty alleviation programmes can be effectively monitored and evaluated which remains a critically important goal in the post-2015 development agenda (United Nations, 2013).

The most recent Household Income and Expenditure Survey (HIES) 2008-09 has been used in this chapter to investigate the level, depth, and severity of poverty, and the degree of inequality based on the household income distribution for the period 2008-09. For the poverty analysis, the analysis is on the incidence of poverty among the households surveyed by using three poverty measures: poverty headcount index; poverty gap index; and severity of poverty index. Given the critical importance of the non-farm sector in rural Fiji, this study is further extended to examine the contributions of non-farm income sources towards poverty reduction for the agricultural households. For the analysis of income inequality, this chapter measures the level of inequality by household income, quintile income distribution, decomposition of inequality by different groups of ethnicity, regional, and household types (i.e., agricultural and non-agricultural households), and the inequality of household income by income sources.

The rest of the chapter is organised as follows: Section 6.2 provides a discussion on the monetary approach to poverty measurement and its associated model specification. Section 6.3 includes a discussion on the theoretical aspects of measurement of income inequality, the methodological approach to decomposition by income components, as well as the associated model specifications. The data issues and assumptions are included in section 6.4 and, section 6.5 presents the empirical results and discussions. The conclusion of the study is presented in the final section.

6.2 The Monetary Approach to Poverty Measurement

Given the complex issues faced by those who are poor, emphasis has been put on the multi-dimensionality of poverty which includes the economic and non-economic dimensions of deprivation (Sen, 1985, 1999; Alcock, 1997; Alkire, 2002; Barr, 2005; Stewart, Laderchi, & Saith, 2007). The multi-dimensionality of poverty raises the standards for the development of more complicated and complex strategies aimed at poverty alleviation (World Bank, 2005; Stewart et al., 2007). Therefore, the requirement of measuring poverty needs to be as comprehensive as the definition of poverty itself in order to achieve an adequate result. The major approaches to poverty measurement include the following: the monetary approach; the capability approach; the basic needs approach; the social exclusion approach; and the participatory approach.

The standard of living comprises of a set possibilities available to individuals or households, necessary to meet their needs. The possibilities of satisfying these needs include the material and non-material items. The monetary approach presents all these items needed in monetary terms, which is income and consumption. Thus, an individual is considered poor if he or she lives in a family whose income and consumption falls below a certain threshold or a minimum level (UNDP, 1997; Case & Deaton, 2003; Laderchi, 2007). The minimum level poverty line is calculated based on individual income (or expenditure) or household income (or expenditure) for the monetary approach of poverty measurement. However, precaution is needed when determining the poverty line because it (poverty lines) can be different between the regions in terms of social, cultural, and economic environment (Hoeven & Anker, 1994).

Poverty, explained in an absolute or relative term, from the welfare economics framework, defines the poverty line as the minimum cost of the poverty level of utility (Ravallion, 1998). In Laderchi's (2007) study, the poverty line is defined as either with respect to a list of basic needs to be fulfilled or with respect to some characteristic of the distribution of the chosen welfare indicator. In this regard, the monetary approach is seen as an objective measurement, which can be contrasted with subjective measurement. Alcock asserts that:

> "Absolute poverty is thus contrasted with relative poverty. This is a more subjective or social standard in that it explicitly recognizes that some element of judgment is involved in determining poverty levels…Judgment is required because a relative definition of poverty is based on a comparison between the standard of living of the poor and the standard of living of other members of society who are not poor, usually involving some measure of the average standard of the whole of the society in which poverty is being studied." (Alcock, 1997, p. 69)

The choice of the poverty line should be in line with social norms and the common understanding of what represents a minimum level (World Bank, 2005). Thus, "in some countries it might make sense to use the minimum wage or the value of some existing benefit that is widely known and recognised as representing a minimum" (World Bank, 2005, p. 34). In the case of Fiji, the official poverty estimates are based on reported household income. The poverty line is defined as the monetary value of the complete amount of goods and services that meet the needs of the minimum level of living standards. Narsey, Raikoti, and Waqavonovono (2010) have defined the incidence of poverty as the "percentage of the population below the Basic Needs Poverty Line (BNPL)" (Narsey et al., 2010, p. 10). The BNPL has been further classified as Food Poverty Line (FPL) and Non-Food Poverty Line (NFPL). The FPL is the minimum amount of dietary energy per person (i.e., 2,100 calories) that is considered adequate to meet the energy needs for maintaining a healthy life and carrying out light physical activity. Based on Fiji's household income and expenditure survey 2008-09, the estimations of BNPL and FPL are F$175 and F$87 per week, respectively, for a household of 4 Adult Equivalents, (Narsey et al., 2010). In order to gain the knowledge about how the position of the less privileged group(s) may be improved, it is vital to investigate the degree of income inequality and the level, depth, and severity of poverty among Fiji households from 2008-09.

The commonly used monetary approach to poverty measurement is the Foster, Greer and Thorbecke (FGT) poverty decomposition technique (Foster, 1983; Foster, Greer, & Thorbecke, 1984; Ravallion, 1996, 1998; Dessallien, 1998; Coudouel et al., 2001; World Bank, 1992, 2002, 2005). The FGT technique consists of headcount index (P_0), poverty gap index (P_1), and severity of poverty or squared poverty gap (P_2), which is defined as the share of the population below the poverty line, and expressed in the following form:

$$P_0 = \frac{1}{N}\sum_{i=1}^{N} I(x_i \leq z) \tag{6.1}$$

where P_0 is the headcount ratio, N is the population in total; I(.) is an indicator function that is 1 if its argument is true and 0 otherwise, x_i is the number of people who are equal or below to the poverty line, and z is the poverty line.

The poverty gap (PG) measure represents the depth of poverty, i.e., it analyses the mean distance separating the population from the poverty line (i.e., with the non-poor being given a distance from zero). The PG measures poverty deficit that captures the resources that would

be needed to lift all the poor out of poverty through perfectly targeted cash transfers, and it is measured as:

$$P_1 = \frac{1}{N}\sum_{i=1}^{N}(1-\frac{x_i}{z})I(x_i \leq z) \tag{6.2}$$

When x_i is just below the poverty line z, the contribution to poverty is very small, and P_i remains at zero when x equals or above z, i.e. I(.) takes value of zero. According to Deaton (1997, p. 146), "the function (1-x/z)I(x ≤ z) is convex in x-although not strictly so-so that the principle of transfers holds-at least in a weak form".

The squared poverty gap (SPG) takes into account not only the distance separating the poor from the poverty line, but also the incidence of inequalities among the poor. While the poverty gap (P_1) considers the distance separating the poor from the poverty line, the squared poverty gap takes the square of that distance into account. The squared poverty gap is weighted by itself (i.e., poverty gap) so it gives more weight to the very poor and the approach is particularly sensitive to the severity of poverty (World Bank, 2005). The SPG is measured as:

$$P_2 = \frac{1}{N}\sum_{i=1}^{N}[1-\frac{x_i}{z}]^2 I(x_i \leq z) \tag{6.3}$$

In the case of Madagascar, it has been found that unskilled workers have a high rate of poverty incidence (they are ranked as the third highest in the poverty level) and this group is ranked fifth in the poverty severity (World Bank, 2005). Such a difference implies that unskilled workers have a higher risk of being in poverty, though their poverty tends to be less severe (or deep). The different types of measures are needed to provide effective ways for identifying different poverty dimensions, and supporting those living in poverty through the provision of needed resources, and targeted poverty-reduction programmes.

6.3 Theoretical Aspects of Measurement of Income Inequality

In contrast to the poverty definition, inequality is a broader concept in that it is defined as the quality of being unequal or as the disparity of distribution or opportunity. In the socioeconomic context, inequality is studied as part of the analysis which covers poverty and welfare, measures the disparity between a percentage of population and the percentage of

resources available, that is income, consumption, or some other welfare indicator or attribute of a population (Sen, 1973; Atkinson, 1970, 1983).

There are several ways of measuring income inequality, all of which have some intuitive or mathematical appeal.[44] In general, as suggested in the literature, a satisfactory inequality measure must meet the five main axioms and these are as follows: the Pigou-Dalton principle of transfer; decomposability; mean or scale independence principle; the principle of population-size independence; and the principle of anonymity. The principle of anonymity (also referred to as symmetry) requires that the inequality measure is independent of any characteristics of individuals other than their income or the welfare indicator whose distribution is being measured (Cowell, 2011). The principle of the population-size independence requires the inequality indices to be invariant to replications of the population, for example, merging two identical distributions should not alter inequality. In other words, an equi-proportionate change in the number of people or households in each group should have the index unchanged (Dalton, 1920, as cited in Cowell, 2001).

The third axiom refers to the principle of the mean or scale independence, which requires the inequality measures to be invariant to uniform proportional changes (Anand, 1983). That is, if each individual's income changes (i.e. when changing the annual income to monthly or weekly income or currency unit changes) by the same proportion, then inequality should not change. The principle of decomposability requires the overall inequality to be related consistently to constituent parts of the distribution, that is "an inequality measure is said to be additively decomposable if the values of the within-group and the between-group inequality measures add up to that of the over-all measure" (Chatterjee & Srivastav, 1992, p. 7).

The final axiom is an inequality measure needs to satisfy the Pigou-Dalton principle of transfer (also referred to the Pigou-Dalton condition), which was initially proposed by Dalton (1920) following the earlier work by Pigou (1912). This principle requires the inequality measure to increase (or at least not fall) in response to a mean-preserving spread. For example, an income transfer from a poorer individual (or group) to a richer individual (or group) should register as a rise (or at least not as a fall) in inequality and an income transfer from a richer to a poorer person (or group) should register as a fall (or at least not as an increase) in inequality. Chatterjee and Srivastav (1992) suggest that in a given distribution of income, the degree of inequality can be viewed and estimated by the use of positive and normative measures. The positive measure of income inequality refers to measuring inequality without any reference to

[44]See Cowell (2011) for a detailed summary of a total of 12 measures of inequality.

any notion of social welfare. It provides statistical information on what proportion of the population has what proportion of the income. Hence, the Gini coefficient (or index) is one of the most used positive measures of inequality (Jenkins, 1991; Chatterjee & Srivastav, 1992; Crowell, 2011). The normative measure starts from a formally derived social welfare function with implications for welfare gains and losses resulting from changes to the degree of inequality. The Atkinson index (one of the normative measures) captures a greater equality in the distribution of income as higher social welfare and vice versa (Atkinson, 1970).

6.3.1 Measurement of Income Inequality

This section presents the measurement of income inequality. The income inequality measurement includes the positive and normative measures. The positive measure considers the nature of a given distributional arrangement (i.e., the measurement of the Gini coefficient along with the Nelson ratio), while the normative measure of inequality incorporates normative judgements about social welfare (i.e., Atkinson index).

Positive Measures: the Gini Coefficient and the Nelson Ratio

The Gini coefficient (derived from the Lorenz curve) for measuring income inequality (not only independent of the mean and the population size) can also be decomposed if the partitions are non-overlapping (i.e. the sub-groups of the population do not overlap in the vector of incomes) (Crowell, 2011). Secondly, the Gini coefficient identifies what proportion of the population has what proportion of the income (Jenkins, 1991) and, thirdly it satisfies the Pigou-Dalton transfer principle that, “any income transfer from a richer to less rich group that leaves their relative ranking unchanged must reduce the value of the index” (Chatterjee & Srivastav, 1992, p. 5). There are several other definitions of the Gini coefficient in the literature that are used for different purposes (see World Bank, 2005; Crowell, 2011).

The specification used for Gini coefficient is expressed as:

$$G = \sum_{i=1}^{n} (CP_i * CY_{i+1} - CP_{i+1} * CY_i) \tag{6.4}$$

where G is the Gini coefficient, CP_i is the cumulative population share, CY_i is the cumulative income share corresponding to the *i*th class interval, and *i* is 1,…n, households. As the Gini coefficients are estimated using numerical integration under a piecewise linear approximation to the Lorenz curve, a concern arises that such a method may cause the measurement of inequality to be underestimated. However, Gastwirth (1972) demonstrates that if the number of fractile groups used in the construction of the Lorenz curve is large enough, then the

downward bias in the inequality estimates is small. To address this issue and estimate accurate results, this study adopts an appropriately smooth approximation to the underling distribution function and then calculates Gini coefficient using a quadratic function across pairs of intervals.

Several studies by Kakwani and Podder (1973, 1976), Kakwani (1980) and Nelson (1984) suggest a series of alternative methods based on the Lorenz curve to capture the degree of inequality in a given distribution. Amongst these alternative methods, Nelson (1984) suggests a method for estimating income inequality that involves measuring the distance between the tails of a given distribution. For instance, Nelson calculates the fifth (P5) and the ninety-fifth (P95) income centiles along the Lorenz curve, and uses the ratio P95/P5 to express the distance between the two extremes of the distribution. This ratio is considered as the measure of inequality and referred to as the Nelson ratio. Chatterjee and Srivastav (1992) note that the downside of this method is that it only concentrates on the extreme values and ignores the distribution in the intermediate ranges. The universally accepted Nelson ratio is used in conjunction with the more satisfactory Gini coefficient as a measure of inequality in this study for any differential impacts.

Normative Measures: the Atkinson Index

The positive measures of inequality are useful in indicating the nature of a given distributional arrangement, and it is the social welfare implications of these arrangements that are perhaps widely useful from a policy viewpoint. The Atkinson index is one of the few inequality measures that explicitly incorporate normative judgments about social welfare (Atkinson 1970). For a given total income, the welfare function underlying the Atkinson measure captures greater equality in the distribution of income as higher social welfare. The formulation of the Atkinson index of inequality can be expressed as follows:

$$A = 1 - \frac{Y_{EDE}}{\mu} \tag{6.5}$$

where A is the Atkinson's inequality index, Y_{EDE} is the notion of the equally distributed equivalent income, and μ is the mean income of a given distribution. Given the index is mean independent, and that each individual has the same utility function (the anonymity assumption), the Atkinson index can be expressed as:

$$A_t = 1 - [\sum_{i=1}^{n} (y_i / \mu)^{1-\varepsilon} * f_i]^{\frac{1}{1-\varepsilon}}, \text{ for } \varepsilon = 1 \tag{6.6}$$

where A_t is the Atkinson's inequality index;
y_i is the income of the *i*th group;
μ is the mean income of a given distribution;
f_i is the proportion of the population in the group; and
ε reflects the strength of society's preference for equality that can take values between zero to infinity.

Equation (6.6) indicates that when ε equals to zero, society is indifferent about inequality in a given distribution, and when the value of ε is very large (i.e., towards infinity (∞)), society is concerned only with the position of the lowest income group. However, the choice of the actual value for ε, as noted by Chaterjee and Srivastav (1992), is rather arbitrary as it reflects a subjective judgement relating to society's attitude to inequality. Atkinson (1970) chooses values between 1 and 2.5 in his study, while Stern (1977) suggests the values between 1.5 and 2.5 on the basis of his survey of the literature on the elasticity of marginal utility of income. In the analysis of income inequality in New Zealand (1983-84 period), Chaterjee and Srivastav (1992) estimate the Atkinson index with values of inequality aversion parameter, ε, between 0 and 3. They note that, "this is sufficiently a wide range of values to enable us to consider the implications of various distributional states" (ibid, 1992, p. 7). The present study chooses the value of ε between 0 and 3 keeping in line with various distributional impacts.

6.3.2 Decomposition of the Inequality Measures

From the distributional inequalities in a given population, it is also helpful to have an inequality measure which is decomposable into components representing inequalities within the subgroups as well as between them. This section presents the model specifications of decomposition within and between the population groups followed by the classification for decomposition by the source of household incomes.

An inequality measure is additively decomposable if the values of the within-group and the between-group component are estimated on the assumption that each person within a group receives the mean income of the groups, while the within-group component is the weighted sum of the values of inequality measures for each group. The weights, in turn, are the particular group's share of relevant totals, such as the total income or population (Campano & Salvatore, 2006). The population is assumed to be composed of the two subgroups 1 and 2. There are n individuals in the whole population, and expressed as:

$$n_1 y_1 = \sum_{i=1}^{n_1} y_{1i} \text{ and } n_2 y_2 = \sum_{j=1}^{n_2} y_{2j} \tag{6.7}$$

with $n = n_1 + n_2$ (6.8)

and $ny = n_1 y_1 + n_2 y_2$ (6.9)

where n_1 is the number of individuals in the subgroup 1;
y_1 is the mean income of the subgroup 1;
n_2 is the number of individuals in the subgroup 2;
y_2 is the mean income of the subgroup 2:
y is the overall mean income of the population; and
$i = 1, 2, \ldots n_1$; and $j = 1, 2, \ldots n_2$.

Turning to the question of decomposability of the Gini coefficient, the literature states that the sum of the between-group and the within-group components is equal to the overall Gini coefficient only under special circumstances.[45] In other words, the Gini coefficient is said to be decomposable only if the partitions are non-overlapping, that is the sub-groups of the population do not overlap in the vector of incomes (Cowell, 2011). Chatterjee and Srivastav (1992) establish a relationship between the overall Gini coefficient and the coefficients for the two subgroups. The equation takes the following form:

$$G(y) \geq (\frac{n_1 y_1}{ny}) * G(y_1) + (\frac{n_2 y_2}{ny}) * G(y_2) \tag{6.7}$$

where G(y) is the overall Gini coefficient, $G(y_1)$ is the Gini coefficient of the subgroup 1, $G(y_2)$ is the Gini coefficient of the subgroup 2, n_1 is the number of individuals in the subgroup, y_1 is the mean income of the subgroup 1, n_2 is the number of individuals in the subgroup 2, y_2 is the mean income of the subgroup 2, and y is the overall mean income of the population.

When considering the decomposition by source of household incomes, several methods can be used to examine how the changes in particular income sources will affect overall inequality. One widely used method to measure this is to decompose the Gini index by components of income (i.e. concentration ratio), which yields significant policy implications (Pyatt, Chen, & Fei, 1980; Kakwani, 1986; Chatterjee & Srivastav, 1992; Podder, 1993; Jedrzejczak, 2012).

In the case of Taiwan for the period 1964 to 1972, Pyatt et al. (1980) using the concentration ratios demonstrate that the ranking of families by agricultural income has declined in importance as a determinant of ranking by total income, while wages grow in importance as an explanation of total family income. Both Kakwani (1986) and Podder (1993) disaggregate the Gini coefficients by source of income in examining the effects of growth by specific components on the overall inequality in Australia. Chatterjee and Srivastav (1992) estimate the contributions of different components of income to the overall inequality in New Zealand. Jedrzejczak (2012) identifies the contribution of each income share to the overall inequality in the case of Poland.

[45] For further details, reference may be made to Anand (1983), Kakwani (1980, 1986), Podder (1993), and Cowell (1985, 2011).

The decomposition of the Gini coefficient by source of income components takes the following form[46]:

$$G(y) = \sum_{k=1}^{K} \frac{\mu_k}{\mu} * C_k = \sum_{k=1}^{K} \frac{\text{cov}[y_k, F(y)]}{\text{cov}[y_k, F(y_k)]} * \frac{2\,\text{cov}[y_k, F(y)}{u_k} * \frac{\mu_k}{\mu} \tag{6.8}$$

where G(y) is the overall Gini coefficient;
μ is the mean of the total income;
μ_k is the mean of the *k*th income component;
C_k is the concentration ratio of the *k*th component of income;
y is the total income made up of the components y_k;
F(y) is the cumulative distribution function;
cov[y_k, F(y)] is the covariance of income component *k* with the cumulative distribution of income;
cov[y_k, F(y_k)] is the covariance of the total income with the cumulative distribution of income; and
k equals 1, 2…, K.

Podder (1993) in extending the study by Shorrocks (1982) proposes four possible interpretations of the contribution of the *k*th income factor. The first possible interpretation is that the percentage of inequality due to source *k* income alone. Second, the reduction in inequality would occur if this source of income were eliminated. Third, the percentage of inequality is observed if this was the only source of income differences and all other incomes were allocated evenly. Fourth, the reduction in inequality would follow from eliminating differences in source *k* incomes.

In examining the concentration ratio closely, Podder (1993) points out that none of these four possible interpretations remains valid. He explains that if the *k*th component of income is a constant for all incomes, then its concentration ratio will be zero, therefore he concludes that this income component does not make any contribution to total inequality. However, he adds that, "we know that an addition of a constant to all incomes decreases total inequality" (ibid, 1993, p. 53). Therefore, equation (6.11) can be transformed as noted by Podder and Tran-Nam (1991) as follows:

$$\sum_{k=1}^{K} \frac{\mu_k}{\mu}[C_k - G(y)] = 0 \tag{6.12}$$

The sign of [C_k – G(y)] in equation (6.12) shows that the *k*th component can have a negative or positive effect on total inequality. In other words, the sign indicates in the presence of the *k*th income component that increases or decreases total inequality (Podder & Tran-Nam, 1991;

[46] See Rao (1967), Kakwani (1980), Podder and Tran-Nam (1991) for mathematical demonstrations.

Chatterjee & Srivastav, 1992). This is further explained as follows: a) If the *k*th component is proportional to total income, the component does not have any effect on total inequality; and b) when the component rises more than proportionately with total income then the concentration index of the coefficient will be higher than the Gini coefficient of total income. Therefore, the sign of $[C_k - G(y)]$ will be positive and consequently, the *k*th income component increases total inequality. Similarly, for a negative effect the *k*th component needs to be less than proportionately with total income. This study utilises equation (6.12) to estimate the disaggregation of overall inequality index by income components. The discussion on the data issues and assumptions made follows next.

6.4 Data and Classifications

The empirical analysis in this chapter involves examining the degree of poverty and inequalities in the distribution of household income per Adult Equivalent (AE) per week in Fiji using the Household Income and Expenditure Survey 2008-09. This dataset contains detailed statistics on 3,573 households' income, which is divided into 16 major income groups. Total household income is defined as the sum of positive amounts of all monetary income sources a household received in the period 2008-09. The total household income is further divided into two major groups (earned income and un-earned income) and consists of eight income components out of the 61 items listed in the HIES 2008-09, these are:

A) Earned income (EI) components are as follows:
   1- farm income (FI), which includes income from the agricultural crops and economic activities;
   2- non-farm labour income (NFLI), which includes salary and wages, and casual income from non-farm employment and economic activities;
   3- business income (BI), which includes income and capital gains from own business;
   4- investment income (INV), which includes earnings from interests, dividends, royalty, and rent from land and property; and
   5- other income (OI), which includes earnings from hire of equipment and animal and other unspecified income.

B) Un-earned income (UI) components are as follows:
   6- government welfare (WEL), which includes government welfare and pension;
   7- remittances (REM), which includes money transfer from domestic and overseas; and
   8- other current transfer (OCT), which includes gratuities, life insurance, accident and workman compensation, scholarship, alimony maintenance and other allowance, and Fiji National Provident Fund (FNPF) withdrawal.

Several assumptions are made to use the dataset amenable to statistical estimation intended for the inequality and poverty indices. These include, first, the total household income is

estimated as the total household income per Adult Equivalent per week.[47] Second, the cumulative proportions of respective population groups and their corresponding cumulative shares in the total (group-specific) incomes have then been calculated for estimating the inequality indices for the groups. A total of 3,573 households in the HIES 2008-09 are identified into various groups as follows:

- by ethnicity, which includes Fijian households, Indo-Fijian households and Others (include other Pacific islanders, Europeans and Chinese households);
- by regional groups, classified as Rural and Urban households; and
- by household type, which the households are distinguished as the agricultural and non-agricultural households; and ethnicity is once again identified within the agricultural and non-agricultural households.

Table 6.1 presents the summary statistics for the household income of Fiji's population in the HIES period 2008-09. The total annual income of 3,573 households (HIES 2008-09) is F$60,467,748. The estimated mean income per AE for all Fiji households is F$90.66. A total of 3,059 households are male-headed and 514 households are female-headed.[48] On average, the households classified as Others have the highest weekly income per AE (F$190.4) followed by Indo-Fijians (F$90.25) and Fijians (F$80.75).

Table 6.1 Summary Statistics for HIES 2008-09 in Fiji

Household	Number of HH	Mean HH Income pAEpw (F$)	Share of HH	Total Annual Income (F$)
By Gender				
Male	3059	99.37	85.61	51,953,459
Female	514	117.53	14.39	8,514,289
By Ethnicity				
Fijian	2040	80.75	0.56	34,074,600
Indo-Fijian	1325	90.25	0.34	20,414,054
Others	208	190.40	0.10	5,979,095
By Region				
Rural	1911	61.28	0.37	22,574,812
Urban	1662	124.43	0.63	37,892,936
By Household Type				
Agricultural Household	1201	56.41	0.23	14,108,824
Non-Agricultural Household	2372	107.99	0.77	46,358,924
Agricultural Household by Ethnicity				
Fijian	908	55.55	0.17	10,497,858
Indo-Fijian	241	60.22	0.05	3,000,410
Others	52	53.63	0.01	610,556
Non-Agricultural Household by Ethnicity				
Fijian	1132	100.96	0.39	23,576,742
Indo-Fijian	1084	96.92	0.29	17,413,644
Others	156	235.99	0.09	5,368,539
Total	3753	90.66	1	60,467,748

Source: Estimation based on the 2008-09 HIES survey.
Notes: HH stands for household, and pAEpw is per Adult Equivalent per week.

[47] The 'Adult Equivalents' for each household is by treating the children (age of 14 and under) as half an adult.
[48] Given the unevenly distributed number of households headed by gender, the poverty and inequality analyses are estimated by ethnicity, region and household type.

By regions, the mean income per AE per week estimated for rural households is F$61.28, while urban households have an average income of F$124.43 per AE per week. By household type, the agricultural households have a relatively lower mean weekly income per AE (F$56.41) than the non-agricultural households (F$107.99). Under the agricultural household category, the Indo-Fijian farm households have the weekly income per AE (F$60.22), others farm households classified (F$53.63) and the Fijian farm households (F$55.55). Among the non-agricultural households, Others have the highest weekly income per AE (F$235.99), followed by Fijian households (F$100.96), and Indo-Fijian households (F$96.92). The estimated results of the magnitude of poverty (i.e., the level, depth and severity of poverty based on the basic needs and food poverty lines) and income inequalities (i.e., within groups, between group and household source of income) are presented in the next section.

6.5 Empirical Results

The empirical results for the level, depth and severity of poverty are reported, followed by the analysis of income inequality amongst the households in Fiji. Section 6.5.1 presents the results for poverty analysis and the comprehensive effects of non-farm income and un-earned income components on poverty reduction. The next section (6.5.2) reports the within-group and between group inequalities, the decomposition of inequality by income components, as well as the estimated results for normative measure of inequality (i.e. the Atkinson index).

6.5.1 Empirical Results: Poverty Analysis

The empirical results presented here are the Basic Needs Poverty Line (BNPL) and Food Poverty Line (FPL) as the benchmark poverty lines in Fiji to analyse the incidence of poverty based on Narsey et al. (2010) poverty line. These estimated BNPL and FPL poverty lines are based on a household of 4 Adult Equivalents per week (see Table 6.2). The estimated results for the incidence of poverty decomposition, i.e., the basic need poverty and food poverty lines are presented in Tables 6.3 and 6.4, respectively. Three poverty measures are used to examine the poverty level (P_0), poverty depth (P_1) and severity of poverty (P_2).

Table 6.2 Poverty Lines for HIES 2008-09

	BNPL pAEpw	FPL pAEpw	Mean HH Income pAEpw
National Level	F$43.75	F$22.01	F$90.65
Rural	F$41.15	F$22.18	F$61.28
Urban	F$46.54	F$21.83	F$124.43

Notes: BNPL is the basic need poverty line, FPL is the food poverty line, pAEpw is per Adult Equivalent per week, and HH stands for household.

Fiji's incidence of food poverty is less severe compared to that of basic needs poverty (Table 6.3). The estimated results show that 30.81% of total households are in basic needs poverty, and 6.72% of total households in food poverty (Table 6.4). The percentage of Fijian households in basic needs poverty is estimated at 32.7%, Indo-Fijian households at 28.91%, and Others at 24.52%. By regional disaggregation, there is a higher percentage of rural households (47.13%) in basic needs poverty compared to urban households (18.11%). Further decomposition shows that 40 percent of the agricultural households are in basic needs poverty compared with 22.56% involved in the non-agricultural households.

Table 6.3 Incidence of Poverty, Basic Needs Poverty Line, 2008-09

Household	Poverty Headcount Ratio, P_0 (%)	Poverty Gap Ratio, P_1 (%)	Squared Poverty Gap Index, P_2
By Ethnicity			
Fijian	32.70	10.18	4.56
Indo-Fijian	28.91	9.95	5.00
Others	24.52	8.02	3.55
By Region			
Rural	40.08	13.04	6.0
Urban	18.11	5.18	2.39
By Household Type			
Agricultural Household	47.13	15.1	6.65
Non-Agricultural Household	22.56	7.37	3.66
Agricultural Household			
Fijian	47.69	15.07	6.56
Indo-Fijian	43.57	14.57	6.69
Others	53.85	18.04	8.07
Non-Agricultural Household			
Fijian	20.67	6.25	2.95
Indo-Fijian	25.65	8.93	4.63
Others	14.74	4.68	2.05
Total Households	30.81	9.97	4.66

Source: Estimation based on the 2008-09 HIES survey.

Under the agricultural household category by ethnicity (see Table 6.3), it estimates that about 433 Fijian households (i.e., 47.69% of total Fijian agricultural households) are in basic needs poverty, followed by 105 Indo-Fijian households (i.e., 43.57% of total Indo-Fijian agricultural households) and 28 Others (i.e., 53.85% of total agricultural households which consists of European, Chinese and other Melanesia ethnics). In the non-agricultural household category, about 278 Indo-Fijian households (25.65%) are in basic needs poverty compared to 234 Fijian (20.67%) and 23 Others (14.74%) households.

In analysing the households in food poverty (Table 6.4), the percentage value is estimated at 6.72% which is significantly lower than that of basic needs poverty (30.81%). Categorising the impacts by three ethnic groups in food poverty, the estimated values indicate that all three groups have the lower level of food poverty by almost three times the level of basic needs poverty. Despite the lower incidence of food poverty, there is still 7.25% of Indo-Fijian

households, 6.57% of Fijians and 4.81% Others households whose live on F$22.01 per Adult Equivalent per week (that is about F$3 a day). In assessing the depth of poverty (poverty gap ratio) and the severity of poverty (squared poverty gap), the depth of basic needs poverty which Fijian households endure is relatively higher than the other two ethnic groups (Indo-Fijian and Others households). The severity of basic needs poverty experienced by Indo-Fijian households is relatively worse than the other two groups. On the other hand, Indo-Fijian households are facing severer and greater depth of food poverty compared to the other ethnic groups.

Table 6.4 Incidence of Poverty, Food Poverty Line, 2008-09

Household	Poverty Headcount Ratio, P_0 (%)	Poverty Gap Ratio, P_1 (%)	Poverty Gap Squared, P_2 (%)
By Ethnicity			
Fijian	6.57	1.70	0.72
Indo-Fijian	7.25	2.48	1.32
Others	4.81	1.11	0.47
By Region			
Rural	10.52	2.87	1.27
Urban	2.53	0.96	0.56
By Household Type			
Agricultural Household	9.41	2.20	0.81
Non-Agricultural Household	5.35	1.83	0.99
Agricultural Household			
Fijian	9.25	2.09	0.72
Indo-Fijian	9.13	2.55	1.12
Others	13.46	2.61	0.83
Non-Agricultural Household			
Fijian	4.42	1.39	0.72
Indo-Fijian	6.83	2.47	1.37
Others	1.92	0.62	0.35
Total Households	6.72	1.96	0.93

Source: Estimation based on the 2008-09 HIES survey.

The percentage of rural households (10.52%) in food poverty is almost five times higher than the urban households (2.53%). The level of agricultural households in food poverty at 9.41% is relatively higher compared to 5.35% of non-agricultural households. By ethnic groups, agricultural households classified as Others (13.46%) is relatively higher in food poverty compared to Fijian (9.25%) and Indo-Fijian (9.13%). Amongst the non-agricultural households, Indo-Fijian households (6.83%) are substantially higher in food poverty to that of Fijians (4.42%) and Others (1.92%).

The food poverty gap ratio is estimated at 2.2% for agricultural households, and 1.83% for the non-agricultural households. Under the agricultural household category, Others households (2.61%) have the highest food poverty gap ratio, followed by Indo-Fijians (2.55%) and Fijians (2.09%). As for the non-agricultural households, Indo-Fijian households (2.47%) have the highest food poverty headcount ratio, followed by Fijians (1.39%) and Others (0.62%).

6.5.2 Decomposition of Poverty by Income Components

The estimated results of poverty decomposition by income components (i.e., farm income, non-farm labour income, business income etc.) are reported in Table 6.5. All of the poverty measures (poverty headcount ratio, poverty gap ratio, and poverty gap squared) show that the inclusion of non-farm income and un-earned income in the agricultural household reduce poverty at different rates under each category. According to the poverty headcount measure (P_0), the household income component identified as Other Income (OI) has the highest contribution to basic needs poverty reduction (22.38%, column 13), followed by the non-farm labour income (12.46%, column 10), remittance income (2.65%, column 15), business income (1.54%, column 11), other current transfers (0.99%, column 16), government welfare (0.44%, column 14), and income from investment (0.22%, column 12). The impacts of these income components are substantially stronger in reducing poverty as indicated by poverty gap ratio (i.e., P_1, depth of poverty) and the poverty gap squared index (i.e., P_2, severity of poverty). As such, the severity of poverty (P_2) shows that additional income from the non-farm labour income and remittance income to the existing household farm income reduces basic needs poverty by 38.74 percent and 7.14 percent, respectively.

Moreover, remittance income as an un-earned household income source plays a significant role in poverty reduction for all agricultural households. For instance, remittances reduce the level of basic needs poverty by 2.65%; the depth of basic needs poverty by 4.94%; and the severity of basic needs poverty by 7.14%. For the Fijian farm households in basic needs poverty, all the poverty measures (P_0, P_1, P_2) indicate that the non-farm labour income (see column 10 of Earned Income in Table 6.5) has greater poverty-reducing effects for the level of poverty (19.52%), depth (48.92%), and severity (60.59%) of basic needs poverty.

Table 6.5 Decomposition of Poverty by Income Source, HIES 2008-09

Categories of Income Source										Earned Income (EI)				Un-earned Income (UI)			
Poverty Index	FI (1)	NFLI (2)	BI (3)	INV (4)	OI (5)	WEL (6)	REM (7)	OCT (8)	THI (9)	%Δ (FI vs NFLI) (10)	%Δ (FI vs BI) (11)	%Δ (FI vs INV) (12)	%Δ (FI vs OI) (13)	%Δ (FI vs WEL) (14)	%Δ (FI vs REM) (15)	%Δ (FI vs OCT) (16)	%Δ (FI vs THI) (17)
Basic Needs Poverty																	
All Agricultural Households																	
P_0	0.907	0.794	0.893	0.905	0.704	0.903	0.883	0.898	0.471	-12.46	-1.54	-0.22	-22.38	-0.44	-2.65	-0.99	-48.07
P_1	0.607	0.426	0.587	0.602	0.311	0.593	0.577	0.59	0.151	-29.82	-3.29	-0.82	-48.76	-2.31	-4.94	-2.80	-75.12
P_2	0.462	0.283	0.441	0.456	0.176	0.444	0.429	0.444	0.067	-38.74	-4.55	-1.30	-61.90	-3.90	-7.14	-3.90	-85.50
Fijian Households																	
P_0	0.871	0.701	0.855	0.873	0.784	0.861	0.838	0.855	0.436	-19.52	-1.84	0.23	-9.99	-1.15	-3.79	-1.84	-49.94
P_1	0.603	0.308	0.577	0.602	0.433	0.592	0.567	0.572	0.146	-48.92	-4.31	-0.17	-28.19	-1.82	-5.97	-5.14	-75.79
P_2	0.472	0.186	0.445	0.453	0.283	0.458	0.433	0.439	0.067	-60.59	-5.72	-4.03	-40.04	-2.97	-8.26	-6.99	-85.81
Indo-Fijian Households																	
P_0	0.911	0.813	0.896	0.909	0.684	0.905	0.891	0.904	0.477	-10.76	-1.65	-0.22	-24.92	-0.66	-2.20	-0.77	-47.64
P_1	0.602	0.449	0.585	0.596	0.279	0.587	0.575	0.589	0.151	-25.42	-2.82	-1.00	-53.65	-2.49	-4.49	-2.16	-74.92
P_2	0.454	0.301	0.436	0.446	0.149	0.435	0.424	0.44	0.066	-33.70	-3.96	-1.76	-67.18	-4.19	-6.61	-3.08	-85.46
Food Poverty																	
All Agricultural Households																	
P_0	0.69	0.452	0.666	0.686	0.302	0.683	0.66	0.668	0.094	-34.49	-3.48	-0.58	-56.23	-1.01	-4.35	-3.19	-86.38
P_1	0.395	0.211	0.373	0.389	0.103	0.375	0.359	0.376	0.022	-46.58	-5.57	-1.52	-73.92	-5.06	-9.11	-4.81	-94.43
P_2	0.277	0.129	0.258	0.27	0.051	0.255	0.243	0.26	0.008	-53.43	-6.86	-2.53	-81.59	-7.94	-12.27	-6.14	-97.11
Fijian Households																	
P_0	0.697	0.295	0.664	0.665	0.473	0.689	0.66	0.66	0.091	-57.68	-4.73	-4.59	-32.14	-1.15	-5.31	-5.31	-86.94
P_1	0.412	0.123	0.383	0.398	0.207	0.395	0.366	0.376	0.025	-70.15	-7.04	-3.40	-49.76	-4.13	-11.17	-8.74	-93.93
P_2	0.304	0.072	0.279	0.303	0.118	0.287	0.263	0.271	0.011	-76.32	-8.22	-0.33	-61.18	-5.59	-13.49	-10.86	-96.38
Indo-Fijian Households																	
P_0	0.68	0.481	0.659	0.674	0.26	0.672	0.654	0.661	0.093	-29.26	-3.09	-0.88	-61.76	-1.18	-3.82	-2.79	-86.32
P_1	0.385	0.226	0.367	0.377	0.076	0.364	0.353	0.371	0.021	-41.30	-4.68	-2.08	-80.26	-5.45	-8.31	-3.64	-94.55
P_2	0.266	0.139	0.25	0.258	0.034	0.244	0.235	0.254	0.007	-47.74	-6.02	-3.01	-87.22	-8.27	-11.65	-4.51	-97.37

Source: Estimation based on the 2008-09 HIES survey.

Legends: P_0 = Poverty Headcount Ratio; P_1 = Poverty Gap Ratio; P_2 = Poverty Gap Squared; FI = Farm Income; NFLI = Non-farm Labour Income; BI = Business Income; INV = Investment Income; OI = Other Income; WEL = Government Welfare; REM = Remittances; OCT = Other Current Transfers; THI = Total Household Income.

Notes: the percentage change between the farm income and other household income components (such as non-farm labour income) is represented as %Δ, and calculated as $\left(\frac{|(2)-(1)|}{(1)}\right) * 100$.

For the Indo-Fijian households in basic needs poverty, this group's impact of poverty reduction is higher from the Other Income (column 13) than the household income components such as non-farm income, business income, and investment income. Remittance income also has a positive effect in reducing the basic needs poverty for both the Fijian and Indo-Fijian farm households in all three poverty indices, P_0, P_1, and P_2.

In terms of food poverty, the additional income from non-farm and un-earned income components show that the level, depth, and severity of food poverty are reduced at differential rates for all agricultural households and by ethnic groups. The additional non-farm labour income to the existing household income reduces the level of food poverty (column 10) by 34.49%, the depth of food poverty by 45.58%, and the severity of food poverty is reduced by 53.43%. For the un-earned income category, remittances (column 15) have the highest contribution in reducing food poverty compared to other un-earned income components (column 14 and 16) for all households in food poverty (Table 6.5).

For the Fijian farm households in food poverty, all of the poverty measures indicate that non-farm labour income has greater poverty-reducing effects (column 10) for the level (57.68%), depth (70.15%) and severity (76.32%) of food poverty. The Indo-Fijian farm households on the other hand, for the same socio-economic status have food poverty reduced through the Other Income source (column 13). It is seen that remittance income once again plays a significant role in reducing food poverty for both the Fijian and Indo-Fijian households.

6.5.3 Empirical Results: Income Inequality Analysis

This section reports the incidence of income inequalities based on the Gini coefficients of the household income distributions based on HIES 2008-09. The results are estimated for within-group inequalities and between-group inequalities by ethnicity, regional and household types. The analysis further estimates inequality based on the source of household income and for agricultural and non-agricultural households.

6.5.3.1 Within-Group Inequalities

The estimated coefficients are reported for the disparities within the groups (in values) and the ranking of the Gini indices of inequality (Table 6.6). The index of inequality and Nelson ratio for the overall sample population is estimated at 0.453 and 33.38, respectively. The households in the top 20% income quintile group obtain 51.4% of total household income per AE per week, while the households in the bottom 20% share 5.38% of total household income per AE per week.

In addition, the average earnings of the top 5% of the households (F$81,674) are proportionately 4 times more than the bottom 20% (F$17,413).

By ethnicity, the Gini index for Others at 0.618 is the highest level of income inequality followed by relatively lower level of inequality (0.436) for the Indo-Fijian households, and the lowest inequality level for the Fijian households at 0.413. By regional areas, rural households (0.374) have relatively lower inequality than urban households (0.451). By household type, the agricultural households (0.345) have a lower Gini index than the non-agricultural households (0.456). This results cohere with the estimated level of inequality by regional areas, given that majority of the agricultural households in the survey are located in the rural areas.

Table 6.6 Income Quintile Inequalities: Ethnicity, Region and Households Types, 2008-09

HH	Gini Index	Lowest 20% Q1	Q2	Q3	Q4	Highest 20% Q5	Highest 5% P95	Lowest 5% P5	Nelson Ratio (=P95/P5)
Overall Sample Population									
Overall	0.453	5.38 ($17,413)	9.55 ($30,940)	13.56 ($43,937)	20.10 ($65,115)	51.40 ($166,501)	25.22 ($81,674)	0.76 ($2,447)	33.38
By Ethnicity									
Fijian	0.413	6.07 ($10,005)	10.37 ($17,077)	14.49 ($23,876)	21.08 ($34,722)	47.99 ($79,048)	21.78 ($35,880)	0.92 ($1,509)	23.78
Indo-Fijian	0.436	5.27 ($6,304)	9.82 ($11,746)	13.97 ($16,710)	20.90 ($24,995)	50.03 ($59,823)	21.77 ($26,034)	0.65 ($779)	33.41
Others	0.618	2.85 ($1,127)	5.79 ($2,291)	9.47 ($3,749)	15.44 ($6,116)	66.46 ($26,320)	40.59 ($16,077)	0.43 ($169)	95.07
By Region									
Rural	0.374	6.77 ($7,929)	11.32 ($13,255)	15.64 ($18,317)	21.41 ($25,078)	44.85 ($52,526)	19.11 ($22,378)	0.97 ($1,138)	19.67
Urban	0.451	5.55 ($11,479)	9.60 ($19,851)	13.67 ($28,271)	19.79 ($40,925)	51.39 ($106,276)	26.32 ($54,422)	0.77 ($1,598)	34.06
By Household Type									
Ag HH	0.345	7.61 ($5,153)	11.94 ($8,088)	16.25 ($11,010)	21.68 ($14,684)	42.53 ($28,808)	17.99 ($12,186)	1.24 ($838)	14.54
Non-Ag HH	0.456	5.14 ($13,157)	9.47 ($24,261)	13.69 ($35,058)	20.17 ($51,679)	51.53 ($132,009)	25.62 ($65,621)	0.64 ($1,645)	39.9
Total	0.453	5.38 ($17,413)	9.55 ($30,940)	13.56 ($43,937)	20.10 ($65,115)	51.40 ($166,501)	25.22 ($81,674)	0.76 ($2,447)	33.38

Source: Estimation based on the 2008-09 HIES survey.
Notes: Figures in parenthesis are household income per Adult Equivalent per week in each specific quintile. HH is household, Ag HH is the agricultural households, Non-Ag HH is non-agricultural households. $ are Fijian dollars

The estimated Nelson ratio (Table 6.6) indicates that household group classified as Others has the highest Nelson ratio (95.07) followed by Indo-Fijian households (33.41) and the lowest ratio for Fijian households (23.78). This suggests that the household income share of the lowest 5% for Others only receive F$169.1 per AE per week compare to F$16,077 for the top 5% of the income earners of this group. The high level of income inequality is also seen in the Fijian and Indo-Fijian household groups. The Fijian household income share of the top 5% receive almost

24 times more income per AE per week than those in the lowest 5% group, and the top 5% of the Indo-Fijian households have 33 folds more income per AE per week than those in the lowest 5%.

By regions, urban households (34.06) have higher Nelson index than rural households (19.67) revealing a higher level of income inequality among urban households than rural households. The estimated coefficients for the urban households in the top 5% income group receive almost 34 times more weekly income per AE in the lowest 5% group. The rural household weekly income per AE in the top 5% group is 19 times higher than those in the lowest 5% group. For the income inequality by household type, the Nelson index for non-agricultural households is estimated at 39.9, which is significantly higher than that of agricultural households (14.54). This implies that the share of top 5% income group of both the non-agricultural and agricultural households are substantially higher (over 39 and 14 times, respectively) than their counterparts in the lowest 5% group. This indicates high levels of income inequality for these rural households. The estimated income distributions point to a higher degree of overall inequality captured by the estimated Gini coefficient values.

6.5.3.2 The Between-Group Inequalities

For a perfect decomposition of inequality (Gini index) the sum of the within-group and between-group components of inequality indices would be equal to the overall index. However, it is unlikely to meet this requirement as the distributions within the subgroups are identical. Hence, the Gini coefficient decompositions are provided at only the lower bounds of the index (Chatterjee & Srivastav, 1992). The estimated results of the between-group inequality (Table 6.7) are for the Gini index decomposed for the sample population in terms of their ethnicity (i.e., Fijian, Indo-Fijian and Others), living areas (i.e., urban and rural sectors) and the household type (i.e., agricultural and non-agricultural households).

The relative level of inequality for each ethnic group to overall index has been estimated using the relationship proposed in equation (6.11). The overall ethnicity Gini index has a value of 0.453, and by each ethnic group the index for Fijian, Indo-Fijian and Others households are 0.413, 0.436 and 0.618, respectively (Table 6.7). The contribution to total inequality from the Fijian household group is estimated at 0.21, Indo-Fijian group is 0.161 and Others group 0.076 out of the overall inequality index value of 0.453, thus leaving a very small share of 0.006 as unexplained. Expressed in percentage terms, the ethnic groups' contribution to total inequality index is 46% (Fijian), 36% (Indo-Fijian) and 17% (Others), respectively. Together all three ethnic groups explain 99% of the overall inequality leaving unexplained 1% of the total inequality share.

By regional classification (Table 6.7) the urban households contribute 64% to the total inequality index followed by the rural households (30%). Together both groups explain 93% of the overall inequality leaving unexplained 7% of the total. The analysis for disaggregating the incidence of inequality between the agricultural and non-agricultural households' indicates that non-agricultural households have a relatively higher percentage share of total inequality (80%) than the agricultural households (16%). Under the category of agricultural household group, the Fijian households (73%) have a relatively higher percentage share of total inequality followed by Indo-Fijian (23%) and Others (4%). Turning the attention to non-agricultural household category, the results indicate that all three ethnic groups explain 98% of the overall income inequality, thus leaving a total inequality share of 2 percent unexplained.

Table 6.7 Inequality by Ethnicity, Region and Household Type

Household	Number of HH	Gini Coefficient	Mean HH Income pAEpw	Contribution to Total Inequality	Percentage Share of Total Inequality (%)
By Ethnicity					
Fijian	2040	0.413	80.75	0.210	46
Indo-Fijian	1325	0.436	90.25	0.161	36
Others	208	0.618	190.40	0.076	17
Total	3573	0.453	90.65	0.447	99
Unexplained				0.006	1
By Region					
Rural	1911	0.374	61.28	0.135	30
Urban	1662	0.45	124.43	0.288	64
Total	3573	0.453	90.65	0.423	93
Unexplained				0.030	7
By Household Type					
Agricultural HH	1201	0.345	56.41	0.072	16
Non-Agricultural HH	2372	0.456	107.99	0.361	80
Total	3573	0.453	90.65	0.433	96
Unexplained				0.020	4
Agricultural Household					
Fijian	908	0.338	55.55	0.252	73
Indo-Fijian	241	0.372	60.22	0.080	23
Others	52	0.331	53.63	0.014	4
Total	1201	0.345	56.41	0.345	100
Unexplained					0
Non-Agricultural Household					
Fijian	1132	0.411	100.96	0.183	40
Indo-Fijian	1084	0.436	96.92	0.179	39
Others	156	0.602	235.99	0.087	19
Total	2372	0.456	107.99	0.449	98
Unexplained				0.007	2

Source: Estimation based on the 2008-09 HIES survey.
Notes: HH stands for household.

6.5.3.3 Results for Income Decomposition by Source of Household Income

Based on the literature, inequality can also be decomposed by the household income sources. The empirical results for decomposition of inequality by the source of household income are presented in Tables 6.8, 6.9 and 6.10. These decomposed results are crucial in understanding the

household sources of income and its level of inequality. The first row presents the mean weekly household income per AE of each household income source. The second row shows the percentage share of each income source. The third row is the Gini coefficients for each income component. The fourth row presents the concentration indices corresponding to each income source as well as the overall Gini index. The fifth row provides the values for the contribution of each income component to the overall inequality. The marginal effect on income inequality when there is a small change in a source of income can be seen in the final row.

Decomposition of Income Inequality: All Households

The estimated results of decomposition of inequality by the source of household income for the total households are presented in Table 6.8. Under the earned income category, Non-farm Labour Income has by far the highest percentage share (51.81%) of total household income followed by Other Income (23.07%), Farm Income (7.26%), Business Income (4.13%) and Investment Income (1.03%).

In terms of un-earned income category, remittance income makes up about 5.86% of total household income, while other current transfers and government welfare contribute 4.71% and 2.13%, respectively. The estimated results of decomposition of Gini coefficients and concentration indices by each income component reveal that these income sources are more unevenly distributed in favour of the higher income-earning households. Moreover, the un-earned income sources such as Government Welfare (0.96) and Other Current Transfers (0.94) are also unevenly distributed among the households. The Gini coefficient for remittance income is estimated at 0.92 implying a higher inequality between the remittance-recipient households (1,104) and non-recipient households (2,496).

In terms of the contribution to the overall income inequality, Table 6.8 shows that the Non-farm Labour Income contributes around 58.37% of the overall inequality followed by Other Income (18.76%), Business Income (4.72%), Investment Income (1.67%) and Farm Income (0.16%). As for the un-earned income category, government welfare contributes 7.3% of the overall household income inequality followed by other current transfers (7.07%) and remittances (1.95%).

Table 6.8 Decomposition of Household Income Inequality, All Households, 2008-09

	Earned Income (EI)					Un-earned Income (UI)			
Total Households	Farm Income (FI)	Non-farm Labour Income (NFLI)	Business Income (BI)	Investment Income (INV)	Other Income (OI)	Government Welfare (WEL)	Remittances (REM)	Other Current Transfers (OCT)	Total Household Income (THI)
Mean HH Income per AE per week	6.58	46.98	3.74	0.93	20.92	1.93	5.31	4.27	90.66
Share of each income source (%)	7.26	51.81	4.13	1.03	23.07	2.13	5.86	4.71	100
Gini Coefficient (G_k)	0.83	0.64	0.96	0.99	0.58	0.96	0.93	0.94	0.453
Concentration Index (C_k)	0.0329	0.2347	0.0187	0.0047	0.1045	0.010	0.0265	0.0214	0.453
Contribution to Overall Inequality ($\frac{\mu_k}{\mu}[C_k-G_y]$)	0.0016	0.5837	0.0472	0.0167	0.1876	0.073	0.0195	0.0707	
Marginal Effect	-0.071	0.0655	0.0059	0.0064	-0.0431	0.0144	-0.0018	0.0236	

Source: Estimation based on 2008-09 HIES. Notes: HH stands for household. AE is adult equivalent. Marginal effect is estimated using Lerman and Yitzhaki (1985) methodology.

Table 6.9 Decomposition of Household Income Inequality, Agricultural Households, 2008-09

	Earned Income (EI)					Un-earned Income (UI)			
Agricultural Households	Farm Income (FI)	Non-farm Labour Income (NFLI)	Business Income (BI)	Investment Income (INV)	Other Income (OI)	Government Welfare (WEL)	Remittances (REM)	Other Current Transfers (OCT)	Total Household Income (THI)
Mean HH Income per AE per week	19.58	11.79	1.52	0.38	19.17	0.78	1.78	1.41	56.41
Share of each income source (%)	34.71	20.90	2.70	0.67	33.99	1.39	3.15	2.50	100
Gini Coefficient (G_k)	0.50	0.80	0.96	0.98	0.42	0.95	0.88	0.97	0.345
Concentration Index (C_k)	0.1198	0.0721	0.0093	0.0023	0.1173	0.0048	0.0109	0.0086	0.345
Contribution to Overall Inequality ($\frac{\mu_k}{\mu}[C_k-G_y]$)	0.2963	0.2851	0.0419	0.0097	0.2725	0.0096	0.0344	0.0504	
Marginal effect	-0.051	0.076	0.015	0.003	-0.068	-0.0043	0.0028	0.0028	

Notes: see Table 6.7 for source.

Table 6.10 Decomposition of Household Income Inequality, Non-agricultural Households, 2008-09

	Earned Income (EI)					Un-earned Income (UI)			
Non-agricultural Households	Farm Income (FI)	Non-farm Labour Income (NFLI)	Business Income (BI)	Investment Income (INV)	Other Income (OI)	Government Welfare (WEL)	Remittances (REM)	Other Current Transfers (OCT)	Total Household Income (THI)
Mean HH Income per AE per week	0	64.79	4.86	1.21	21.8	2.51	7.1	5.72	107.99
Share of each income source (%)	0	60	4.5	1.12	20.19	2.32	6.58	5.3	100
Gini Coefficient (G_k)	0	0.53	0.95	0.99	0.64	0.96	0.9219	0.9203	0.456
Concentration Index (C_k)	0	0.2738	0.0206	0.0051	0.0921	0.0106	0.03	0.02	0.456
Contribution to Overall Inequality ($\frac{\mu_k}{\mu}[C_k-G_y]$)	0	0.5712	0.0451	0.0188	0.1942	0.0199	0.0779	0.0729	
Marginal effect	0	-0.0287	0	0.0076	-0.0077	-0.0033	0.0121	0.0199	

Notes: see Table 6.7 for source.

The estimated marginal effect of a 1% change in a particular income component is shown in the final row for various earned income and un-earned income categories (see Table 6.8). The results show that a 1% increase in Farm Income, holding other income components constant, will reduce the overall inequality by 7.1%. Similarly, given that all other sources of income are unchanged, a one percent increase in Other Income reduces the overall inequality by 4.31%. On the contrary, a 1 percent increase in Non-farm Labour Income will result in a 6.55% increase in overall household inequality. Also, an increase of 1% in Business Income and Investment income will increase the overall inequality at a moderate rate of less than 1% for both these categories. For the un-earned income category, remittances reduce the level of inequality though it is at a very marginal rate.

Decomposition of Income Inequality: Agricultural Households

Table 6.9 shows the results of decomposition of household income inequality for the agricultural households. The farm income is the main source of income for the agriculture-oriented families, which contributes 34.71% of the total household income followed by Other Income (33.99%), and Non-farm Labour Income (20.9%). The other sources that constitute as a source of income at the respective levels are Remittances (3.15%), Business Income (2.7%), Other Current Transfers (2.5%), Government Welfare (1.39%), and Investment Income (0.67%). Under the earned category, the Gini coefficients reveal that the two income sources of Farm Income (0.5) and Other Income (0.42) are relatively evenly distributed and showing a lower level of inequality across the agricultural households compared to other income sources of inequality at very high rate, i.e., Investment Income (0.98), Business Income (0.96) and Non-farm Labour Income (0.8).

As for the un-earned income category (Table 6.9), the Other Current Transfer (0.97) has the highest value for inequality followed by Government Welfare (0.95) and Remittances (0.88). The contribution of each income component to total household income inequality shows that Farm Income (29.63%) has the highest percentage share of overall income inequality, followed by Non-farm Labour Income (28.51%) and Other Income (27.25%). The contributions to overall inequality at lower levels include Other Current Transfers (5.04%), Business Income (4.19%), Remittances (3.44%), Investment Income (0.97%), and Government Welfare (0.96%). The marginal effect results indicate that a 1% increase in households' farm income (or Other Income source) can potentially reduce the overall inequality by 5.08% (or 6.75%). A one percent rise in government welfare reduces the overall inequality of agricultural households by 0.43%.

Decomposition of Income Inequality: Non-agricultural Households

In contrast to agricultural households, the main income source of non-agricultural household inequalities (Table 6.10) is from the Non-farm Labour Income component (i.e., salary, wages and casual income from non-farm employment and economic activities) which contributes about 60% of total household income. The remaining share of income inequalities is from Other Income (20.19%), Remittances (6.58%), Other Current Transfers (5.3%), Business Income (4.5%), Government Welfare (2.32%) and Investment Income (1.12%). The Gini coefficients imply that the income types such as Investment Income (0.99) and Business Income (0.95) are most unevenly distributed in favour of the higher income-earning households than income as a whole.

The Gini coefficients for un-earned income sources such as Government Welfare and Other Current Transfers are estimated at 0.96 and 0.92, respectively. This supports the view that government welfare and current transfer payments are not effectively targeted and distributed to the needy families of the non-agricultural households. Remittances coefficient value (0.922) causes high inequality due to the fact that only 756 households (out of 2,372 households) are remittance-recipient households. In terms of total income inequality, Non-farm Labour Income has the highest contribution at 57.12%, followed by Other Income (19.42%). The lower level contributions of inequality at the corresponding rates are Remittances (7.79%), Other Current Transfers (7.29%), Business Income (4.51%), Government Welfare (1.99%) and Investment Income (1.88%).

The marginal effect in Table 6.10 shows that a 1% increase in the non-agricultural household income (Non-farm Labour Income) decreases the overall inequality by 2.87%, while the inequality can be reduced by 0.77% if there is a 1% increase in Other Income source. The Government Welfare income also has the inequality reducing effect, with other income components held constant, a 1% increase in the welfare payments will result in 0.33% reduction in the overall inequality.

Table 6.11 The Atkinson Indices of Inequality Results by Ethnicity, Region, and Household Type, 2008-09

	Mean HH Weekly Income per Adult Equivalent (AE)	Value of Epsilon (ε), the Atkinson Indices and corresponding Y_{EDE}					
		ε = 0	ε = 1	ε = 1.5	ε = 2	ε = 2.5	ε = 3
Total Households	F$90.65	0	0.30	0.41	0.55	0.80	0.93
		(F$90.65)	(F$63.47)	(F$53.91)	(F$40.81)	(F$18.21)	(F$6.19)
By Ethnicity							
Fijian	F$80.75	0	0.25	0.35	0.45	0.61	0.80
		(F$80.75)	(F$60.28)	(F$52.78)	(F$44.51)	(F$31.36)	(F$16.30)
Indo-Fijian	F$90.25	0	0.29	0.41	0.62	0.87	0.96
		(F$90.25)	(F$64.48)	(F$53.12)	(F$34.59)	(F$11.54)	(F$3.94)
Others	F$190.4	0	0.50	0.61	0.68	0.73	0.78
		(F$190.4)	(F$95.14)	(F$75.02)	(F$61.09)	(F$50.63)	(F$42.36)
By Regional							
Rural	F$61.28	0	0.21	0.30	0.38	0.46	0.55
		(F$61.28)	(F$48.25)	(F$43.01)	(F$37.99)	(F$32.81)	(F$27.33)
Urban	F$124.43	0	0.30	0.42	0.64	0.90	0.97
		(F$124.43)	(F$86.98)	(F$72.48)	(F$44.62)	(F$12.91)	(F$4.28)
By Household Type							
Agricultural Household	F$56.41	0	0.18	0.25	0.31	0.38	0.44
		(F$56.41)	(F$46.25)	(F$42.26)	(F$38.65)	(F$35.20)	(F$31.70)
Non-Ag Household	F$107.99	0	0.31	0.43	0.61	0.86	0.95
		(F$107.99)	(F$74.50)	(F$61.74)	(F$42.00)	(F$15.15)	(F$5.08)
Agricultural Household							
Fijian	F$55.55	0	0.17	0.24	0.30	0.35	0.40
		(F$55.55)	(F$45.98)	(F$42.24)	(F$38.92)	(F$35.93)	(F$33.20)
Indo-Fijian	F$60.22	0.00	0.21	0.29	0.37	0.45	0.54
		(F$60.22)	(F$47.61)	(F$42.65)	(F$37.89)	(F$32.86)	(F$27.42)
Others	F$53.63	0.00	0.17	0.24	0.30	0.36	0.40
		(F$53.63)	(F$44.70)	(F$40.81)	(F$37.40)	(F$34.46)	(F$31.95)
Non-Agricultural Household							
Fijian	F$100.96	0.00	0.26	0.36	0.50	0.72	0.87
		(F$100.96)	(F$74.91)	(F$64.36)	(F$50.29)	(F$28.61)	(F$12.85)
Indo-Fijian	F$96.92	0.00	0.29	0.42	0.65	0.89	0.96
		(F$96.92)	(F$68.97)	(F$55.97)	(F$33.93)	(F$10.36)	(F$3.57)
Others	F$235.99	0.00	0.48	0.59	0.67	0.74	0.79
		(F$235.99)	(F$122.38)	(F$96.56)	(F$77.45)	(F$61.92)	(F$48.99)

Source: Estimation based on 2008-09 HIES.

Notes: Figures in parenthesis is the equally distributed equivalent income (Y_{EDE}) expressed in Fiji Dollar (F$) per AE per week. The estimate for ε = 1 has been alternated to ε = 0.99 using equation (6.3) for each estimate.

6.5.3.4 The Atkinson Index

The normative measure of Atkinson indices of inequality (Table 6.11) are estimated for six different values of the distributional parameter ε (0 to 3), which reflects the strength of a society's preference for equality. If the estimated value of the parameter ε is greater than zero it implies that there a social preference for equality (or an aversion to inequality). As the value of parameter ε rises the society attaches more weight to income transfers at the lower end of the distribution and less weight to transfers at the top end (see Atkinson (1983) and Chatterjee and Srivastav (1992)). For the total households, when ε = 0, the equally distributed equivalent income (Y_{EDE}) (i.e., the mean income of distribution) and the Atkinson index is almost zero (first row of Table 6.11).

The estimated Atkinson indices and the corresponding Y_{EDE} show that when ε equals 0.99 (shown as ε = 1), the Y_{EDE} is about F$63.47 per AE per week. This implies that if income was equally distributed it would only have required F$63.47 per person per week to achieve the same level of welfare as the existing distribution with a mean income of F$90.65 per AE per week.The Atkinson's inequality index (when ε equals 0.99) is estimated around 0.3, which indicates the loss to welfare caused by this unequal distribution of the given income. In other words, the same level of welfare could be reached with only 70% (i.e. 1-0.3) of the existing total household income in Fiji in 2008-09. Thus, the potential gain from income redistribution is 30% of the existing income distribution. As the value of ε equals to 3, the potential gain from income redistribution reaches to 93% for all households.

The results for ethnicity shows that by emphasising more weight to income transfer at the lower end of the income distribution (i.e., setting the value of ε equals to 3), the Indo-Fijian household group (96%) has the highest potential gain from redistribution, followed by Fijians (80%) and Others (78%). For the regional results, both rural and urban households would significantly benefit from income redistribution. However, it is particularly beneficial for the urban household group as their inequality indices are relatively higher than those for the rural household group at each value of parameter ε (Table 6.11).

As the value of ε equals to 3, the potential gain from income redistribution is estimated at 97% for the urban household group and 55% for the rural household group. Similarly, as the values of ε rises, both agricultural (44%) and non-agricultural (95%) households from the lower end of existing income distribution would be benefit from income redistribution. For the agricultural household category, the Indo-Fijian households with low income (54%) have the highest potential gain from income transfer, followed by Fijians (40%) and Others (40%).

Similar results are also found for these three ethnic groups under the non-agricultural household category, which indicate that the Indo-Fijian household low-income group (96%) benefited particularly from redistribution, followed by Fijians (87%) and Others (79%). The implication of either region-bias or household type-bias inherent in the distributional arrangements is that the policy initiatives aimed at achieving greater income equality would succeed better by prioritising the urban population or the non-agricultural households.

6.6 Conclusion

This chapter examines the level, depth, and severity of poverty and income inequality in Fiji using the HIES 2008-09. The poverty results indicate a higher percentage of rural households are found to be in basic needs and food poverty compared to their urban counterparts. When comparing the two major household types, there are more agricultural households in basic needs and food poverty than non-agricultural households in Fiji in 2008-09. The findings indicate that non-farm household income sources contribute significantly towards poverty reduction for all agricultural households.

By segmenting the households according to the geographic criteria and economic activities, the empirical results clearly establish that Fiji still has a long way to go in reducing the income gaps between the very rich and the very poor for both rural and urban households, and the very rich and very poor in the agricultural and non-agricultural households. In particular, non-agricultural households endure greater inequalities in positive and normative terms. The distribution of income within the non-agricultural households is also more unequal than for those in the agricultural households. The Gini coefficient for the total population reveals stark differences that exist between different population groups. The results by ethnicity show that Indo-Fijian households experience greater income inequalities (based on the positive and normative measures) than Fijian households. The decomposition results for the separate factor income components also indicate major sources of inequality. The inequality-enhancing effect, in particular, is generated by the household income sources such as Non-farm Labour Income, Business Income, and Investment Income. The Farm and Other Income contribute to inequality-reducing effect, and the government welfare payment especially has the most equality impact on the agricultural and non-agricultural households.

The implications of the poverty findings suggest that Fiji will require poverty reduction and income inequality policies to meet its Millennium Development goal of halving the poverty in

the post-2015 due to high large income differentials and inequality in both urban-rural areas, and agricultural and non-agricultural households. To ease the pressure from the increasing level of rural-urban migration due to expiry of land leases and larger squatter settlements in the urban areas, nonfarm income-generating activities should be encouraged amongst the agricultural household members as this would raise their income and hence reduce poverty. The opportunity of learning and alternative career options should be avail for the rural youth and women in the non-agricultural sectors.

Overall, agriculture should be a continuing impetus for economic and rural development in the case of Fiji, since most households depend largely on agricultural operations for their livelihoods and food security. Moreover, a balanced development programme should not only focus on the rural-urban divide, but also within the rural areas and targeted at all ethnic groups.

Chapter 7
Conclusion and Policy Implications

7.1 Introduction

Fiji, a predominantly agrarian country and also facing some resource-constraints has given high priority to agriculture-led growth. Despite the change in the country's political scenario since the post-2000 coups (i.e., 2000 and 2006 coups) and with the global financial and economic crisis, strategies have been set to meet the goals of agricultural transformation. Agricultural output in the period 2000 to 2012 has also been adversely affected by a series of natural disasters, civil unrest and land tenure issues. These challenges have affected many aspects of the economy resulting in high unemployment (due to limited opportunities that increased the intensity of rural-urban migration), low productivity in agricultural and non-agricultural sectors (due to reduction in investment in these sectors), price volatility (resulting from devaluation of domestic currency), and a high trade deficit. The government strategies noted in the Supplement to the 2014 Budget has placed increased emphasis to achieve higher rates of economic growth in both agricultural and non-agricultural sectors (Ministry of Finance, 2013).

To demonstrate how agriculture can be used as an effective development sector to promote economic growth and hence combat poverty and improve welfare in Fiji, the macro- and micro-level considerations have shaped this study. First, at the macro-level, the study is motivated by the need to understand how agriculture contributes to Fiji's overall economic growth, and how the government's commitment to increase self-sufficiency, food security and reduce its import dependency can be achieved through strategic promotion of cash crops and other high-value agricultural products.

Second, at the micro-level, the study evaluates a) which factors affect the off-farm labour participation and supply allocation decisions in the agricultural households, b) what is the role of remittances income in the agriculture and rural development, and c) how non-farm income sources can act as a safety net and a means of reducing poverty among the agricultural households. The microeconomic foundation of the study is based on the theory of household choice in the presence of incomplete and imperfect markets. In doing so, several hypotheses are tested using various secondary datasets.

The study identified several areas of significance for Fiji. Theoretically, it contributes to an understanding of the intertwined relationship between agriculture and rural development. The empirical analyses undertaken draws a roadmap of how household welfare, especially for those involved in the agricultural sectors can be improved and where future policies could focus to deal better with agriculture and rural development. Several econometric techniques and tests are utilised to examine various hypotheses in the context of agriculture-welfare nexus. The empirical results for Fiji present several underlying important issues and implications at the macro-level relating to the interplay between agriculture and economic development, and at the micro-household level issues that highlight the role of agricultural income, non-farm income, remittances and other welfare income to improve welfare and socio-economic development.

The research rationale and objectives provide the significance of analysing agriculture-welfare and rural development nexus. The literature review presents the role of agriculture in economic growth and the phenomenon of commercialisation and small-scale farmers. The theoretical aspects of the agricultural household model are discussed in relation to off-farm labour participation and supply allocation decisions and the effects of remittances on recipient households. The definition and the measurement of poverty and inequality in the agricultural household level are examined to provide the policy implications in the overall context of Fiji's agriculture and rural development. The rest of this chapter is organised as follows: Section 7.2 presents the summary and conclusions of findings for each chapter. Section 7.3 presents policy recommendations based on the findings followed by areas for future research in the final section.

7.2 Summary and Conclusions of Analytical Chapters

The focus of this thesis on the paradigm of agriculture and rural development nexus for Fiji provides various implications based on the empirical findings. At the macro-level, the study notes the contributions of the agricultural sector to economic growth and its association with other sectors in the economy. At the micro-level, the study indicates the off-farm labour supply behaviours amongst adults in the agricultural households and the impact of non-farm incomes on poverty reduction and income inequality.

7.2.1 Summary and Conclusions of Chapter 3

Given the potential role of agriculture as a key determinant of economic growth, poverty reduction and rural development, the first substantive part of the thesis provides agricultural

sector-economic growth nexus along with other non-agricultural sectors (i.e., manufacturing, non-manufacturing industry, and services sectors) in Fiji. This is followed by the contributions of production inputs (i.e., labour force, agricultural machinery and irrigation), infrastructure and communication facilities, and government efforts (i.e., government expenditures in agricultural sector) to the growth of agricultural production for the period from 1980 to 2011. The findings show the causality linkages between various sectors at the aggregate level, as well as the growth of agricultural crops, food manufacturing, and hotels and restaurants at the disaggregate level. Using the annual time series data, Autoregressive Distributed Lag approach to cointegration methodology is used to estimate the agriculture-growth nexus. The next step evaluates causality amongst the output growth of agriculture, manufacturing, non-manufacturing, and services sectors in the short-run and long-run using the Vector Autoregressive approach.

The empirical findings support the view of forward- and backward-linkages that exist between the agricultural and non-agricultural sectors, i.e., non-agricultural sectors generate forward linkages when agricultural outputs are supplied as inputs for non-agricultural production. Furthermore, growth in the non-agricultural sectors contributes to industrial expansion in agro-processing and food manufacturing, which in turn provides a new engine for growth and opportunities to explore import substitution. In this regard, growth in the agricultural sector leads to a higher level of economic growth in the long-run. The findings highlight the importance of trade openness for economic growth in the long-run. Thus, a higher level of openness during the early stages of economic development stimulates growth in various sectors leading to higher economic growth. The results also confirm adverse effects of natural disasters on the economy both in the short and long-run. Other factors such as growth in capital stock (i.e., tractors and number of tractors per 100 square kilometres of arable land), expansion of irrigated agricultural land, improvement in infrastructure and communication facilities, and government expenditure in agriculture are found to be crucial in improving the production capacity of agriculture in Fiji.

The Granger-causality test results show that the growth of agricultural and non-agricultural sectors are interdependent both in the short- and long-run. At the disaggregated level, interdependent relationships are seen between crop production, food manufacturing, and hotels and restaurants sectors, implying the need to support related sectors in determining an appropriate development strategy to realise higher levels of benefits from the expansion of these sectors.

7.2.2 Summary and Conclusions of Chapter 4

Chapter 4 presents the household level determinants of off-farm labour participation and allocation decisions of adult members in the agricultural households in Fiji. A set of various demographic and socio-economic variables for 6,094 persons in 1,201 agricultural households have been derived from the Household Income and Expenditure Survey (HIES) 2008-09. This analysis is important in the context of Fiji, given that low agricultural productivity and low agricultural income in the agricultural households can be potentially compensated by the off-farm income work. The empirical estimation applies a more recent analytical framework of double-hurdle model that investigates what motivates an individual household member to participate in off-farm economic activities (likelihood of off-farm participation) and what factors influence the number of days the individual allocated to off-farm work (the level of off-farm participation).

The results show that age and work experiences have a significant impact on off-farm income participation for both male and female adults, and the level of participation is only significant for female participants. Ethnicity and gender do not significantly increase the likelihood of engaging in off-farm work for both the Fijian male and female adults. However, Fijian male participants in off-farm activities work fewer days than Fijian females. While Indo-Fijian males are observed to be participating in off-farm activities, this is not the case for Indo-Fijian females. Other factors such as an individual's marital status, formal education, household head status, and family size have differential impacts on off-farm participation and labour supply allocation decision-making process. It also shows that individuals from lower income households are more likely to be excluded from off-farm income-generating activities.

The findings for the households involved in various types of agricultural production show that fresh fruit and vegetables (FFV), root crops, livestock, rice, and sugar crops have different impact on one's decisions about off-farm participation and the allocation of labour time. The results indicate that females involved in FFV farming participate in off-farm work but have less amount of labour time allocated to such activities. However, females involved in the traditional root crops farming are less likely to engage in off-farm work compared to males. Also, the males involved in livestock production allocated less amount of labour time to off-farm work.

7.2.3 Summary and Conclusions of Chapter 5

This chapter provides the contribution of remittance income for agriculture and rural development in Fiji at the micro-level analysis using the Household Income and Expenditure

Survey 2008-09. The remittances-household consumption nexus employs the seemingly unrelated regression technique and the issue of remittances-agriculture nexus is estimated using logit regression model to measure the linkages between remittance income and crop selection. The Poisson regression model estimates the probability of crop diversification among the remittances recipients and non-recipient households.

Contrary to general belief that remittances are mostly used for food consumption amongst the Pacific island nations, the results show that remittances have alternative uses in the households in Fiji. Remittances are specially targeted toward expenditures in education and housing, though the expenditure patterns differ between urban and rural areas and also between Fijian and Indo-Fijian households. In the urban areas, Indo-Fijian households use remittance income substantially on education expenditure while remittances received by Fijian households are used mainly for housing.

For the remittances-agricultural nexus, the results show that agricultural households are more likely to use remittances to foster agricultural production in fresh fruit and vegetables (i.e., banana and cabbage) and livestock (i.e., cattle, pig and goat). In terms of diversification of farming activities, the remittance-recipient households are more likely to grow more than one type of fruits and vegetables and also add different types of livestock to their farm compared to the non-recipient households.

7.2.4 Summary and Conclusions of Chapter 6

The most recent Household Income and Expenditure Survey 2008-09 has been used to investigate the level, depth, and severity of poverty, and the degree of inequality based on the household income distribution and rural-urban areas. Poverty analysis results indicate a higher percentage of rural households in the basic needs and food poverty categories compared to their urban counterparts. In comparing the household types, agricultural households experience basic needs and food poverty compared to those in the non-agricultural households where the non-farm household income sources contribute significantly towards poverty reduction.

By segmenting the households according to geographic criteria and economic activities, the empirical results indicate that Fiji still has a long way to go in reducing the income gap. The income differentials are very large between the very rich and the very poor in both the rural and urban households, and the very rich and very poor of those in the agricultural and non-agricultural households. The results by ethnicity show that Indo-Fijian households experience

greater income inequalities (based on the positive and normative measures) than the Fijian households.

The Gini coefficient for total population reveals that stark differences exist between different population groups. The decomposition results by separate income components also indicate major sources of inequality. The inequality-enhancing effect, in particular, is generated by various household income sources from Non-farm Labour Income, Business Income, and Investment Income. The Farm Income and Other Income categories contribute to inequality reducing effect, and the government welfare payment, especially, has the most equality impact on the agricultural and non-agricultural households.

7.3 Contributions and Policy Recommendations

The empirical assessments in Chapters 3 to 6 have several areas of significance for Fiji as well as for the case of other developing countries. First, it fills the knowledge gap in the 'new agriculture for development' literature for the agriculture-non-agricultural sectoral growth contribution and crop cultivation-food manufacturing-hotel and restaurant sectors nexus; the determinants of off-farm economic activity participation and labour supply allocation decisions among members of agricultural households; and the nexus of remittances-welfare-agricultural production and diversification; and poverty and income inequality reduction in the agricultural household level.

Second, the empirical findings can be applied in the case of Asia, Pacific and Caribbean countries that are agriculture-based economies with a large population dependent on small-scale agriculture for food security and livelihood. Third, it provides a comprehensive approach that emphasises the multiple functions of agriculture for rural development, and identifies the level of agricultural household welfare through various sources of income and crop diversification. Fourth poverty reduction and income inequality as a development goal addresses the United Nation's Millennium Development Goals of poverty reduction and welfare improvement. This study highlights the future policy focus to deliver enhanced outcomes for agriculture and rural development. Finally, the applied empirical evaluations provide findings that can assist policy makers, government agencies, bilateral and multilateral aid organisations, non-government organisations, domestic agencies and business sectors to improve agriculture for development, and to design effective strategies and responsive polices to integrate Fiji's small-scale farmers into the national economy.

Agricultural households in the rural Fiji provide the cultural and ethnic identities that mark its social diversity. The empirical results in this study affirm the importance of family farming both in agricultural and rural development in Fiji. Among the potentialities of family farming it is its fundamental role in food production. The government and public polices represent a powerful mechanism that can be utilised to support and promote family farming. Government intervention can both guarantee anticyclical measures for macroeconomic protection and create long-lasting mechanisms such as funds and insurance against natural disasters and price crises. The empirical analysis in chapters 3, 4, 5 and 6 clearly point to strengthening of agri-food sector (at the macro-level) and family farming (at the micro-level) in Fiji.

Agriculture-Economic Growth Nexus

The findings on agriculture and economic growth relationship have vital policy implications for Fiji. The key policy consideration requires of possible short- and long-run interdependence and linkages between agricultural and non-agricultural sectors. This can be achieved by accelerating the sectoral output growth through the provision of technological, institutional, tax credit and price incentive schemes designed to raise the productivity of smallholder farmers, business owners, and entrepreneurs. In this regard, rural unemployment can be reduced through improvement of agricultural productivity. In terms of growth in food and agricultural production, emphasis should be placed on productivity and conservation in the existing farmlands as the expansion of arable land is limited in Fiji due to its unique geographical, socioeconomic, and environmental circumstances.

The results indicate the need for key strategies aimed at increasing agricultural productivity through farm technology adoption, especially in soil and water conservations. The focus could be on the intensity of technology adoption over a period of time combined with the role of social learning in agricultural innovation and diffusion. Plot level data for specific crops, with additional consideration for the role of gender, is required to enhance technology-adoption decisions in Fiji. Another main policy support requires an enhancement in the private sector investment, access to financial sectors and guarantee for financial security.

As food security is one of the most important issues facing many developing nations, the development of Fiji's agricultural sector and support of agribusiness development to establish partnerships will be critical for economic growth and development, and social wellbeing. The narrow agricultural production base points to strengthening its diversification strategies and to further exploit the inter-linkages with manufacturing, industry, and services sectors, particularly tourism, information and communication technologies and finance. Fiji has a high

level of skilled labour and capability to address strategic areas of agri-food and value-chain development through technological innovation. Assistance through Food and Agriculture Organisation, other United Nations organisations, aid agencies and other multilateral organisations will be crucial to improve the sectoral developmental activities to enhance economic growth and development. The policies are critical areas of agriculture, rural development and poverty reduction.

Labour Participation in Off-farm Employment

Farm income and non-agricultural daily wages have a direct impact on the probability of off-farm participation and labour supply allocation decisions. As the likelihood of participating in the off-farm work increases as the daily wage increases, female participants in particular allocate more of their labour time to off-farm work. Remittance income on the other hand, reduces the need to undertake off-farm work as a means to ease the constraints on farm household income, which also confirms to the benefits of developmental impact of remittances.

Based on the findings, the policy implication is to focus on households in various divisions of the country. The results indicate a higher incidence of participation in off-farm income-generating activities in the Northern and Western divisions compared to the Central division. The government should enhance employment opportunities in these divisions that also attract tourists and are also large agricultural producing divisions as well. The male and female participants in the Western division also spend a greater amount of off-farm labour time than other divisions. The strategies for tourism development and other industries linked to this sector should be encouraged, as well as the provision of infrastructure, public-private partnerships and increase in public and private investment.

It is also crucial to understand the behaviour of agricultural household members on making off-farm labour allocation decisions under the assumption of both perfect and incomplete or missing markets. The findings highlight the importance of non-farm income generating activities in reducing the problems of low agricultural productivity, poverty, and food insecurity. To address these issues the policy makers and the government should identify various inefficiencies to remove barriers affecting low-income agricultural households, and enhance their participation in off-farm income generating activities. Polices and development programmes aimed at providing incentives to the households to participate in rural non-farm activities and capacity building of rural households are crucial. Agriculture diversification and cash crop production should be encouraged through various schemes to provide farmers with

the necessary technical support and financial assistance to further enhance their access to resources. This would consequently lead to higher production efficiency. In addition, well-developed infrastructure facilities such as better road and sea transports are prerequisites for transformation from subsistence into commercialised agriculture in Fiji.

Integrated Crop-Livestock Production

The government should re-examine the current farming systems and develop a sustainable way to the intensification of crop production. For instance, the integrated crop-livestock production system is commonly practised by most smallholder farmers in Fiji. This system can be further enhanced with an appropriate management and technical support, for example, this can include activities such as exporting nutrients, maintaining diversity in plant species, and allowing for sufficient recovery periods between use of land for grazing or cutting. It has been seen that, in the case of Brazil, a well-managed integrated crop-livestock production system enhances livelihood diversification and efficiency by optimising production inputs (i.e., labour) and increases resilience to climatic and economic stresses (Landers, 2007).

Water Interventions

Given the abundant rainfall and relatively intact forest cover that allows capture and retention of water in underground aquifers, water interventions are critically important in Fiji. On the one hand, expansion of groundwater development in the rain-fed tropical zones needs rural electrification programmes as the cost of fuel is rendering the use of diesel-powered pumps for smallholder farmers. On the other hand, sustainable intensification requires smarter, precision technologies for irrigation and farming practices that use ecosystem approaches to conserve water. Therefore, policy makers need to analyse accurately the relative contributions of rain-fed and irrigated production at the national level. A full-scale analysis of rainfall patterns and soil moisture deficits will be needed to stabilise production from existing irrigation systems under climate change impacts.

Localised community-based water harvesting and small-scale storage offers another way to increase water storage (McCartney, Rebelo, Xenarios, & Smakhtin, 2013). Small-scale storage, in particular, offers the benefit of more local control and fewer externalities in terms of submerged area or other environmental impacts. Farm ponds and small water harvesting works all have significant potential to help increase yields and productivity through supplemental irrigation and extending the growing season. Improved water control may also be achieved through methods that focus on the control of evaporation, such as conservation farming, drip irrigation, furrowing and levelling of fields. Thus, promotion of these methods

should be encouraged by the government agencies by providing technical and financial supports.

Addressing Land Tenure Issue and Rights

The land tenure system in Fiji is a complex issue (Ward, 1995, Gounder, 2000). As a broad-based land reform programme is often critical for reducing rural poverty, the Land Bank programme introduced by the government will be important to get access to land. It can lead to increased investment and contribute to economic growth and more equitable development. It will reduce uncertainty and increase efficiency in credit and land markets, and smallholder farmers can use their land as collateral for agricultural inputs, improvements, innovations and expansion of their enterprises. Secure access to land is therefore crucial to reducing vulnerability to poverty in rural areas. As women are more vulnerable to insecure land tenure (i.e., land rights may be obtained through kinship relationships with men or marriage) access to land through Land Bank would see a major change in their role on agriculture development and poverty reduction. Therefore, policies and legislation must recognise land availability and usage. The poor in rural areas could be empowered to ensure that their needs are addressed and are part of the policy formulation.

Remittances, Household Welfare and Agriculture Sector

The migration of individuals and/or families has increased over the past two decades in search of employment opportunities to improve their standard of living. This phenomenon observed in Fiji has increased since the post-1987 coup period. Remittance flows are seen in both urban and rural households that provide an important financial resource necessary for household development needs, family support by serving as a safety net and are utilised for productive and social purposes. The impact of remittance income on household welfare (especially those in the rural areas) improves wellbeing, thus policy makers should support strategies that provide opportunities in the sector-wide development, encourage livelihood schemes and investment in agricultural sector that will contribute to the creation of wealth for the households and the economic and social development of the nation.

Research on the impact of remittance income on agricultural production and diversification is a relatively new area of research in comparison to the remittances-household consumption nexus. The policy implication for the remittances-agriculture nexus denotes that remittance income can be productively used in agricultural production and diversification, and as a potential source of income for rural development. The government should provide institutional support for financial services and banking groups to increase the ease of

remittance transfers in the rural areas, lower the transaction costs, encourage investment schemes and development of small businesses. In addition modern communication technology should be introduced, as well as linking the remittance recipient households to other financial schemes such as savings, credit (i.e., credit for productive investments and housing), and insurance (i.e., agricultural production insurance).

Poverty and Inequality

The implications of the poverty findings suggest that Fiji is unlikely to achieve its Millennium Development Goal of halving poverty in the immediate post-2015 period due to the large income disparities and inequality in the urban-rural areas, and among the agricultural and non-agricultural households. Given the higher level of rural-urban migration due to the expiry of land leases and larger squatter settlements in the urban areas, non-farm economic activities should be encouraged. Activities such as participating in any non-farm employment, as well as establishing non-farm small businesses should be encouraged among the agricultural household members as this would raise their income and hence reduce poverty. Moreover, a balanced development programme should not only focus on the rural-urban divide, but also within the rural areas and cover all ethnic groups. Various specific policy recommendations are noted below for agriculture and rural development and poverty reduction.

Integration and Targeting

To enhance the nexus between agriculture and rural development in the context of Fiji, it becomes evident that there is no single efficacious policy. Thus, the agriculture-welfare development policies, which place emphasis on poverty reduction, must be integrated into both provincial and central development policies to provide for the needs of rural households (at large), and farm households in particular. This integration of agriculture and rural development is recommended given Fiji's socioeconomic difficulties along with the incidence of poverty and inequality in the rural and urban sectors (amongst agricultural and non-agricultural households). The integration strategy aimed at reducing poverty should be in line with the ADB approach (2004), which proposes three development pillars comprising of sustainable economic growth, social development, and good governance. In particular, it emphasises that such poverty alleviation strategy requires strong commitment and political will besides involvement of peoples' participation at the provincial and central level (see also Deolalikar, Brillantes, Gaiha, Pernia and Racelis, 2002, p. 12).

Targeting the poor seems to be a critical first step in poverty alleviation strategies. This provides impetus for designing appropriate policy which directly addresses the needs of the

most vulnerable households. The main purpose of this targeting policy is to provide a safety net to support the households in a large community that are vulnerable to events or shocks leading to poverty. This policy is also intended to avoid the misallocation of financial or other resources and ensure that support is mobilised to the poor. In addition to Fiji's existing safety net programmes, special attention should be paid to those households (as identified in Chapter 6) which are on the edge of falling into basic needs poverty or food poverty.

Emphasis on Agricultural Households and Family Farming

Agricultural households play a crucial role with regard to food security and wellbeing in Fiji. This is because, first, an increase in available food surplus, either by improving production for self-consumption in the farms or by increasing local or regional circulation of the surplus. Second, improvement in feeding conditions may boost other dimensions such as health and education. To improve farm income, the contract farming system should be promoted in Fiji. Under this system the local farmers (especially those with small-scale farms) will supply and produce the agricultural products while the agribusiness firms (usually medium- to large-scale buyers such as exporters or food processors that need a steady supply of raw/immediate materials meeting certain level of quality standards) retain the responsibility for credit, inputs, farm machinery, technical assistance and marketing. This system possesses significant potentials for improving welfare and rural development if it can facilitate the transfer of technology and the integration of small-holder farmers into the national economy.[49]

To strength family farming, there are two areas in which public policies for family farming have a particularly important role in the current social and economic context. The first is access to technical training and innovations, thus, the extension services remain crucial. Such services could help farmers to design projects, create collective synergies and mediate their access to information. Second, is to set-up markets and commercialisation where smallholder farmers could have access to provision of food-supply security, environmental preservation and actions to protect rural livelihoods through government policies.

Promotion of Human Assets

When the most underprivileged and vulnerable groups are well taken care of by the use of targeted programmes, the second crucial step in the agriculture and rural development should be in the areas of developing and training farmers' capacity. The need to promote human assets is extremely important in order to facilitate the poor to improve their lives. Due to lack

[49] See studies by Glover (1984), Minot (1986), Glover (1987), Glover and Kusterer (1990), Little (1994), Porter and Phillips-Howard (1997), Birthal, Joshi and Gulati (2005), Patrick (2005), Warning and Key (2002), Key and Runsten (1999), Miyata, Minot and Hu (2008).

of capabilities such as education, skills and training would contribute to limited confidence, and together they reinforce powerlessness, voicelessness, and marginalisation in society (Sen, 1985, 1999), these should be addressed through investing in human assets.

Education and skills are the key factors to improve the living standards. Adult classes in vocational agriculture schools should be encouraged, which provide a basis for extending skills or re-training persons in agriculture. For the agricultural households, access to agricultural and new information technologies should be enhanced through skills training and guidance programmes. For the members of those households participating in the off-farm economic-generating activities, especially those involved in small business enterprises, they should be encouraged by the incentive provided by the policy and supported through the provision of education and training in entrepreneurship and small business management.

Targeting the educational development needs of young people should be included from the early stage of high school. This could include the following: promoting informal education and validating lessons learnt through on the job training experience; setting up programmes to grant scholarships to young people with physical disabilities and those from the most vulnerable households; and developing vocational training for unskilled young persons.

Government agencies and institutions should also ensure farmers' access to relevant external knowledge and help link it to traditional knowledge, especially those low-income smallholder farmers. Farmer field schools should be focused on building farmers' capacity to analyse their production systems, identify problems, test possible solutions and adopt appropriate practices and technologies. To make wise decisions about what to plant and where and when to sell, farmers need access to reliable information about market prices, and government market information services is vital. In order to take full advantages of SMS messaging and the Internet, a well-established telecommunication system is the key.

Empowering Women

The conventional view that agriculture is largely a male domain has played a role in poor recognition of women in agriculture. The fourth UN Convention on Women estimated that 70 percent of the poor in developing countries were women. Despite their major contributions to agricultural work and other rural economic activities, women's economic roles remain largely invisible and unrecognised in public policy and in the governance process (IFAD, 2011).

The State of Food Insecurity in the World (FAO, 2011) highlights the need to close the gender gap in access to agricultural resources, education, extension, financial services and

labour markets; to invest in labour-saving and productivity-enhancing technologies and infrastructure to free up women's time for more productive economic-generating activities; and to facilitate women's participation in flexible, efficient and fair rural labour markets. Failure to release women's full potential in agriculture is a significant contributing factor to low growth and food insecurity (World Bank, 2008).

In the case of Fiji, women and those with a disability in the agricultural households are found to be more deprived in terms of their access to off-farm employment and resources (as seen in Chapter 4). Therefore, women and the disabled in both agricultural and non-agricultural households should be considered as important stakeholders in any poverty alleviation and rural development programmes through giving them opportunities to improve their livelihoods. There is a need for policy that will promote the role of women and the disabled in development activities; however, this role can only materialise if their access to education, skills training, and health services are also improved. Government agencies should also provide an effective model to empower women farmers by improving their collective strength and bargaining power. They should work with women farmers and their families to assist them in establishing their own farming organisations, and train them on marketing, organisational development and access to finance. In this way, a cadre of women farmer-trainers at the grassroots level can be established. The women farmer-trainers, in return, could provide knowledge and training to local women farmers, enhancing their access to financial and marketing services, tools and technology, and processing facilities for their products.

Promotion of women-friendly technology can play a crucial role in both agricultural and rural development. The simple drip irrigation technologies introduced in rural Nepal by International Development Enterprises is a good example of how rural Nepali women have benefited from such technologies to build their livelihoods through vegetable cultivation from small patches of land.[50] Assistance through small loans (microfinance), cultivation support and economic infrastructure would improve women livelihood and social development.

Addressing Isolation

By complementing and enhancing of the Fiji's of human assets, relevant policies and strategies aiming to address isolation should be strengthened. In terms of geographical isolation, there is a divide which impacts on the lives of people living in remote rural areas compared to those living in urban areas (geographical constraints such as mountains/hills and islands). These constraints are exacerbated by a lack of accessibility to both areas such as a

[50] See www.ideorg.org, accessed 24 December 2014.

lack of roads, transportation as well as communication and access to basic services. Availability of transportation infrastructure (roads, public buses and ferries) assist peoples to improve their social and economic prospects and their living standards. Development of necessary transportation infrastructure will increase the income of the farmers by lowering input prices, raising output prices, thus enabling farmers to produce more profitable, agricultural crops. It may also benefit the landless households by generating opportunities for employment in the rural non-farm sector and raise wage rates by making labour more mobile. As seen in chapters 3 and 4, access to urban markets and links between the agricultural and non-agricultural sectors determine different stages of non-farm employment in rural areas. High rural high transportation costs reduction would improve agricultural productivity and non-farm employment opportunities. With further development in agriculture sector it can promotes local non-farm employment through local production and expenditures linkages.

Investment in infrastructure is therefore crucial as it will reduce transport costs to urban areas, and local goods and services will integrate with urban goods and services. This will result in positive spill-over effects from agriculture (result from the reduced transportation costs) to urban areas. Although a reduction in transport costs may decrease local non-farm employment, at the same time it will promote access to urban employment through seasonal off-farm labour participation. Finally, local policy should also address education and skills development in both rural and urban areas.

Promotion of Income-Job-Creation

The promotion of income-job-creation activities is extremely vital to substantially lift the poor out of poverty and also break the cycle of poverty. In rural areas, income-job-creation activities will be largely based on the opportunities provided by agricultural and non-agricultural sectors (as noted in Chapter 4). Intervention in these sectors should therefore include the following: advice on agricultural production and assistance in production marketing; educational seminars on artisanal fishing and marine resources conservation; and support for the development of cooperatives, especially for women.

Intervention should also take account of specific characteristics of urban areas and the opportunities they offer. This includes vocational training in weaving, embroidery, hairdressing, masonry, cabinet making, plumbing and other urban trades; granting microcredit to purchase tools for recipients of vocational trainings and to finance promoting potential and economically viable projects and support for the establishment of cooperatives, especially for women and those with a disability. Moreover, the employment promotion strategy based on

job-oriented training needs to be launched and targeted towards tourism, manufacturing, construction, trade and services, transportation, and communication sectors.

Job-creating social projects in the informal sector, on the other hand, should also be encouraged by the government. These projects would yield a large number of temporary jobs complementing those available through the formal sector. On the other hand, it will be useful to establish a job market-monitoring centre to assist job seekers. The data collected from this monitoring centre, in return, would provide useful information on what type of skills that are needed for the type of jobs. Hence, the governmental agencies could use this information to design and update job-training programmes for the potential job seekers.

Overall, all of the above policies and strategies can have positive impacts for the poor, especially those in the agricultural and non-agricultural households. However, the policies would not achieve intended outcomes if the local government does not support them. Government's commitment and political will is therefore a prerequisite to ensuring the successful implementation of these policies. On the other hand, a delay in policy implementation will contribute to worsening the poverty level and further compromise the wellbeing of the poor in rural communities in Fiji.

7.4 Areas for Future Research

This study provides a quantitative approach to examine the nexus between agriculture and rural development in Fiji. To capture the qualitative aspects of how smallholder farmers are integrated in the global agri-food value chains, a participatory research method using questionnaires as the tool of data collection and analysis should be considered for future research. The characteristics of the participatory research will enable the participants to express their perceptions, feelings, and thoughts about the researched subject thus capturing rich data that would not have been collected using a quantitative approach. The use of this method will be beneficial as it provides the whole picture of barriers and obstacles that small-holder farmers experience and endure in their endeavours to create and implement pro-poor agriculture development policies.

The combination of both qualitative and quantitative methods in a future study is vital as poverty is a multidimensional phenomenon, which has both material and non-material aspects. The triangulation of both methods will therefore be crucial in enabling to demonstrate the different effects of poverty on human life as a whole. As this study is concerned at the

household level, it is important to analyse how the government's policy contributes to addressing poverty effects for urban and rural households.

As the people living in the rural areas (especially those in the agricultural households) suffer higher levels of poverty than people in the urban areas, it is therefore, recommended that future research should also identify the specific locations in the rural areas where people are affected the most. This information can then be used to develop a combined qualitative and quantitative methodology to enable more direct and practical advantages to be obtained. This should also be directed to specific locations in urban areas, as there is a high influx of people from rural to urban areas and living in squatter settlements.

In terms of natural resources such as land, forest and sea, there are several issues and problems dealing with land cultivation, illegal logging, endangered marine life, and extraction of natural resources in Fiji. These problems also bring about strong poverty impacts on those whose livelihoods depend on these activities. However, these have not been included in this research but are important areas for future research.

Follow-up research is required to investigate the impact of policy implementation and recommendations discussed in this study. The analysis of the stages of Fiji's national economic and social development plan for the agricultural and rural development as well as on poverty reduction remain important to benefit the nation and its people.

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