

ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

**Operating Performance and Capital Structure
of Rural Saving and Credit Cooperatives in Ethiopia:
Application of Panel Threshold Method**

By

Melkamu Engida Zemed

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ACRONYM

CSS	Cooperative Sub-Sector
FCA	Federal Cooperatives Agency
ICA	International Cooperative Alliance
ILO	International labour Organization
MFI	Microfinance Institute
NBE	National Bank of Ethiopia
PEARLS	Protection, Effective financial structure, Asset quality, Rates of return and Cost, Liquidity and Signs of growth
RCPB	Regional Cooperative Promotion Bureau
RUFIP	Rural Financial Intermediation Program
RUSACCO	Rural Saving and Credit Cooperative
SACCO	Saving and Credit Cooperative
SNNP	Southern Nation and Nationality People
WOCCU	World Council of credit unions

ABSTRACT

The main objective of this study was to examine whether operating performances of rural saving and credit cooperatives are under the influence of capital structure inline with loans growth, and to test if threshold relationship exists in these cooperatives of the Amhara, Oromia, SNNP and Tigray regions. A panel data of 92 rural saving and credit cooperatives from 2004 to 2007 was used and threshold regression analysis model developed by Hansen (1999) applied. Further, this study reviews the saving and loan outreach as well as financial performance of rural saving and credit cooperatives using Protection, Effective financial structure, Asset quality, Rates of return and cost, Liquidity and Signs of growth(PEARLS) monitoring system software that developed by World Credit Cooperative Union.

The empirical findings depict that capital structures significantly influence rural saving and credit cooperatives. The threshold variables (net worth to loan ratio) have two values 0.11 and 0.01. When the threshold value is between these figures, every unit of growth in loans increases operating performance by 0.10 times, which is not satisfactory. The empirical findings also show that the growth in loans for the rural saving and credit cooperatives in all four regions affects operating performance. In addition, saving and loan outreach performance varies by region. While, Oromia comprises 53% of the rural saving and credit cooperatives, Amhara dominates with small number of savers (14%) but with large number of borrowers (30%). In general, the number of savers to borrowers in Amhara is 3:1, in Tigray 3.2:1, in SNNP 4:1 and in Oromia 23:1. Moreover, the empirical findings of financial performance of rural saving and credit cooperatives using monitoring system software shows that all rural saving and credit cooperatives in the country are not practicing loan loss protection and even solvency is 50% less than the standard.

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND

The cooperative movement in the world has a long history. In Ethiopia it has only a half century and it is widespread through out the country with various kinds of cooperative type. Rural saving and credit cooperatives (RUSACCOs) are among the various types of cooperatives and its movement began in the beginning of 2000.

RUSACCO is an association of persons having a common interest, organized for the purpose of encouraging thrift, accumulating savings, and providing credit for its members (Johnson, 1936). RUSACCOs are one of the successful cooperative ventures in Ethiopia (Wolday, 2004) and they have an important role to play in economic and rural financial development. However, they are not play significantly so far and only have diminutive contribution to the financial sector even after the reform of the sector.

In the early 1990's, the Ethiopian banking sector was subject to significant change. Public banks were privatized, and regulation and supervision of National Bank of Ethiopia (NBE) redefined. In this period, new private banks, Micro-Financial Institutions (MFIs), saving and Credit Cooperatives (SACCOs) as well as RUSACCOs were created and competition in the banking sector increased substantially. In this environment of structural change, banks and MFIs are extending their activities to new type of urban and rural banking service products. However, the newly created RUSACCOs as well as the existing urban based SACCOs are focusing only on saving and loan products with specific and limited location.

Over the past eight years, according to Federal Cooperative Agency (FCA), the RUSACCOs market share in saving and loan product is insignificant, return on capital or equity is not increased as compared to the growth of membership. Their competition also declined. These RUSACCOs also have long been suffered from problems such as poor governance, lack of adequate fund sources, lower member participation, stagnant share capital contribution, imbalance share to saving combination, in active leadership, dependency on government and NGO support, poor bookkeeping records, inadequate business scope and internal control, poor administration and supervisory framework, non-standard accounting practices, poor asset quality, and dismal financial performance. In this regard, the problem of RUSACCOs deserves special considerations.

RUSACCOs have been operating in the rural financial banking system as cooperative. A cooperative organization is essentially a member driven agency. Hence, every member should and is required to have share and saving to improve the operational performance of RUSACCOs by strengthening their capital structure to finance their assets through some combinations of equity and debt.

Earlier literature has examined the relation between operating performance and capital structure. Controlling capital structure of RUSACCOs and their operating performance is one of the most critical tasks they face in ensuring their long term survival. Earning positive profits in order to be able to plow at least some of those profits back into the capital base of RUSACCOs is also one of the keys to building a healthy growing financial intermediary (Glenn, Westley, Sherrill, 1997). Hence, for any RUSACCOs to strength capital structure and improve operating efficiency the first task to be done is optimal asset allocation i.e. the most appropriate mix of equity and liabilities, in order to minimize costs of capital and to maximize member's share value.

The purpose of this paper is to investigate whether operating performance (net profit margin) are under the influence of capital structure (net worth to loan ratio) inline with business growth (loan growth rate) of RUSACCOs. Meanwhile, as RUSACCOs are regional, this study focuses to explore if there is any threshold relationship in Amhara,

Oromia, Tigray and SNNP. Panel data techniques along with a regime-switching framework to determine the state of the RUSACCOs within the model was used. Following Hansen (1999), a least square estimation (LSE) of threshold and regression slopes using fixed effects transformation was applied. A non-standard asymptotic theory of inference was developed which allows construction of confidence intervals and testing of hypothesis. A bootstrap method to assess the statistical significance of the threshold effect was also implemented.

Special attention is devoted to compare RUSACCOs performance specifically on saving and loan outreach as well as financial performance using PEARLS¹ monitoring system software.

In this paper we provide evidence that there is a threshold relationship between loan growth and operating performance and also between four regions RUSACCOs under the influence of capital structure, and we interpret this result by apply econometric model (Hansen 1999) to estimate the threshold points. We use balanced panel with data for 92 RUSACCOs from 65 woredas for the period 2004 to 2007. As is standard in the empirical growth literature, we use averaged data for four years.

1.2. STATEMENT OF THE PROBLEM

RUSACCOs have played an important role in the country's rural financial system. The need to improve the national savings effort by the rural community and their access to credit would call upon the policy makers to emphasize the expansion of the RUSACCOs. With this object in view, the number of RUSACCOs rise to more than 2,170 before end of 2007. However, the rate of escalation in quantity of RUSACCOs without a significant improvement in their financial competence leads to the question of how RUSACCOs are financed since these issues are relating to decisions to be taken on composition of RUSACCOs capital and debt.

¹ Each letter of the word PEARLS measures key areas of RUSACCOs operations: **P**rotection, **E**ffective financial structure, **A**sset quality, **R**ates of return and cost, **L**iquidity and **S**igns of growth.

The member of RUSACCOs provides capital by way of shares and savings which are rotated in loans to members. The other source of fund is borrowing from outsiders. Such funds are referred to as liabilities. The growth of loans has impact on operating performance and the successful management of the loan is generally considered the most challenging aspects of the financial management of RUSACCOs.

More specifically, the availability of the most appropriate mix of equity and liabilities, determine the extent to which RUSACCOs is operating efficiently. However, it must be understood that availability of optimal asset allocation by itself doesn't bring operating efficiency.

So far, most of previous studies in the country attempted to explore the performance of capital structure of commercial banks as well as MFIs by employing econometric models. However, only few studies were made on RUSACCOs. Among a couple of review studies in Ethiopia include Wolday, 2002; Dagneu 2004; Wolday 2004. According to these studies, RUSACCOs are not efficient in both resources allocation and operations mainly due to absence of separate proclamation for financial cooperatives, distortion of financial norms by multipurpose cooperatives, lack of adequate fund sources, deficiency in skills and experience in modern RUSACCO practices and absence of a standard prudential regulation for RUSACCOs. However, these studies fail to consider other factors limiting the operating performance of RUSACCOs. For instance, limited financial product, very low capital base and inadequate fund for financing loan, high liquidity, fear to borrow.

In light of this fact the main problem would be how RUSACCOs finance their asset through some combination of equity (share and reserve) and debt (saving); are loan growth and operating performance of RUSACCOs under the influence of capital structure; is there any threshold relationship between loans growth and operating performance of RUSACCOs; and is there any threshold relationship difference among the regions of the country and also how efficient RUSACCOs outreach and financial performance.

Since the detailed information base necessary to forward a solution to the problem is not readily available, it is assumed that such type of study will help to provide such details. In the process of analyzing operating performance of RUSACCOs in order to identify the optimal capital structure a number of related issues and questions arise. It would be necessary, for example, to review the historical, structure and role of RUSACCOs; measuring the outreach and financial performance; identify the existing relationship between loan growth and operating performance.

Therefore, it is not possible to provide a solution to the problem raised without giving some thought to these considerations. Accordingly, this study attempts to measure the performance of RUSACCOs in the major four regions of the country.

1.3. OBJECTIVES OF THE STUDY

The overall objective of this research is to measure the level of operational performance of RUSACCOs. More specifically, this study aims at

1. Examining whether operating performance (net profit margin) of RUSACCOs are under the influence of capital structure (net worth to loan ratio) inline with loan growth rate;
2. Testing if there exist asymmetric threshold relationship between operating performance of RUSACCOs and loan growth;
3. Exploring whether threshold relationship are different in the RUSACCOs of Amhara, Oromia, Tigray and SNNP regions;
4. Examining the saving and loan outreach as well as financial performance of RUSACCOs using PEARLS monitoring system software;

1.4. SIGNIFICANCE OF THE STUDY

In countries such as Ethiopia, where rural population is the dominant, the existence of strong and capable RUSACCOs is essential for agricultural and overall rural economic development. This show RUSACCOs has a significant contribution to nationwide as well as household's level financial growth. RUSACCOs is often said to be the life blood of rural community and plays a crucial role in oiling the wheels of their business activities.

However, little is known about how they can get stable financing sources and minimizing the capital cost; how they run their business ever lastingly and maximizing the members' value; how growth of loans and operating performance are under the influence of capital structure; in what condition their exist relationship between loan growth and operating performance; why and how capital structure have different effect on operating performance in different regions. Therefore, studies are required on these and other aspects of RUSACCOs performance.

An analysis of factors influencing operating performance of RUSACCOs in order to find the best combination that maximizes the members' value and minimize cost of capital would help policy makers and cooperative promoters to formulate successful rural financial development strategies. Therefore, the factors that influence the optimal asset allocation must be studied.

An accurate knowledge of the existing condition and performance of RUSACCOs is an important precondition not only to the overall development of the financial sector at federal or regional level but also to the flow of funds into the RUSACCOs level. Given the limited research in this area, the study result might initiate policy action and stimulate further research from different perspective.

1.5. SCOPE AND LIMITATION OF THE STUDY

This study has covered member savings, share capital, operating expenses, loans, operating income, assets and net worth in relation to RUSACCOs in four major regions. In particular, the study has considered 92 purposively selected sample RUSACCOs from 65 woredas. Since the study was conducted only based on annual financial data from annual report of FCA, it couldn't represent the aggregate financial data behavior of RUSACCOs. Moreover, FCA didn't keep update records in some of the variables such as expenditure and income; the information provide by FCA primarily depends on assumptions. Thus, computations based on such data are likely to have some errors.

Another shortcoming of this study originates from the use of equal sample size to the four sample groups (Amhara, Oromia, Tigray and SNNP) have a big difference in size of the population, number of RUSACCOs established and area of the regional size. However, random sampling proportion to the size of the population, number of RUSACCOs established and area of the region is not account for.

CHAPTER TWO

REVIEW OF RURAL SAVING AND CREDIT COOPERATIVES IN ETHIOPIA

2.1. COOPERATIVE SECTOR

The cooperative movement in Ethiopia took birth in 1960. By as early as 1973 more than 116 cooperatives with a total membership of about 33,400 were established. With the fall of the imperial regime in 1974 through the far-reaching collectivization policy of military government, cooperative society's proclamation No 241/1966 and 71/1975 was repealed and replaced by proclamation No 138/1978 with a view to include for the establishment and consolidation of producer and service cooperatives. Before adoption of mixed economy in 1991, there were 3,273 producer and 9,823 service cooperatives with a total membership of about 10 million persons.

Until 1995 little or no attention was paid to cooperative sector. Proclamation No 85/1994 and proclamation No 147/1998 unshared in the incumbent government by providing necessary ambience for rejuvenation of the sector movement (FCA, 2001). Currently, according to FCA (mid of 2008), 21 kinds of 21,406 primary cooperatives, 115 secondary cooperatives (Unions) and one cooperative federation with a total membership of about 5 million people have been promoted and registered.

The regional distribution of the primary cooperatives shows that Addis Ababa comprises 49.6% and the rest Oromia 19.9%, Amhara 11.1%, SNNP 7.2% and Tigray 6.9%. The remaining regions collectively accounted for 5.3% of the number of primary cooperatives. Out of these various types of primary cooperatives 5,885 (27.5%) are SACCOs. Within these SACCOs 2,170 (35%) and 3,715 (65%) are RUSACCOs and urban SACCOs (USACCOs) respectively (Annex-1).

2.2. SAVING AND CREDIT COOPERATIVE

In the world cooperative history the SACCO idea was first conceived in the mind of F.W.Raiffeisen (1818-1883) in Germany. USACCO in Ethiopia has a half century long origin. The first USACCO was established in 1964 by employees of Ethiopian Airlines. During the same period, USACCO was established by employees of Ethiopian Road Authority and the Telecommunication Agency (Dejene, 1993). However, according to Dagnew (2004) the first USACCO was established by the employee of the Ethiopian roads Authority in 1957.

RUSACCOs are organized based on members residence and for the sake of simplicity of management; ease to identify members' characteristics; to develop members' confidence; to minimize operational costs of the cooperative; and to enable household members to be the beneficiary of the savings scheme. According to Melkamu (2006), the first RUSACCO was established in Dejen woreda Amhara region Yetnora-Tik village with 105 founding members with support of volunteers in overseas cooperative assistance (VOCA)/Ethiopia in 2000.

2.3. HIERARCHICAL LLEVEL

The cooperative sector in Ethiopia is hierarchically structured into a four level namely primary, secondary (union), Federation and League. At the base of the structure are the primary cooperatives which operate autonomously and are Kebeles/ village level-oriented. They are primary share holder member of the cooperative union, the second tier in the system. The cooperative unions are responsible for ensuring liquidity at the primary level and providing services, which are beyond the primary societies. The cooperative unions are in turn, the primary shareholder members of cooperative federation. Finally, the league serves as an apex cooperative organization. It doesn't directly involve in production and service giving activities, but serve as a mouth piece of cooperatives in the country. It has not yet been formed in the country (Figure-1).

2.4. INSSTITUTION ASPECT

According to the criteria set under RUSACCOs promotion manual (1997), the staff of woreda cooperative promotion offices identifies potential area to organizing RUSACCOs. Once the area is identified, the team that comprises promotion officers and others visits the area and, meet the opinion makers and talk them about the concept of RUSACCOs. If necessary the team makes a second visit and gets a date fixed for a meeting of the area residents and at the date meeting after a through discussion group facilitators is identified to make a detailed study of the proposal. Once about 10 to 15 people are enthused, a saving group is formed. As and when the group attains member size of 25 to 50, it goes to registration. The team helps the saving groups to formulate bylaw and then the group elects the committee members and make application for registration. The RUSACCOs are registered by RCPBs.

The organizational structure of RUSACCO comprises general assembly and other five committees such as control, management, loan, saving and education. The general assembly comprising all the members and has ultimate control over the affairs of RUSACCO. It lays down by-laws, business rules and also, prescribes share capital, admission fee and compulsory savings. Besides, elects management and other committees. The general assembly of RUSACCO approves the business plan and budget at the beginning of the year. Seven persons is the usual number of members on the management committee. The key management functionaries are chairperson, secretary and treasurer. Almost all RUSACCOs have insufficient resources to have a paid manger or bookkeeper, with the result that the secretary normally maintained the accounts. While the other committees consisting of three members each.

To become member of RUSACCO, registration fee (mostly ten birr on average) is paid together with an initial share capital contribution. To remain an active member, regular saving must be made too. These saving and contributions do not only provide the RUSACCOs with its capital but are also the basis upon which the amount that a member can borrow is determined.

2.5. THE ROLE OF RURAL SAVING AND CREDIT COOPERATIVESs

The general role of RUSACCOs is to encourage savings by creating local saving activities and then using the pooled funds to make loans for productive, consumer or social purposes to their members (FAO, 2001). In the global financial market RUSACCOs play various roles and it includes saving and loan service, time deposit, transferring of money, serving non-members as informal bank for deposit, housing loans, insurance, and youth saving.

The main reasons that instigate the establishment of RUSACCOs in the majority of the rural community is due to their advantages that includes savings are mobilized locally and returned to members in the form of loans. Besides, interest rate on both savings and loan are generally better than rates given by banks and the reason for this is that RUSACCOs have very low overheads compared to other formal financial institutions; educate their members in financial matters how to keep track of finances and pay dividends on share to their members once they are established and profitable (SACCOL, 2003).

The actual roles of RUSACCOs that are operating in the remote area of Ethiopia are grouped in the following way. These are

- (i) **Internal and External Fund Sources Collection:** The main sources of funds are saving, share, administration fees, and entrance fees as internal sources. Saving and share is contributed by members is voluntary and unpaid. The external source is funds from financial institutions and donors;
- (ii) **Loan Services:** members obtain loans after they have saved for a specific period of time mostly one year. Most RUSACCOs allow members to borrow from 3 to 5 times the amount of their saving contribution;

(iii)Interest Rate Service: the loan repayment period with interest rate or service charges in most RUSACCOs is one year. RUSACCOs paid interest for the members saving according to NBE rate and also receive interest rate or service charges² for the loans they disbursed according to their bylaw;

(iv)Dividend Distribution: if by year end the RUSACCO has generated income in excess of its expenses dividend distributed to members according to their share and saving;

Earlier literatures have examined the role of RUSACCOs and SACCOs. According Moody (1971) and Flannery (1974), difficulties were noted by researchers to determine the overall role including their unique ownership structure.

On the contrary, Overstreet and Rubin (1991) identified diverse RUSACCOs roles principles that were included the provision of low cost credit and high-yielding deposits, building financial stability, and serving an open membership with financial services.

However, there was a huge gap in categorizing the role of RUSACCOs. For instance, based on the RUSACCO roles to follow researchers were classified into two schools of thought. The first group were those who linked RUSACCO role to follow some form of classical based economic model and cost minimization models that were suggested by Taylor (1971, 1977, 1979), and Spencer (1996). The other group was those who linked cooperative functioning to economic relationships between the cooperative and its members that were suggested by Robotka (1947) and Phillips (1953). Other researchers suggest that the classic cooperative principles underlie the key role of RUSACCOs using some form of member benefit measurement to explain the behavior of RUSACCOs where member benefit objective models were referred to by Taylor (1979), Walker and Chandler (1977) and Croteau (1966).

² In all pastorals and semi-pastorals areas of the country the term “Interest rate” is not accepted by the majority of the cooperative members. Therefore, the cooperative promoters used the term “service charge” to replace the term interest rate.

The recent finding that presented by Ferguson and McKillop (1997) outline RUSACCOs' main role as being the promotion of thrift that is directed at fulfilling human and social needs stating that RUSACCOs are not formed to make profits, rather to maximize the benefit to their members. The benefit gained by members not being restricted to financial gain but also including other social factors such as finance education for members. This is the basic idea that related to the existing Ethiopian RUSACCOs.

On the whole when we compare the general and actual role of RUSACCOs, there is an enormous gap from the Ethiopian RUSACCOs context. For instance, the Ethiopian RUSACCOs are not in a position to implement majority of the roles that is undertaken by the rest of the world other than saving and loan services. Therefore, it requires revision of their role according to the RUSACCOs promotion guideline.

In addition, as Ferguson and McKillop (1997) stated the differing views on RUSACCO role should benefit from an analysis of how RUSACCO principles fit within the overall cooperative movement principles throughout their emergence and development into the current internationally accepted principles adopted by the International Cooperative Alliance (ICA). Their links to cooperative movement principles are evidenced within their regulatory framework, bylaws and from definitions that have been coined by the many researchers who have studied this unique financial institution.

2.6. COMPONENTS OF FINANCIAL STATEMENT

In the existing situation RUSACCOs are produced three types of financial statements. These are cash flow summary, balance sheet, and income and expenditure statement. Cash flow summary is a simple summary of cash inflows and outflows over a given period of time. In majority of the RUSACCOs this is the only statement produced on a monthly basis.

The balance sheet provides a listing of all the assets, liabilities and capital of RUSACCOs at a given point of time. The asset of the balance sheet usually comprises loans, fixed assets and interest receivable. On the other hand, a liability includes member saving, dividend and saving interest and capital consist of share and reserve. The income and expenditure statement is a summary of the income and expenses of the RUSACCOs for a period of time. The proper management of the RUSACCOs assets will generate either income or expenses. The major forms of income in RUSACCO are interest on loans, service fees, entrance fees, donation and rental income. In the course of operating the RUSACCOs business a variety of expenses are incurred. These are operational costs and interest paid on savings and loans.

CHAPTER THREE

REVIEW OF LITERATURE

3.1. THEORETICAL LITERATURE

As there are vast literatures in the area of cooperatives in general and RUSACCO as well as SACCOs in particular, it is tried to comprehend the most relevant and recent ones around the main research themes.

A cooperative is a grouping of people pursuing common economic, social and educational aims by means of a business is the other definition that many cooperative leaders and thinkers will favor even today, many years after it was written by the eminent French economist and cooperator, Charles Gide (1847-1932).

A recent definition (1995) published by the ICA described a cooperative as being “an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise.”

International Labour Organizations (ILO) is one of the international organizations that pay close attention to the development of cooperatives in general. According to ILO, a genuine cooperative was defined as: “an association of persons who have voluntarily joined together to achieve a common end through the formation of a democratically controlled organization, making equitable contributions to capital required and accepting a faire share of the risks and benefits of the undertaking in which the members actively participates.”

In the case of Ethiopia, the definition reflects the basic or peculiar aspects of the above cooperative definitions. The present proclamation No 147/1998 defined cooperative societies as “a society established by individuals on voluntary basis to collectively solve, their economic and social problems and to democratically manage same.” Following to this proclamation, various kinds of cooperative such as agricultural, housing, mine, consumer, and SACCO have been organized in the country.

According to Berthoud and Hinton (1989) RUSACCO is defined as being cooperative societies that offer loans to their members out of the pool of savings that are built up by the members themselves. Similarly, World Council of Credit Union (WOCCU), defined RUSACCOs as user-owned MFIs that offer saving and credit services to their members.

In Ethiopia, membership in a RUSACCO is based on a common bond, a linkage shared by savers and borrowers that can be based on a community, organizational, religious or employee affiliation. However, promoting the rural dwellers to become a member of RUSACCOs after establishing their own RUSACCOs to have easy access to financial services at the farm gate has always facing a challenge.

In this regard, Jacob Yaron (2004), states that providing financial services to the rural population has always constituted a challenge to governments due to the inherent difficulties associated with providing such services to rural clientele, often characterized by isolated markets, seasonality, and highly covariant risk such as widespread regional crop failures and commodity price fluctuations. Servicing these clientele results in high transaction costs, limited opportunities for risk diversification, Lack of adequate rural physical and human infrastructures (e.g. roads, electricity health and education), and asymmetric information, more prevalent in rural than in urban areas often dissuade for-profit formal financial institutions from entering these markets. Inadequate policies with respect to agriculture and financial markets further scare away those from taking a larger share in rural financial intermediation.

Similarly, Rajarm (2001) explained how formal financial institutions do not show much interest to put their resources in rural areas. In this regard, he pointed out that finance is one of the most crucial inputs for economic activity, growth and development. If finance through own accumulated resources or equity is neither available nor sufficient then productive investment will be severely restricted.

Financial institutions play an important role in this regard by channeling funds from surplus sector (savers) to deficit sectors (investors). However, these institutions do not show much enthusiasm to put their resources in rural and backward areas for the benefit of poor people as these are commercial organizations and are basically interested in profitability and sustainability for the reasons of incentive for functioning and for safeguarding the interest of stakeholders.

In the same way, Binswanger and Landell-Mills (1995) states that constraints in relation to banks that excludes the poor because small transactions are unprofitable. Providing financial services to the poor and women is not easy. Many borrowers are not credit worthy and don't have profitable project. However, in contrary many developing countries like Ethiopia has designed a policy and development strategy to support the forgotten poor rural community.

On the other hand, to show the importance of RUSACCOs Ferguson and McKillop (1997) contrasted RUSACCOs to the more dominant form of organization found in industrial societies that is based on speculative gain of a private or corporate kind. They also explained the clear difference of RUSACCOs to other financial institutions by enlightened the functions of RUSACCOs. In conclusion, they found out that the need for RUSACCOs to the rural community is undeniable fact.

In Ethiopia, since 2000 RUSACCOs are expanded in all rural area of the country. However, their business status shows that they are running their business with poor performance efficiency as well as lack of capital, or operating fund which is obtained through equity (capital) and debt. The main sources of funds in these RUSACCO

comprise of own funds from members that include share capital and savings. To increase the pool of funds available for on-lending, RUSACCO may borrow from public banks as other sources of funds in addition to donation from donors.

According to E.F. Brigham (1996) money invested by the owners is referred to as capital or equity. On the other hand, borrowed fund or credit that must be repaid in the future, usually with interest is referred to as debt and such funds are referred to as liabilities.

In financial term, capital structure refers to the way a RUSACCOs finances its asset through some combination of equity and debt. As E.F. Brigham (1996) defined, capital structure is a business finance term that describes the proportion of a company's capital, or operating money, that is obtained through debt and equity. Broadly speaking, capital structure is composed of owned funds and borrowed funds. In the case of both capital and liabilities, the funds mobilized are available to the RUSACCO for its use, but these liabilities belong to other persons or institution that must be eventually paid back.

Since capital is expensive for small businesses like RUSACCOs, it is particularly important for members as well as cooperative promoters to determine a target capital structure for their RUSACCOs. However, in practice it is not. Therefore, there is a theoretical foundation as well as practical need of measuring the capital structure and profitability of RUSACCOs through various methods. This analysis can be extended to look at whether there is in fact an 'optimal' capital structure: the one which maximizes the value of the RUSACCOs.

At present, the key issue for RUSACCOs members as owner is to evaluate their RUSACCO's particular situation and determine its optimal capital structure. As E. F. Brigham (1996) explained, "The optimal capital structure is the one that strikes a balance between risk and return and thereby maximizes shareholder's value and simultaneously minimizes the cost of capital."

To obtain the result of the measuring the capital structure and profitability of RUSACCOs different methods like financial ratio analysis and econometric methods can be applicable. Ratio analysis is one commonly used tool of financial statement analysis. In general terms, the use of ratios allows the analyst to develop a set of statistics that reveal key financial characteristics of the RUSACCOs under scrutiny.

According to Miller and Donald E. (1980) ratios are used in two major ways. First, ratios for the firm in question are compared to industrial standards. Second it uses to compare the trend over time. These key financial ratios that identified by Miller (1980) and used in this study paper are:

4. **Net profit margin:** it measures how profitable a RUSACCO's business after all operational expenses have been deducted, thus revealing how effectively the RUSACCO's management is controlling the total expenses. It is one of the profitability ratios and hereby profitability is a measurement for operating performance for RUSACCOs. This paper uses net profit margin as the proxy variables for operating performance.
5. **Current ratio:** it is defined as current asset over current liabilities. In RUSACCOs financial statement this ratio can easily interpreted as saving to loans. It is one of the quick liquidity ratios and it measures RUSACCO's ability to provide sufficient cash to conduct business over the period. It is also debt repayment ability. Current ratio used as proxy variable for liquidity.
6. **Saving to Net worth ratio:** it is the amount of capital necessary to absorb losses while providing financial stability. This paper uses this ratio as the proxy variables for capital adequacy. Capital adequacy indicates the requirement of capital to cover claims on asset in the event of both expected and unexpected losses. It also indicates the capital strength of RUSACCOs.

7. **Net worth to loan Ratio:** it is the financial mix or percentage of RUSACCO's funds that make-up total capital. It measures business risks of RUSACCOs. This ratio uses as the proxy variables for capital structure. It relates to the decision to be taken on composition of capital i.e. own or borrowed fund.

On top of that many different financial ratios have been promoted for financial institutions in the world, but few have been consolidated into an evaluation method that is capable of measuring both the individual components and the system as a whole. For the case of cooperatives in particular to SACCOs, two system tools that comprise different type of ratios were developed. These are CAMEL³ and PEARLS.

The CAMEL ranking system is the first management tool that used to measure the performance of SACCOs. It was adopted by WOCCU to use as a management and supervisory tool to control the safety of SACCO members saving. However, due to its many modification requirement then replaced by PEARLS monitoring system.

Since 1990, the WOCCU has been using PEARLS as a financial performance monitoring system to offer management guidance for SACCOs as well as RUSACCOs. It is also a supervisory tool for cooperative promoters and regulators. PEARLS is the only monitoring system software that available this days to evaluate the performance of RUSACCOs with the permission of WOCCU. PEARLS comprise a variety of quantitative indicators and currently there are 41 indicators under the system. These indicators are grouped into six key areas: Protection, Effective financial structure, Asset quality, Rates of return and cost, Liquidity and Signs of growth. According to WOCCU (2002), the objectives of the PEARLS are to provide an executive management tool in identifying probable causes of institutional shortcomings. Secondly, it is intended to standardize evaluation of ratios and formulas. It also intends to provide an option for comparative rankings with objectivity. Finally, it provides an effective supervisory tool for national federations in evaluating credit union performance.

³ CAMEL: Capital Adequacy, Asset Quality, Management, Earnings, Liquidity

3.2. EMPIRICAL LITERATURE

There is wide range of empirical literature on rural financial institutions that explains the operating performance and capital structure of RUSACCOs in developing countries. Among the various notable works the most relevant and recent ones are reviewed as follows.

In their analysis, Kuei-Chiu Lee and Chia-Hao Lee (2006), using threshold regression method credit cooperatives in Taiwan are under the influence of capital structures. On the contrary, according to this study with a poor capital structure, the increase in loans reduces net profit margins. The empirical finding of this study also shows that the growth in loans for credit cooperatives between regions within the country affects net profit margins.

The previous empirical studies on capital structure that conducted by Titman and Wessels (1988) pointed out the inverse correlation between the short-term debt ratio and the scale of company operations. Likewise, Brandley et al. (1984) who applied computer simulation analysis, find that there exists an optimal liabilities ratio for companies and indicate inverse correlation between debt ratio and earnings volatility. On the contrary, Erik (2002) argued that the tax shields achieved by leverage can effectively enhance the value of the firm, but such benefits get offset by the cost associated with leverage. Therefore, liability ratio must be at its optimal level in order to effectively enhance the value of the firm.

In their analysis, Hameeteman and Scholtens (2000), using Pearson method and a multiple regression model to examine the correlation between growth rates and capital structures, assets, changes of pre-tax earnings and scales of the top 100 banks found that there exists a significant negative correlation between capital size, assets, growth rates and pre-tax earnings. Also, the growth rates of large banks decline gradually with the decrease of capital, assets and pre-tax earnings.

The empirical research that conducted by Jensen and Meckling (1976) observed the existence of conflicts of interest among manager and leaders. Similarly, Jensen (1986) finds that managers of firms with unused borrowing power and large free cash flows are more likely to undertake low-benefit or even value-destroying mergers so higher debt ratio can increase firm value.

Correspondingly, Ross (1977) states that information asymmetry exists between managers and members of cooperatives so the increase of debt ratio will be taken as a positive signal to them and hence increase the firm value.

The empirical research on the optimal capital structure conducted by Castanias (1983) found that the expenses to cover debt are large enough to induce the typical firm to hold an optimum mix of debt and equity. In their analysis, Bergman and Callen (1991) states there exists negative relationship between the ratio of intangible assets to total assets and the debt ratio.

To show the impact of debt ratio, Kim and Sorensen (1986) find that firms with higher insider ownership have greater debt ratios than firms with lower insider ownership. They also find that highly growing firms use less debt rather than more debt, high-operating firms use more debt rather than less debt, and firm size appears to be uncorrelated to the level of debt.

Specifically, Chinese scholars have done some empirical research about the relationship between the capital structure and firm value. Wang (2003) applied multiple regression analysis and concluded that debt financing has positive impact on firm value. Nevertheless, when Chien-Chung Neih (2005) used the same method but different sample, completely different result is found.

According to Chien-Chung Neih (2005) study that aimed to test whether there exists an optimal debt ratio using panel threshold regression model to examine threshold effects of financial leverage on operating efficiency (and firm value) of Chinese firms, he

found that there exists triple threshold effect and the coefficients are all positive and significant for four regimes. These results identified that the operating efficiency is positively related to debt level. However, the positive effect decreases when debt ratio increases since the results show that the lower the debt to asset ratio, the higher the impact coefficient. Therefore, according to Chien-Chung Neih (2005) finding financial managers should use financial leverage wisely to improve the operating efficiency in order to maximize the firm value and investors should refer to the debt ratio to make investment decisions.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1. SAMPLING PROCEDURES AND DATA SOURCES

Four national regional states namely Amhara, Oromia, SNNP and Tigray were purposively selected. This is because: (a) majority of the established RUSACCOs (96%) were found in these four regions (Table-1); (b) most of the RUSACCOs in these regions have relatively long duration since established and at least they have already started providing saving and credit services to their members; (c) RUSACCOs promotion with the support of the seven year project which is called as Rural Financial Intermediation Program (RUFIP) for Cooperative Sub-Sector (CSS) initially started in these four regions simultaneously in the year 2004; (d) existence of good status of annual report; and finally they represent different agro-ecological zones of the country.

Table-1: Number of RUSACCOs Established with RUFIP/CSS Support

No	Name of Region	RUSACCOs Established as of July7, 2007				
		2004	2005	2006	2007	Total
1	Amhara	24	62	81	87	254
2	Oromia	24	196	311	406	937
3	SNNP	46	72	101	125	344
4	Tigray	43	61	67	61	232
	Total	137	391	560	679	1,767

Source: FCA Annual Report, July 2007

A balanced panel data consisting of 92 sample RUSACCOs (Annex-2) from 65 woredas that have started providing saving and credit services from July 8th, 2004 to July 7th, 2007 was used for the study. The total number of observation is 368. To make the sample size equal in each four regions, 23 RUSACCOs were selected by taking the least number of RUSACCOs established by Amhara as compared to 24 in Oromia, 44 in Tigray and 46 in SNNP before July 7th, 2004. Here, RUSACCOs which have been established after July 8th, 2004 are not considered in the sample.

All financial data comes from FCA from 8th July 2004 to 7th July 2007. In addition, personal observation, individual and group discussions with the FCA's senior officers were held to gather additional primary information. The type of data that were collected from FCA includes number of RUSACCOs, membership size, fee, saving, share capital, grant, reserve, operating expenses, loans, operating income, asset, liability, loan income, interest on saving and loan, dividend, assets and net worth.

4.2. TECHNIQUES OF DATA ANALYSIS

Based on the objectives of the study appropriate techniques of analysis such as descriptive analysis based on the findings of PEARLS monitoring system and econometric analysis derived from panel threshold regression analysis method were employed.

4.2.1. DESCRIPTION ANALYSIS

This study examines the operating performance status of RUSACCOs by analyzing their saving and loan outreach as well as financial performance of the RUSACCOs from 2004 to 2007 using PEARLS. This financial performance monitoring system method is selected because it is the only tool that has been utilized by few RUSACCOs in the country since mid of 2007.

In the descriptive analysis, saving and loan outreach condition as well as financial performance evaluation of sample RUSACCOs in the study areas of the four regions were analyzed by using 12 indicators of PEARLS such as Protection (P1, P2 and P6), Effective financial structure (E1, and E5), Asset quality (A1 and A2), Rates of return (R9) and Signs of growth (S1, S5, S7, and S10) (Table-2). This descriptive analysis help one to have clear picture about the RUSACCOs in the four major regions and to draw some preliminary conclusions on the savings and loan outreach as well as RUSACCOs involvement in financial intermediaries.

Table-2: The “PEARLS” Monitoring System Ratios with WOCCU Standard

Ratio	Description and Formula	Standard
P1	Allowance for Loan Losses / Delinquency >12 months	100%
P2	Net Allowance for Loan Losses/Delinquency 1-12 months	35%
P6	Solvency	100%
E1	Net Loans/Total Assets	70-80%
E5	Savings Deposits / Total Assets	70-80%
A1	Total Loan Delinquency/Gross Loan Portfolio	<=5%
A2	Non-Earning Assets / Total Assets	<=5%
R9	Total Operating Expenses / Avg. Total Assets	<10%
S1	Growth in Loans to Members	Dependent on E1
S5	Growth in Savings Deposits	Dependent on E5
S7	Growth in Share Capital	Dependent on E7
S10	Growth in Membership	>5%

Source: WOCCU, 2002

4.2.2. ECONOMETRIC ANALYSIS

According to Hansen and Caner (2004) threshold regression model (sample splitting models) that proposed by Tong (1978) and developed by Hansen (1999) has some popularity in current applied econometric practice. The model splits the sample into classes based on the value of an observed variable-whether or not it exceeds some threshold. When the threshold is unknown (as is typical in practice) it needs to be estimated, and this increases the complexity of the econometric problem.

The model becomes very popular for economic and financial research especially in firm’s investment and financial operation performance. It has a wide variety of applications in economics. A few studies also applied on this method. The literature, including Jury and Lotti (2006), Kuei-Chiu Lee and Chia-Hao Lee (2006), Chien-Chung Neih and Lu (2000) and Hansen (1999), uses threshold models for the investment equation where the threshold variables are measures of financial constraints and also for panel threshold effect analysis between operating efficiency and capital structure.

The goal of this paper is to investigate whether operating performance of RUSACCOs are under the influence of capital structure inline with loan growth. Panel data techniques along with a regime-switching framework that endogenously determines the state of the RUSACCOs within the model was used.

Following Hansen (1999), a least square estimation of threshold and regression slopes using fixed effects transformation was applied. A non-standard asymptotic theory of inference was developed which allows construction of confidence intervals and testing of hypothesis. A bootstrap⁴ method to assess the statistical significance of the threshold effect was also implemented. The regimes can be single and multiple depend on threshold variables and they are determined by the values of observed variables that related to capital structure. In general, the model specification in this study is similar to those developed in earlier work by the Hansen (1996, 1999) as it is shown in Annex-3.

4.3. THE MODEL SPECIFICATION

In this study, based on the Hansen (1999), the following model specification for a single threshold model is proposed.

$$OP_{it} = (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_1 LGr_{it} I(CS_{it} \leq \gamma) + \beta_2 LGr_{it} I(CS_{it} > \gamma) + \varepsilon_{it} \quad (25)$$

As in Hansen (1999) the observed data are a balanced panel $\{ OP_{it}, CS_{it}, LGr_{it} : 1 \leq i \leq n, 1 \leq t \leq T \}$.

⁴ Given the panel nature of the data Hansen (1996) recommends the following implementation of the bootstrap. Treat the x_{it} and q_{it} as given, holding their values fixed in repeated bootstrap samples. Take the regression residuals $\hat{\varepsilon}_{it}^*$ and group them by individual. Treat the sample $(\hat{\varepsilon}_1^* \hat{\varepsilon}_2^* \dots \hat{\varepsilon}_n^*)$ as the empirical distribution to be used for bootstrapping. Draw (with replacement) a sample of size n from the empirical distribution and use these errors to create a bootstrap sample under H_0 . (Notice that the test statistic F_1 does not depend on β_1 under H_0 , so any value of β_1 may be used.) Using the bootstrap sample, estimate the model (16) and alternative (5) and calculate the bootstrap value of the likelihood ratio statistic F_1 (17). Repeat this procedure a large number of times and calculate the percentage of draws for which the simulated statistic exceeds the actual. This is the bootstrap estimate of the asymptotic p-value for F_1 under H_0 .

WHERE,

$I(.)$: Indicator Function.

i : indexes the RUSACCOs from 1, 2, 3 ...92

t : indexes the year from 2004 to 2007

Dependent variable

OP_{it} : Operating Performance

Independent variable

CS_{it} : Capital Structure (threshold variable),

LGr_{it} : Loan Growth rate

CA_{it} : Capital Adequacy (controlled variables)

CR_{it} : Current Ratio (controlled variables)

This study uses CS_{it} as threshold variable denoted by (γ) to examine whether operating performance of RUSACCOs are under the influence of capital structure inline with loans growth rate, and whether there exists asymmetric threshold relationship.

An alternative intuitive way of writing Eq. (25) is

$$OP_{it} = \begin{cases} (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_1 LGr_{it} + \varepsilon_{it}, & \text{if } CS_{it} \leq \gamma \\ (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_2 LGr_{it} + \varepsilon_{it}, & \text{if } CS_{it} > \gamma \end{cases}$$

In addition to the Eq. (25) which considers two regimes as in Hansen (1999), in this study the following three regimes models also applied because in practice multiple threshold models may appear.

$$OP_{it} = (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_1 LGr_{it} I(CS_{it} \leq \gamma_1) + \beta_2 LGr_{it} I(\gamma_1 < CS_{it} \leq \gamma_2) + \beta_3 LGr_{it} I(\gamma_2 < CS_{it}) + \varepsilon_{it} \quad (26)$$

Where the threshold are ordered so that $\gamma_1 < \gamma_2$. The Eq. (26) can also be expressed as follows:

$$OP_{it} = \left\{ \begin{array}{ll} (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_1 LGr_{it} + \varepsilon_{it}, & \text{if } CS_{it} \leq \gamma_1 \\ (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_2 LGr_{it} + \varepsilon_{it}, & \text{if } \gamma_1 < CS_{it} \leq \gamma_2 \\ (\mu_i + \theta_i CA_{it} + \theta_i CR_{it}) + \beta_3 LGr_{it} + \varepsilon_{it}, & \text{if } CS_{it} > \gamma_2 \end{array} \right\}$$

In this study focus was given to both single and double threshold models. In Eq (25) the observations are divided into two ‘regimes’ depending on whether the threshold variable CS_{it} is smaller or larger than the threshold value (γ).

As Hansen (1999) shows in his paper, the least square estimation with fixed effect transformation was applied in this study. One traditional method to eliminate individual effect (u_i) is to remove individual averages, i.e. de-mean. Therefore, this paper derives the average of Eq. (25) for single thresholds model as Eq (4) in Annex-3.

For any given γ^5 , the slope coefficient β Eq. (25) can be estimated by ordinary least square (OLS). Similarly, when (γ_1, γ_2) Eq. (27) is known, the linear slope coefficients ($\beta_1, \beta_2, \beta_3$) can be estimated with OLS.

It is very important to test whether threshold effects exist. The hypothesis of no threshold effect in Eq.(25) can be expressed by the linear constraint as $H_0: \beta_1 = \beta_2$. Under H_0 the threshold γ is not identified. This type of testing yields non-standard distributions.

⁵The computation of the LSE of the threshold γ involves the minimization problem (9). Since $S_1(\gamma)$ depends on γ only through the indicator functions $I(q_{it} \leq \gamma)$, the $S_1(\gamma)$ is a step function with at most nT steps, with the steps occurring at distinct values of the observed threshold variable q_{it} . Thus the minimization problem (9) can be reduced to searching over values of γ equaling the (at most nT) distinct values of q_{it} in the sample. To implement the minimization, the following approach may be taken. Sort the distinct values of the observations on the threshold variable q_{it} . Eliminate the smallest and largest $g\%$ for some $g > 0$. The remaining N values constitute the values of γ which can be searched for $\hat{\gamma}$. For each of these N values, regressions (7) are estimated yielding the SSE (8). The smallest value of the latter yields the estimate $\hat{\gamma}$. In practice, N may be a very large number, and the optimization search describe above may be numerically intensive. A simplifying shortcut which yields nearly identical results is to restrict the search to a smaller set of values of γ . Instead of searching over all values of q_{it} (between the $g\%$ and $(1-g)\%$ quantile) the search may be limited to specific quantile, perhaps integer valued. This greatly reduces the number of regressions performed in the search. The estimates from such an approximation are likely to be sufficiently precise for most applications of interest.

If the threshold effects do exist, then the estimated threshold value $\hat{\gamma}$ and the actual threshold value γ_0 will be consistent. At this time, due to the presence of nuisance parameter, asymptotic distribution exhibits a highly non-standard pattern. Hansen (1997) suggested that it is necessary to construct a no-rejection region of confidence interval to test γ . When the value of $LR_1(\gamma_0)$ is big enough so that p-value falls outside the confidence intervals, it means that we can significantly reject null hypothesis H_0 . This means that threshold estimated value $\hat{\gamma}$ does not equal to the actual threshold value γ_0 . Approximate confidence intervals can be derived from Eq. (20) of Annex-3.

Similar to single threshold model it is necessary to construct a confidence interval for the two threshold parameters $\{\gamma_1, \gamma_2\}$. Bai (1997) uses change point models and finds that the refined threshold estimates and that of single threshold model share the same asymptotic distribution. Therefore, it is suggested that confidence interval should be constructed in the same way that single threshold model is constructed.

The estimator $\hat{\beta} = \hat{\beta}(\hat{\gamma})$ depends on the threshold estimate $\hat{\gamma}$, which appears to complicate interface on β . As Chan (1993) and Hansen (2000) indicated, when threshold estimate is equal to the actual threshold value $\hat{\beta} = \hat{\beta}(\gamma)$, then, $\hat{\beta}$ is close to normal distribution and its covariance matrix is similar to Eq. (23) in Annex-3.

4.4. VARIABLE INCLUDED IN THE MODEL

In this study, it is intended to use financial information in modeling the relationship between operating performance and capital structure inline with loan growth rate and other variables that are assumed to affect the relationship. These variables include operating performance, capital adequacy, capital structure, current ration, and loan growth rate. The definition of variables in this study is as follows:

1. **Operating Performance (OP):** it measures how profitable a RUSACCO's business after all operational expenses have been deducted, thus revealing how effectively the RUSACCO's management is controlling the total expenses. It is one of the profitability ratios and hereby profitability is a measurement for operating performance for RUSACCOs. The highest the margin, the better profitability is.

$$OP = \text{Pre-tax earnings} / \text{Revenue}$$

2. **Capital Structure (CS):** it is the financial mix or percentage of RUSACCO's funds that make-up total capital. It measures business risks of RUSACCOs. It relates to the decision to be taken on composition of capital i.e. own or borrowed fund. The lower the net worth to loan ratio means the higher the business risks.

$$CS = \text{Net Worth to loan Ratio} = \text{Net value} / \text{Loans}$$

3. **Current ratio (CR):** in RUSACCOs financial statement this ratio can easily interpreted as saving to loans. It is one of the quick liquidity ratios and it measures RUSACCO's ability to provide sufficient cash to conduct business over the period. It is also debt repayment ability. If current ratio is smaller than one, it means there are liquidity risks in the short term.

$$CR = \text{Current asset} / \text{Current liabilities}$$

4. **Capital Adequacy (CA):** it is the amount of capital necessary to absorb losses while providing financial stability. Capital adequacy indicates the requirement of capital to cover claims on asset in the event of both expected and unexpected losses. It also indicates the capital strength of RUSACCOs. The higher the saving to net worth ratio means the lower the capital.

$$CA = \text{Saving} / \text{Net value}$$

5. **Loan Growth Rate (LGr):** it is $\text{Loan (t)} - \text{loans (t-1)} / \text{Loans (t-1)}$. The growth in loans is an indicator of and capital utilization for RUSACCOs.

CHAPTER FIVE

RESULT AND DISCUSSIONS

5.1. INTRODUCTION

As mentioned in chapter four, five variables are used as input to determine whether operating performance of RUSACCOs are under the influence of capital structure inline with loans growth rate, whether threshold relationship are different from region to region and also to test if there exist threshold relationship between operating performance of RUSACCOs and loans growth rate included in this study.

Balanced panel data with a total of 368 observations from 65 woredas within four regions was collected from the annual report of FCA for the four year period. This can be taken as balance sheet and income statements of RUSACCOs. To determine the number of threshold, model (25) and model (26) were estimated using LSE allowing for (sequentially) zero, one and two thresholds. The test statistics along with their bootstrap p-values for single and double threshold models are employed to test threshold effects for the four regions jointly and independently.

The next discussion of this chapter categorized into tow sections. The first section discusses the empirical result along with some explanation. The second section reports the outreach and financial performance of RUSACCOs using PEARLS.

5.2. OPERATING PERFORMANCE AND CAPITAL STRUCTURE WITH LOAN GROWTH RATE

Following Hansen's notation Eq. (25) and Eq. (26) was applied to examine whether operating performance of RUSACCOs are under the influence of capital structure, and whether there exist asymmetric threshold relationship.

Summary of the minimum, maximum, mean, percentile, and the standard deviation of dependent and independent variables are given in Table-3. This table shows that the standard deviation of variables of CA and LGr have high values reflected the size difference among the RUSACCOs.

Table-3: The Minimum, Maximum, Mean, Percentile, and the Standard Deviation Of dependent and independent variables

Variable	Min	25% Percentile	Mean	75% Percentile	Max	SD
OP	-0.0166	-0.0162	-0.000026	0.0036	0.3067	0.0331
CA	-1.3245	-0.3783	0.000035	-0.3558	28.0079	2.5368
CR	-0.6554	-0.0602	-8.81e-06	0.3446	1.4821	0.5295
LGr	-1.5034	-0.6118	-4.73e-06	-0.1118	40.0549	2.4723
CS	-1.05585	-0.01045	0.000024	-0.0849	30.8236	1.6655

Source: Researcher Computation

As in Hansen (1999), single and double threshold regression model are used in this study. In the process of panel threshold regression in order to know whether there is single-threshold and/or double-threshold effects and their p-values bootstrapping method was applied along with their F-test statics. This study first tests the threshold effects for the sample RUSACCOs and the test statistics F_1 and F_2 along with their bootstrap p-values are shown in Table-4.

Table-4: Testing of Single and Double Threshold Effects

Test	F	P-Value ⁶	Threshold value		
			10%	5%	1%
Single Threshold	16.7	0.036	8.432	10.621	25.128
Double Threshold	13.38	0.064	8.091	10.978	38.974

Source: Estimation Result

⁶ Note that P-value and threshold values are computed after 300 sampling based on bootstrapping method.

The test result shows that the test for a single threshold F_1 is highly significant with a bootstrap p-value of 0.036, and the test for a double threshold F_2 is also strongly significant with a bootstrap p-value of 0.064. From the finding we conclude that there is strong evidence that there are two thresholds in the regression relationship.

The point estimates of the two thresholds which are 0.1045 and 0.0097 and their asymptotic 95% confidence intervals are reported in Table-5.

Table-5: Estimated Threshold Value with Confidence Interval

Threshold Value	Estimate	95% Confidence Interval
γ_1	0.1045	(0.1026 -- 0.1063)
γ_2	0.0097	(0.0078 -- 0.1153)

Source: Estimation Result

The existing of two threshold values indicates the presence of three regimes. Thus the three classes of RUSACCOs indicated by the threshold value estimates can categorized RUSACCOs with ‘very low net worth’, ‘very high net worth’ and ‘other’.

The asymptotic confidence interval for the estimated threshold values is very tight, indicating little uncertainty about the nature of this division. The 95% confidence intervals for γ_1 and γ_2 can be found from $LR'_1(\gamma)$ and $LR'_2(\gamma)$ by the values of γ for which the likelihood ratio lies. It is interesting to examine the unrefined first-step likelihood ratio function $LR_{1(\gamma)}$, which is computed when estimating a single threshold model. The first-step threshold estimate is the point where the $LR_{1(\gamma)}$ equals zero, which occurs at $\hat{\gamma}_1 = 0.1045$. There is a second major dip in the likelihood ratio around the second-step estimate 0.0097. Thus the single threshold likelihood conveys information that suggests that there is a second threshold in the regression.

Table-6 reports the number of RUSACCOs which fall into the three regimes each year and Regions. We find that most of the RUSACCOs are in the lower net worth to loan ration regime and this result indicates that most of the RUSACCOs are involved in

the higher risk. As we know that the lower the net worth to loan ratio, the higher the business risks is thus the inability to recover loans may trigger an operational crisis. It is interesting to note that the Tigray region show an increase in the number of RUSACCOs with net worth to loan ratios in the last year of the sample.

Table-6: Number of RUSACCO within Three Regimes by Year and Regions

RUSACCO Class	2004	2005	2006	2007
$CS_{it} \leq 0.0097$	85	92	91	75
Amhara	92	92	92	92
Oromia	92	92	92	92
Tigray	92	92	92	75
SNNP	85	92	91	92
$0.0097 < CS_{it} \leq 0.1045$	0	0	0	3
Amhara	0	0	0	0
Oromia	0	0	0	0
Tigray	0	0	0	3
SNNP	0	0	0	0
$0.1045 < CS_{it}$	7	0	0	14
Amhara	0	0	0	0
Oromia	0	0	0	0
Tigray	0	0	0	14
SNNP	7	0	1	0

Source: Estimation Result

The regression slope estimates, conventional OLS standard errors and t-ratio are displayed in Table-7. These results indicate that when net worth to loan ration is either lower than 0.0097 in the single threshold model and lower than 0.1045 in the double threshold model, loans growth creates negative impacts on net profit margins of RUSACCOs. The poor capital structures of RUSACCOs within this range indicate that increase in loans will hurt net profit margins.

Table-7 further indicates that the optimal net worth to loan ration of RUSACCOs should be between 0.0097 and 0.1045. Within this range, the impacts of loans growth to net profit margins are obvious and the impact is significant. In other words, one-unit increase in loans growth creates 0.0854 unit increase in net profit margins.

Table-7: Panel Estimation Results with One and Two Threshold Value

Model:1 One Threshold	Parameter	Estimates	t_{OLS}	OLS_{SE}
Constant	μ_i	0.00076****	0.47	0.00162
CA	θ_1	-0.00131****	-1.91	0.00068
CR	θ_2	0.02368****	7.61	0.00311
LGr I($CS \leq 0.1045$)	β_1	-0.02231****	-2.77	0.00805
LGr I($CS > 0.1045$)	β_2	0.00136****	1.03	0.00133
LR test for null of no threshold (F)		16.7		
Number of Bootstrap replication		300		
Model:1 Two Threshold	Parameter	Estimates	t_{OLS}	OLS_{SE}
Constant	μ_i	0.000751****	0.46	0.00162
CA	θ_1	-0.001310****	-1.91	0.00068
CR	θ_2	0.023817****	7.62	0.00312
LGr I($CS \leq 0.0097$)	β_1	-0.022456****	-2.78	0.00806
LGr I($0.0097 < CS \leq 0.1045$)	β_2	0.085414****	0.39	0.21698
LGr I($CS > 0.1045$)	β_3	0.001366****	1.03	0.00133
LR test for null of no threshold (F)		13.38		
Number of Bootstrap replication		300		

Source: Estimation Result

Meanwhile, this study also finds that two controlled variables such as the capital adequacy which is a proxy variable of deposit to net worth ratio and current ratio which is a proxy variable for liquidity have significant impacts on operating performance which is a proxy variable to net profit margins. The capital adequacy show significant but negative impact on net profit margins, however, on the other hand, current ration show significantly and positive impact on net profit margins. In sum, this study finds that there exists an asymmetric relationship in the effects of loan growth on operating performance of RUSACCOs in the country.

The OLS standard error is quite high, indicating that there is still considerable uncertainty in the estimate. Based on the theory of Hansen (1999) for least squares threshold regression (the model without fixed effect), we would expect the threshold estimates to be consistent. So that asymptotic confidence intervals would still take the form given in Table-5, but would require a different threshold value.

Moreover, this paper also examines whether threshold relationships are different in Amhara, Oromia, SNNP and Tigray regions. This paper tests the threshold effects for sample RUSACCOs from each Region. The empirical finding on Table-8 shows that under 5% significant levels, there is a double-threshold relationship in all four regions.

The F-stats and p-value of the threshold values are also shown in Table-8. These results indicate that both operating performance and loans growth of RUSACCOs in all four regions are under the influence of net worth to loan ratio and therefore, there exist threshold relationships and its existence evaluated.

Since all the four regions are experience significant threshold effects, this study also evaluates all these four regions RUSACCOs. Table-9 shows that the RUSACCOs in all four regions show approximately equal to the threshold value of the country which is 0.1045 and 0.0097. This study finds that the impacts of loans growth to net profit margins within the range of optimal net worth to loan ratio in Tigray (0.000133), and SNNP

(0.0000774) smaller than that of the country (0.0854). This implies to some extent these two regions may use leverage to improve their operating performance.

Table-8: Testing of Threshold Effects of All Regions

Region	Test	F	P-Value ⁷	Threshold value		
				10%	5%	1%
AMHARA	Single Threshold	1.22	0.0086	6.158	6.547	9.258
	Double Threshold	0.72	0.5491	0.091	0.078	1.749
OROMIA	Single Threshold	12.87	0.506	3.432	4.662	5.218
	Double Threshold	21.3	0.002	18.091	17.278	28.974
SNNP	Single Threshold	1.72	0.236	6.432	7.601	9.288
	Double Threshold	1.38	0.2389	1.091	0.093	3.014
TIGRAY	Single Threshold	1.97	0.0306	2.932	3.222	5.108
	Double Threshold	1.23	0.3026	3.091	1.098	4.009

Source: Estimation Result

On the contrary, in Amhara and Oromia regions the impacts of loans growth to net profit margins within the range of optimal net worth to loan ratio is below the optimal level. This may be due to the fact that these regions are where the competition in the rural financial market is the fiercest so that the room for RUSACCOs is squeezed to use financial structure to improve operating performances.

⁷ Note that P-value and threshold values are computed after 300 sampling based on bootstrapping method.

Table-9: Parameter Estimates for Amhara, Oromia, SNNP and Tigray Regions

Amhara	Parameter	Estimates	t_{OLS}	OLS_{SE}
CA	θ_1	-0.8557***	-1.35	0.657
CR	θ_2	0.8326***	1.33	0.624
LGr I($CS \leq 0.0097$)	β_1	- 1.0032***	-1.41	0.716
LGr I($0.0097 < CS \leq 0.1045$)	β_2	dropped		
LGr I($CS > 0.1045$)	β_3	dropped		
LR test for null of no threshold (F)		13.38		
Oromia	Parameter	Estimates	t_{OLS}	OLS_{SE}
CA	θ_1	0.004126***	4.64	0.00089
CR	θ_2	0.000189***	4.55	0.00018
LGr I($CS \leq 0.0097$)	β_1	0.006528***	6.46	0.00101
LGr I($0.0097 < CS \leq 0.1045$)	β_2	dropped		
LGr I($CS > 0.1045$)	β_3	dropped		
LR test for null of no threshold (F)		21.03		
SNNP	Parameter	Estimates	t_{OLS}	OLS_{SE}
CA	θ_1	0.000087***	1.93	0.00005
CR	θ_2	-0.000392***	-0.95	0.00042
LGr I($CS \leq 0.0097$)	β_1	-0.00103***	1.43	0.00072
LGr I($0.0097 < CS \leq 0.1045$)	β_2	-0.00488***	-0.40	0.01205
LGr I($CS > 0.1045$)	β_3	0.000077***	1.57	0.00005
LR test for null of no threshold (F)		13.38		
Tigray	Parameter	Estimates	t_{OLS}	OLS_{SE}
CA	θ_1	0.000035***	1.36	0.00005
CR	θ_2	0.000029***	1.06	0.00003
LGr I($CS \leq 0.0097$)	β_1	-0.00026***	-0.76	0.00035
LGr I($0.0097 < CS \leq 0.1045$)	β_2	0.00038***	0.32	0.0012
LGr I($CS > 0.1045$)	β_3	0.000133***	1.94	0.00005
LR test for null of no threshold (F)		1.23		

Source: Estimation Result

5.3. OUTREACH AND FINANCEAL PERFORMANCE

This section summarizes findings of the RUSACCOs performance using PEARLS based on outreach and financial performance. Outreach is a measure of the scale and depth penetration of RUSACCOs service to treated rural poor.

According to Lariviere and Martin (1999) cited by Wolday (2000), Outreach is the provision of a wide array of quality financial services to a large number of poor people. It is measured in terms of the number of clients, loan size, percentage of loans to clientele below the poverty line, percentage of female clients, range of financial and non-financial services offered to the poor, the level of transaction costs levied on the poor and the extent of client satisfaction with respect to financial services.

Financial performance is the rates which show how RUSACCOs ensure their protection, effective financial structure, rate of return, liquidity, profitability and growth.

In this part of empirical result discussion for the consolidated and for each Regional RUSACCOs outreach which focus mainly on saving and credit service as well as financial performance that focuses specifically on an examination of 12 key financial indicators of the PEARLS looking at key sample RUSACCOs of the four major regions is presented.

5.3.1. SAVING OUTREACH PERFORMANCE

Efforts to extend rural finance services to the people who are undeserved by financial institutions are classified as outreach. Outreach in Ethiopia varies by region (Table-10). Although Oromia is home to the largest number of RUSACCOs (53% of the total number of RUSACCOs as of July 2007, the Amhara region dominates the outreach results with small number of savers (14%) but with large number of borrowers (30%).

On the other hand SNNP is land to the largest borrower (43%) but by half less as compared to the number of savers in Oromia. This could be because of many reasons, among these culture, administration problem to borrow, inability to identify projects, risk aversion behavior, and economic status are the few. Where as Tigray better than Oromia in number of borrowers but less number of savers as compared to other three regions. As of July 2007, all 1,767 RUSACCOs of these four regions served almost one sixth of compulsory savers as borrowers. In general, the number of savers to borrowers in Amhara 3:1, in Tigray 3.2:1, in SNNP 4:1 and in Oromia 23:1.

In terms of scale⁸ that measured in terms of number of individual members, RUSACCOs are generally very small and rarely numbering over 200 members per RUSACCO. In addition to their members, some of these RUSACCOs serve non-member clients (especially teachers) that receive savings services only. As of July 7, 2007, the four regions consolidated saving outreach status shows that all RUSACCOs serving 136,448 members. These RUSACCOs had mobilized a saving 19.6 million birr. This four-year period reveals a huge increase in the volume of savings and reflects the extent to encourage savings mobilization.

In July 2007, in these four major regions there were six member savers (136,448) for every member borrower (22,480). The average saving size per member was Birr 139; however, this figure does not take into account non-member clients and child savers. The average saving size per member increased slightly from Birr 99 in 2005 to Birr 120 and Birr 139 in 2006 and 2007 respectively. This consolidated data are presented in-depth in the following ways.

⁸ Before mid 2008, the number of RUSACCOs that have more than 200 members are Tigray (3), SNNP (53), Amhara (5) and Oromia (29)

**Table-10: Summary of Outreach indicators by Region
(July 7, 2007)**

Indicator	Amhara	Oromia	SNNP	Tigray	Ethiopia
Number of RUSACCOs	254	937	344	232	1,767
Number of Borrowers	6,720	3,011	9,639	3,110	22,480
% of Regional Borrowers to Countrywide Borrowers	30%	13%	43%	14%	100%
Number of Savers	19,709	68,625	36,735	11,379	136,448
% of Regional Savers to Countrywide Savers	14.4%	50.3%	26.9%	8.4%	100%

Source: Authors calculation from the data from FCA and RCPBs

5.3.1.1. AMHARA

The Amhara RUSACCOs (here after ARUSACCOs) served 20,357 clients (19,709 members, 232 non-members, and 416 Children) in July 7, 2007. It has increased its membership by 103% on average in the last five years. ARUSACCO has 20,465 saving accounts that belong to members, non-member clients and children under the age of 6 to 13.

Since ARUSACCOs served a total of 20,357 clients on July 7, 2007, the fact that there are 20,465 saving accounts illustrates that there are members-clients that have multiple savings accounts; for example, a voluntary savings account and a compulsory savings account. The most popular account is the passbook savings (compulsory savings). The Table-11 below illustrates that the number of saving accounts is concentrated in compulsory savings (earn 3.5% interest as of July 7, 2007) while the voluntary saving volume is concentrated in voluntary savings (members and non-members) and children savings. The annual saving size at ARUSACCOs per member is Birr 294, representing 33.4% of GNP per capita⁹.

⁹ For the case of simplicity in all four regions it is assumed that GNP per capita is Birr 880 (USD 100) (2007, WB)

Table-11: Type of Savings and Saving Accounts

Type of Savings and Saving Accounts	Compulsory (Passbook) Savings	Voluntary Savings		Child Savings	Total
		Members	Non-Members		
Number of Saving Accounts	19,709	232	108	416	20,465
% of Total Number	96.5%	1.13%	0.54%	2.03%	100%
Volume of Total Savings ('000 Birr)	5,786.25	70.17	24.81	31.24	5,912.47
% Volume of Total Savings	97.86%	1.19%	0.42%	0.53%	100%
Maximum Saving Size per product (Birr)	335.00	250.00	308.00	17.00	
Minimum Saving Size per product (Birr)	1.00	3.50	2.00	1.00	
Average Saving Size per					
• Product (Birr)	293.58	3.03	229.7	75.08	288.91
• Member (19,709)- Birr					293.58
• Member/GNP per Capita*					33.36%

Source: Authors calculation from the data from FCA and RCPBs

In the region from the 20,465 saving accounts 15,659 corresponded to men (76.5%) and the remaining accounts belonged to women. On other hand, 91% of the saving accounts are for amounts less than Birr 20.00. While these small accounts make up 86.3% of the volume of total saving accounts, a mere 4% of accounts larger than Birr 50 make up 7.7% of the savings volume (Table-12).

Table-12: ARUSACCOs Compulsory Savings Outreach (July 7, 2007)

Description	<\$10	\$10–20	\$20–50	\$50–100	>\$100	Total
Number of Saving Accounts	11,992	5,942	985	493	297	19,709
% of No. of Saving Accounts	60.85%	30.15%	5.0%	2.5%	1.5%	100%
Volume of Savings ('000 Birr)	3,903	1,200	335	237	218	5,913
% Volume of Total Savings	66%	20.3%	6%	4%	3.7%	100%

Source: Authors calculation from the data from FCA and RCPBs

5.3.1.2. OROMIA

There are 68,625 members of Oromia RUSACCOs (here after ORUSACCOs) at July 7, 2007. Like Tigray and SNNP in the region there is no any practice in promoting child savings. Besides, there is no any evidence at FCA that show the existence of any of the saving accounts other than compulsory savings during this study in the region. On account of that the analyses on saving outreach mainly focus on compulsory (passbook) savings.

The existing data shows that there were 68,625 saving accounts with total savings amount Birr 5,055,054. The average saving size at ORUSACCOs per member is Birr 73.66, representing 8.37% of GNP per capita. ORUSACCOs unlike to other regions RUSACCOs are dominated by women savers. In the region there are 44,809 (65%) women savers as of July 7, 2007 (Table-13).

5.3.1.3. TIGRAY

The Tigray RUSACCOs (here after TRUSACCOs), served 11,379 members at July 7, 2007. In this region there is no any practice in promoting child savings. The available data at FCA doesn't have any of the saving accounts other than compulsory savings in the region. Because of this it is difficult to analyze the saving outreach other than compulsory savings.

In the region there were 11,379 saving accounts with Birr 5,310,365 total savings having Birr 288.5 maximum and Birr 4.50 minimum saving size per product. The average saving size at TRUSACCOs per member is Birr 469 representing 53.3% of GNP per capita. TRUSACCOs have a less membership per RUSACCOs compare to Amhara, SNNP and Oromia but higher in savings per RUSACCOs as well as average size per members (Table-13); therefore, it has a larger concentration of volume in the compulsory savings category. Of the total passbook saving accounts, 38% of these corresponded to women, while men had 62% of the number of accounts.

5.3.1.4. SNNP

In the case of SNNP similar to Oromia and Tigray regions there is no any practice in promoting child savings and saving accounts other than compulsory savings. The SNNP RUSACCOs (here after SRUSACCOs), served 36,735 members at July 7, 2007.

According to the data obtained from FCA, there are 36,735 saving accounts as equal to their member size with total savings amount Birr 2, 706,043 having Birr 636.35 maximum and Birr 19.34 minimum saving size per product. The average saving size at SRUSACCOs per member is Birr 73.66 similar to Oromia region, representing 8.37% of GNP per capita (Table-13).

Table-13: Summary of RUSACCOs Membership and Compulsory Savings (July 7, 2007)

Description	Amhara	Oromia	SNNP	Tigray	Ethiopia
Average Membership Size/RUSACCOs	78	73	106	48	76
Compulsory Saving/Member (Birr)	293.58	73.66	73.66	469.24	139.42
Compulsory Saving/RUSACCOs(Birr)	22,780.00	5,394.94	8,023.13	22,889.50	10,540.31
Total Compulsory Savings (Million Birr)	5.79	5.06	2.76	5.31	19.6
% Total Compulsory Savings	29.5%	25.8%	17.6%	27.1%	100%
Average Compulsory Saving per Member /GNP per Capita*	33.36%	8.37%	8.37%	53.32%	15.84 %

Source: Authors calculation from the data from FCA and RCPBs

5.3.2. LOAN OUTREACH PERFORMANCE

Paralleling the growth of savings volume from Birr 1.7 million in July 7, 2004 to Birr 19.6 million in July 7, 2007, the gross loan portfolio of the 1,767 RUSACCOs increased from Birr 1.33 million in July 7, 2004 to Birr 19.28 million in July 7, 2007. The average loan size in mid of 2007 was Birr 839. This shows the average loan size represents 95.34% of GNP per capita. This average loan size is three times higher than

the average loan size of Birr 277 in July 7, 2005. The loan portfolio, as the savings portfolio discussed above, suggests that the four regions RUSACCOs in general serve the poor with rural finance services.

The general situation loan outreach performance for of four major regions is presented in Table-14 and the in-depth analysis of Amhara and Tigray region subsequently. However, due to absence of sufficient information at FCA, it is difficult to analyze for Oromia and SNNP.

Table-14: Summary of RUSACCOs Loan Outreach (July 7, 2007)

Description	Amhara	Oromia	SNNP	Tigray	Ethiopia
No. of RUSACCOs	254	937	344	232	1,767
Loan service provider RUSACCOs	138	NA	NA	111	249
% of Loan service Providers	54%			47.8	14%
Volume of Loan (Birr)					
• July 2007	7,520,261	4,522,610	1,587,600	5,627,402	19,258,343
• July 2006	1,288,628	1,004,235	1,645,058	2,700,402	6,638,323
• July 2005	1,045,939	650,000	116,280	286,373	2,098,592
No. of Members in RUSACCOs	19,709	68,625	36,735	11,379	136,448
No. of Borrowers	6,720	3,011	9,639	3,110	22,480
% Borrowers per Members	34%	4%	26%	27%	17%

NA: No Information Available (i.e. number of borrowers and loan service provider RUSACCOs)

Source: FCA, RCPBs and Authors calculation from the data from FCA and RCPBs

5.3.2.1. Amhara

ARUSACCOs had 6,720 loans borrowers in July 2007. The fact that ARUSACCOs serves clients that are members only (108 non-member savers) and offers child savings services (416 accounts) helps to provide the RUSACCOs with the resources to finance its lending portfolio. In total there are roughly three savers (20,645) for each one borrower (6,720). The average loan size granted at ARUSACCOs in July 2007 was Birr 1,120 and it was 127% of GNP per capita.

These loan sizes are larger than the consolidated average loan size Birr 838 for the same year. These larger loans may be indicative of more flexible loan products that meet the size demands of member borrowers. Many of the RUSACCOs in Amhara have yet to adopt savings driven growth and continue to rely on shares for financing portions of their loan portfolios. In the region men holds 75% of the number of loan beneficiaries and these loans represent 86% of the volume of loan portfolio.

As shown above in the Table-15, only 138 ARUSACCOs were participating in the loan service out of 254 existing RUSACCOs. At ARUSACCO, loans granted for amounts Birr 501 to Birr 1,000 are 42% of the number of RUSACCOs operating loan services. Three-fourths (73%) of the ARUSACCOs loans amount are for less than Birr 1,000. ARUSACCO is an example of where a few loans (10% of the number of RUSACCOs operating loan services) total more than \$2,000. The depth of the lending activities can be hidden if one does not examine loan size distribution in addition to looking at average loan sizes. The median loan size of Birr 1,369.25 is much more representative than the Birr 1,120 average loan size granted.

Table-15: Depth of Loan Outreach in Amhara (July 7, 2007)

Description	<\$500	\$501–1,000	\$1,001–2,000	\$2,001–3,000	>\$3000	Total
No. of Loan service provider RUSACCOs	43	58	24	8	5	138
% out of total (138)	31%	42%	17%	6%	4%	100%
Volume of Loan (Birr)	430,393	2,021,587	2,697,302	1,428,221	945,638	7,523,141
% of portfolio Volume	6%	27%	36%	19%	12%	100%

Source: Authors calculation from the data from FCA and RCPBs

5.3.2.2. Tigray

By the end of July 2007, 111 TRUSACCOs had provided loan services to their members from. In total there are four savers (11,379) for one borrower (3,110). The average loan size granted at TRUSACCOs was Birr 1,810 which is higher than ARUSACCO loan amount and the median loan size granted in July 2007. The average loan size granted was 206% of GNP per capita while that of the median loan size granted was 100% of GNP per capita. In the region men holds 71% of the number of loan beneficiaries.

Table-16: Depth of Loan Outreach in Tigray (July 7, 2007)

Description	<\$500	\$501–1,000	\$1,001–2,000	\$2,001–5,000	>\$5000	Total
No. of Loan service provider RUSACCOs	15	46	31	15	4	111
% out of total (138 not 254)	14%	41%	28%	14%	3%	100%
Volume of Loan (Birr)	53,728	905,421	1,510,917	1,116,581	1,991,260	5,627,872
% of portfolio Volume	1%	16%	27%	20%	36%	100%

Source: Authors calculation from the data from FCA and RCPBs

Table-16 show numbers of loan service provider RUSACCOs are smaller in Tigray than Amhara even though the larger loan size possible at ARUSACCOs was Birr 4,842 and at TRUSACCOs was Birr 15,341 which is three times double than the ARUSACCOs. Like the saving portfolio, the loan portfolios at TRUSACCOs signals depth outreach. The loan size ranges from Birr 110.71 to Birr 4,841.50.

In the Tigray out of 232 TRUSACCOs only half of them were participating in the loan service and loans granted for less than Birr 1,000 were 55% of the number of RUSACCOs operating in loan services. Four TRUSACCOs whose loan amount greater than Birr 5,000 represented 36% of the total loan portfolio volume.

5.4. FINANCIAL PERFORMANCE

This section looks at key ratios of the PEARLS to assess the consolidated financial performance of 1,767 RUSACCOs of the four major regions and the individual performance of Amhara, Oromia, SNNP and Tigray RUSACCOs.

Summary of the standards and achievements using 12 PEARLS ratios for the four regions is shown in Table-17.

Table-17: Summary of PEARLES Standards and Achievements

Ratio	Standard	4 Regions	Amhara	Oromia	Tigray	SNNP
P1	100%	Not Practiced in all Regions				
P2	35%	Not Practiced in all Regions				
P6	100%	58%	66%	106%	44%	66%
E1	70-80%	79%	135%	41%	212%	67%
E5	70-80%	83%	134%	49%	202%	76%
A1	<=5%	≤ 2.2% ¹⁰	3%	NA	4.2%	NA
A2	<=5%	≤ 2.2% ¹¹	2.5%	NA	2.2%	NA
R9	<10%	<10% ¹²		<10%		
S1	Dependent on E1	Very low				
S5	Dependent on E5	42%				
S7	Dependent on E7	18.6%				
S10	>5%	15.7%				

Source: Results Calculation

5.4.1. PROTECTION

The primary goal of evaluating the protection indicators (P1 and P2), as the heading implies, is to ensure that RUSACCOs provides depositors a safe place to save their money. Provisions for loan losses are the first line of defense against unexpected losses to the RUSACCOs. The goal of P1 is to have 100% provisions for loan losses from loans that are greater than 12 and the goal of P2 is provisions of 35% net allowance for loan losses required for loans delinquent between one and twelve months. However, both P1 and P2 are not practiced until this study was conducted. According to WOCCU when RUSACCOs do not recognize loan losses the following undesirable results will be produced. These are asset values are inflated, reported net income is overstated, member savings are not secure and dividends are overstated and erroneously paid out.

¹⁰ Melkamu (2006)

¹¹ Melkamu (2006)

¹² Melkamu (2006)

The other protection indicator considered in this study is solvency (P6). This indicator measures the relative worth of one birr in member savings after adjusting for known and probable losses. By the use of total asset, saving and share of the consolidated 1,767 RUSACCOs solvency ratios varies from 44% in Tigray to 106% in Oromia. On average the solvency ratio of four regions RUSACCOs from 2005 to 2007 (data not available for 2004) is less than 50% of the world standard. This implies the situation needs early attention by the promoters and regulator of RUSACCOs in the country.

5.4.2. EFFECTIVE FINANCIAL STRUCTURE

The financial structure is the most important variable that affects growth, profitability and efficiency. RUSACCOs that maintain most (70-80%) of their total assets in the loan portfolio have the greatest opportunity to maximize returns on these productive assets while providing their member-clients with the credit services they seek. Financial structure is always changing and requires careful management, especially in cases of rapid growth.

In this study E1 and E5 are the indicators that considered due to the availability of data. The goal of E1 is placing 70-80% of its total assets in loans to its members and E2 is to have the same amount as E1 for savings to total asset. Results of these ratios analysis show that except Oromia the other three regions attained the target. This findings show that since the loan portfolios the most profitable asset of RUSACCOs maintaining this ratio determine they are in a road to have growth potential and overall financial strength. Similarly, a healthy percentage of savings indicate that RUSACCOs has developed effective marketing and is well on their way to achieving financial independence.

5.4.3. ASSET QUALITY

Asset quality is the main variable that affects RUSACCOs profitability. An excess of defaulted or delayed repayment of loan have negative effect to RUSACCOs earnings because these assets are not earning income (WOCCU, 2002). In this study A1 and A2 are the indicators that considered analyzing the asset quality of RUSACCOs.

The goal of A1 is to maintain the delinquency rate below 5% of total loans outstanding. Where as that of A2 is to limits non-earning assets to a maximum of 5% of the total credit union an asset. According to Melkamu (2006), both A1 and A2 attained less than 2.2% which is by half lower than the WOCCU standard. This indicates in majority of RUSACCOs there is institutional weakness and the do have more difficult to generate sufficient earnings.

5.4.4. RATE OF RETURN AND COSTS

The Rates of Return and Costs indicators monitor the return earned on each type of asset and the cost of each type of liability. On the assets side, one can determine what types of assets earn the highest returns. On the liability side, one can determine what the least and most expensive sources of funds are. In this study R9 considered as a key indicator to analyze the administrative cost of RUSACCOs per average total asset. The goal of R9 is to maintain operational and administrative cost at 5% of average total assets. Compared to other rural finance institutions, RUSACCOs have much lower operational cost which is a primary ratio to determine their efficiency. According to Melkamu (2006), administrative cost is much lower than 10% in Amhara and Tigray regions.

5.4.5. SIGNS OF GROWTH

Signs of Growth reflect member client satisfaction, appropriateness of product offerings and financial strength. Growth directly affects RUSACCO's financial structure and requires close monitoring to maintain balance. In this study growth in loans, saving, share and member are analyzed. In general in the 1,767 consolidated RUSACCOs, there has been increasing membership about 15.7%, savings by 42% and member share by 18.6% per year during 2004 to 2007. However, there is no any significant growth in loans. The result of this analysis shows that there is sign of growth S5, S7 and S10. However, growth by itself is insufficient the only successful way to maintain asset values is through strong, accelerated growth of assets, accompanied by sustained profitability. Therefore, each RUSACCO of these four regions should give attention to the growth indicators of PEARLS since they can help RUSACCOs to maintain a balanced and effective financial structure.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1. CONCLUSION

RUSACCOs are among the various types of cooperatives in the country who begins their operation after 2000. Over the past eight years, they are characterized by insignificant market share, slow return on capital as compared to fast growth in members and feeble in competition. Although RUSACCO in the country do have such obstacles they have made their contribution to the local economics in rural Ethiopia, due to the historical role of the cooperative movement.

The goal of this paper is to investigate whether operating performance of RUSACCOs are under the influence of capital structure inline with loan growth rate. Following Hansen (1999), a least square estimation of threshold and regression slops using fixed effects transformation was applied. The empirical research of this study finds that the optimal net worth to loan ration of RUSACCOs should be between 0.0097 and 0.1045. This conveys that there is a second threshold and RUSACCOs fall into three regimes.

RUSACCOs in the lower net worth to loan ratio involved in the higher risk. The higher the business risks thus imply the inability to recover loans and it may trigger an operational crisis. Within this range, the impacts of loans growth to net profit margins are obvious and the impact is significant. In other words, one-unit increase in loans growth creates 0.0854 unit increase in net profit margins. Also, both loan growth rate and operating performances of RUSACCOs in four regions are under the influence of net worth to loan ratio and threshold effect exist. Meanwhile, this study also finds that the capital adequacy and liquidity have significant impacts on operating performance. The capital adequacy show negative while liquidity positive impact on net profit margins.

Outreach is a measure of the scale and depth penetration of RUSACCOs service to treated rural poor. Financial performance is the rates which show how RUSACCOs ensure their protection, effective financial structure, rate of return, liquidity, profitability and growth.

The empirical result of performance measurement indicators indicated that outreach varies by region, they served almost one sixth of their members. In addition, these RUSACCOs are not practiced allowance for loan loss but have been implemented other indicators. The result of the software indicated that majority of the four regions RUSACCOs are not in a position to attend the WOCCU standards.

6.2. RECOMMENDATION

On the basis of the above findings, the following measures are recommended to enhance the operational efficiency of RUSACCOs in the country.

- **Revisit the policy framework for the financial sector for improving broad-based, inclusive access to finance:** To be effective, the rural financial service will need to be embedded in a set of overall policies and strategies that support sustainable, pro-poor financial systems development and integrated globally accepted good practices.
- **Maintain proactive support of Government for the development of cooperative financial services:** Making ownership and governance of cooperative financial sector more transparent and independent; making funds available for growth on increasingly business terms, and developing guarantee schemes, to facilitate greater financing from other sources; and making the full cost of service transparent.

- **Raise public confidence in the sustainability, credibility and reliability of RUSACCOs:** Poor public perception is partly related to the past cooperative crisis, but doubts are also raised due to the many inherent operational and systemic weaknesses of RUSACCOs and their emerging system. Dependence on donor driven (RUFIP/CSS) and government support needs to be replaced by a primary emphasis on member-based governance and increased savings mobilization, especially in RUSACCOs.
- **Expand operations of RUSACCOs:** A more systematic approach is needed to better utilize excess liquidity in commercial bank of Ethiopia to help meet the enormous funding needs of RUSACCOs. Successful experiences should be documented and disseminated. Guarantee fund schemes can serve as a tool to help overcome the reluctance of the banks to lend to RUSACCOs.
- **Develop more pro-poor financial services:** Besides indirect support develop direct lending products, particularly for RUSACCOs. Deposit mobilization could also be important if designed to be accessible to the poor.
- **Put increased emphasis on capacity building.** While funders have provided several credit lines to re-finance RUSACCOs, there is increasing demand for technical assistance to enable the growth of rural finance to be sustainable.

In general the above recommendations are broad and they are more relating to the policy makers. However, to be specific to the RUSACCOs under this study they are required to give great emphasis to the following issues:

1. Financial management of RUSACCOs should be efficiently managed by employed accountants;
2. Interest rates should reflect the real cost of the service and safe-guard self-sufficiency, i.e. pricing should include operational costs and inflation and financial costs.

3. The know-how and technical capacity of board members and management should be strengthened; participation of members should also be stronger.
4. Internal management and control systems, as well as audit services should be strengthened with support of cooperative promotion offices.
5. Sustainable sources of funding should be made available, especially for the RUSACCOs with their limited ability to raise savings.
6. Attention should be given to the WOCCU standards and strategy should be designed to achieve the targets annually,
7. Strategy should be developed to expand the outreach and improve financial performance.
8. Creation of an institutional framework for a higher level cooperative system. This should improve refinancing opportunities for RUSACCOs and spread risk.
9. RUSACCOs leaders and supporters should use financial leverage wisely to improve the operating efficiency in order to maximize the RUSACCOs value and to the debt ratio to make investment decisions.
10. Attention should be given to product development other than saving and loan services.
11. Role of RUSACCOs should be revised according to the RUSACCO promotion materials

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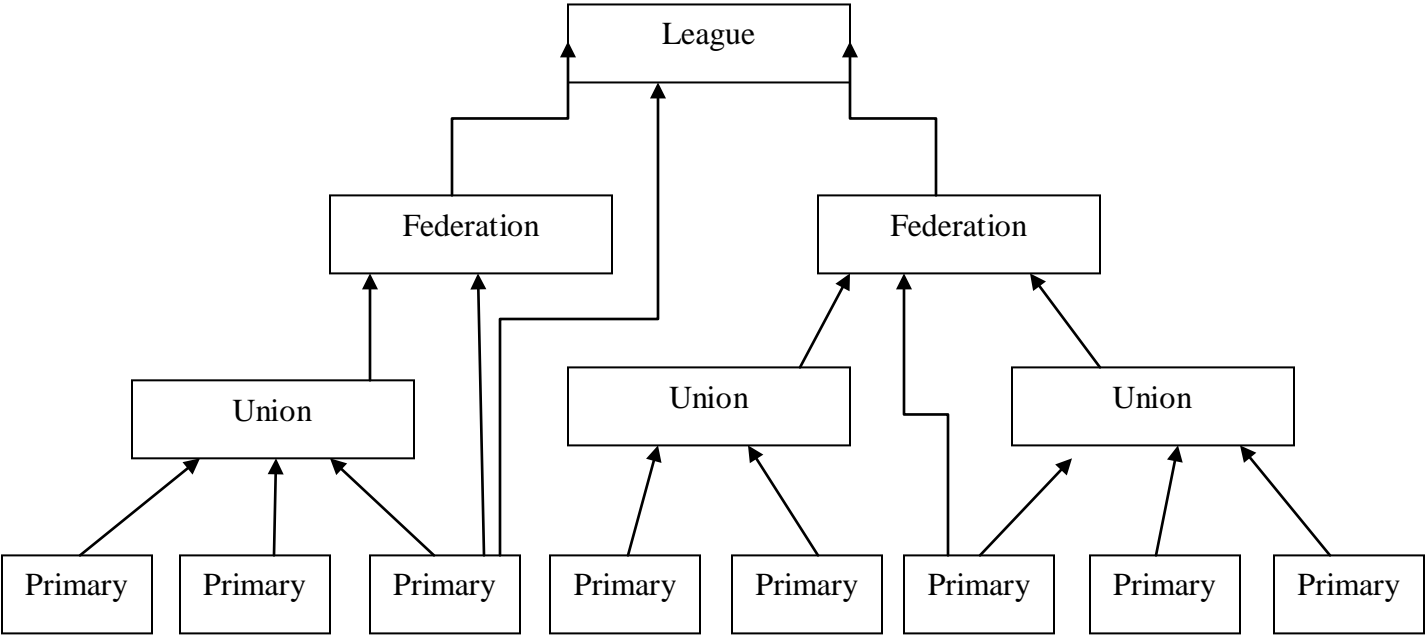
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Figure-1: Four Hierarchy level for RUSACCOs



Annex--1: Urban and Rural SACCOs in Ethiopia

Period /Year	USACCO	Cumulative USACCO	RUSACCO	Cumulative RUSACCO	Total Number of SACCOs
Imperial Regime 1974	35	35	--	--	35
Derge Regime 1990	65	484	--	--	484
Transitional Govt 1994	71	497	--	--	497
EPRDF Regime					
1995	25	522	--	--	522
1996	56	578	--	--	578
1997	42	620	--	--	620
1998	50	670	--	--	670
1999	46	716	--	--	716
2000	48	764	3	3	767
2001	81	845	15	18	863
2002	83	928	32	50	978
2003	278	1,206	39	89	1,295
2004	703	1,909	148 ¹³	237	2,146
2005	624	2,533	405	642	3,175
2006	375	2,908	628	1,270	4,178
2007	557	3,465	709	1,979	5,444
Mid 2008	250	3,715	191	2,170	5,885

Source: USACCO (1978 – 1999): Wolday (2003)

USACCO and RUSACCO (2000 – Mid 2008): Melkamu (2006)

¹³ 11 RUSACCOs was promoted with support of ACE Programme and the rest 137 with RUFIP/CSS

Annex-2: List of RUSACCOs in the study

Amhara

Year	RUSACCOs	Woreda
1993	Gojjam Ber	Dejen
1994	Hiwote Selam	Burie
1994	Andenet	Alefa
1994	Alem Tsehay	Lay Gayent
1994	Edget Ber	Lay Gayent
1995	Andinet	Dejen
1995	Tesfa	Dejen
1995	Yetmen	Enemay
1995	Genet Ber	Burie
1996	Abay	Debay Tilatgen
1996	Muday	Huletiju Enesie
1996	Tach Ber	Jabi Tehnan
1996	Mesobe work	Yilmana Densa
1996	Genet Womberma	Womberma
1996	Beranti	Dangila
1996	Tseda	Gonder Zuria
1996	Yezelkal	Alefa
1996	Taddese	Alefa
1996	Tenkel Ber	Chelga
1996	Gonder Ber	Fogera
1996	Shewaber	Dejen
1996	Edget Lerobit	B/Dar Zurya
1996	Melka Jebdu	Ankober

OROMIA

Year	RUSACCOs	Woreda
1996	Hulul	Robe
1996	Sadik	Robe
1996	Sululta Wakite	Sude
1996	Lemu Dima	L/Bilbilo
1996	Lemu Aria	L/Bilbilo
1996	Katar Genet	Tiyo
1996	Watera Misa	Diksis
1996	Abdi Rabi	D/Tijo
1996	Ifa Kabenya	Merti
1996	Burka Gemechisa	D/Sire
1996	Shabo Shuli	Cholle
1996	Kusaye veg.producers	Ejere
1996	Hora sankale	Ambo
1996	Dano Rogge	Dano
1996	Rikicha Gudina	Dawo
1996	Sike	Ilu
1996	Tombe	Weliso
1996	Derara Tedecha	Boset
1996	Welenchit Andinet	Boset
1996	Hawi Gudina	Shashemane
1996	Gemechu Gola	Fentale
1996	Dale	Berek Aleltu
1996	Chancho	Sululta Mulo

SNNP

Year	RUSACCOs	Woreda
1996	KALSHA	Lemo
1996	ANDNET	Lemo
1996	SUNDUSA	Soro
1996	WESHEBA	Soro
1996	DEGA KEDIDA	kedida
1996	NEGAGE	kedida
1996	SHINE JEBA	Angacha
1996	KUYAA	Angacha
1996	HASSE GOMISA	Wonago
1996	DAMA DERARCHO	Wonago
1996	KOKEBERISA	Yirga Chefa
1996	HARU ANDINET	Yirga Chefa
1996	MANTENA TOME	Sodo Zuria
1996	WAJA KERO	Sodo Zuria
1996	BOMBAY	Boloso Soro
1996	BASSA GOFERA	Boloso Soro
1996	BECHA GULCHAMO	Meskan
1996	KOCHE LIMAT	Meskan
1996	JEJU WALEGA	Abeshge
1996	NACHA QULIT	Abeshge
1996	BERHAN	Aleta Wodo
1996	ADDIS FANA	Aleta Wodo

TIGRAY

Year	RUSACCOs	Woreda
1996	Jehane	Almata
1996	Alem birhan	Almata
1996	E/Hashenge	Ofla
1996	Hiwot	Ofla
1996	Haftamnesh	E/Mehoni
1996	Fre Alaje	Emba Alaje
1996	Fana	H/Wejerat
1996	Densa	H/Wejerat
1996	Mesert Me-ebale	Enderta
1996	Meballe	K/Awla-elo
1996	Goigol Hayeloga	S/T/Amba
1996	Wereruba	Adwa
1996	Senay	Adwa
1996	Hamodo	M/Leko
1996	Marta	Ahferom
1996	Kokeb	W/Leke
1996	H/Selam	D/Tembien
1996	Kebabo	Tsegdie
1996	Wuhdet	T/Adiabo
1996	Kassech	T/koraro
1996	Atakilti	K/Tembien
1996	Mengesha	Tselemti

ANNEX-3: The Model Specification, Estimation and Testing

Hansen Model (1999)

1. MODEL SPECIFICATION

The following model specification is for a single threshold model. However, in practice multiple threshold models may appear. As in Hansen (1999) the observed data are a balanced panel $\{y_{it}, q_{it}, x_{it} : 1 \leq i \leq n, 1 \leq t \leq T\}$. The subscript i indexes the RUSACCOs and the subscript t indexes time. The dependent variable (net profit margin as proxy variable to operating performance) y_{it} is scalar, the threshold variable (net worth to loan as proxy variable to capital structure) q_{it} is scalar, and independent variable (loan growth rate as proxy variable to business growth) x_{it} is a k vector. The structural equation of interest is:

$$y_{it} = u_i + \beta_1' x_{it} I(q_{it} \leq \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + e_{it} \quad (1)$$

where $I(\cdot)$ is the indicator function. An alternative way of writing (1) is:

$$y_{it} = \left\{ \begin{array}{l} u_i + \beta_1' x_{it} + e_{it}, \text{ if } q_{it} \leq \gamma \\ u_i + \beta_2' x_{it} + e_{it}, \text{ if } q_{it} > \gamma \end{array} \right\}$$

Another compact representation of (1) is

$$y_{it} = u_i + \beta' x_{it}(\gamma) + e_{it} \quad (2)$$

The observations are divided into two 'regimes' depending on whether the threshold variable q_{it} is smaller or larger than the threshold value i.e. γ . The regimes are distinguished by differing regression slopes, β_1 and β_2 . For the identification of β_1 and β_2 , independent variable x_{it} has to be time invariant. Meanwhile, it is also assumed that threshold variable q_{it} is time invariant. The item e_{it} is assumed to be independent and identically distributed (iid) with mean zero and finite variance σ^2 . The extended model allows the existence of heterogeneous variables. When T remains constant, and $n \rightarrow \infty$, this model derives similar conclusions.

In addition, in some applications there may be multiple thresholds. In this study the following multiple or double thresholds model is considered.

$$y_{it} = u_i + \beta_1' x_{it} I(q_{it} \leq \gamma_1) + \beta_2' x_{it} I(\gamma_1 \leq q_{it} \leq \gamma_2) + \beta_3' x_{it} I(\gamma_2 < q_{it}) + e_{it} \quad (3)$$

Where thresholds are ordered so that $\gamma_1 < \gamma_2$ and in this study it is possibly to extend model (1) into multiple thresholds model.

2. ESTIMATION

As Hansen (1999) shows in his paper, the least square estimation with fixed effect transformation was applied in this study. One traditional method to eliminate individual effect (u_i) is to remove individual averages, i.e. de-mean. This method is easy to understand in linear models, but requires extra cautions in non-linear models. Therefore, this paper derives the average of Eq. (1) for single thresholds model:

$$\bar{y}_i = u_i + \beta' \bar{x}_i(\gamma) + \bar{e}_i \quad (4)$$

Where $\bar{y}_i = T^{-1} \sum_{t=1}^T y_{it}$ $\bar{e}_i = T^{-1} \sum_{t=1}^T e_{it}$

$$\bar{x}_i(\gamma) = T^{-1} \sum_{t=1}^T x_{it}(\gamma) = \begin{pmatrix} T^{-1} \sum_{t=1}^T x_{it} I(q_{it} \leq \gamma) \\ T^{-1} \sum_{t=1}^T x_{it} I(q_{it} > \gamma) \end{pmatrix}$$

Eq. (2) subtracts Eq. (4) can derive:

$$y_{it}^* = \beta' x_{it}^*(\gamma) + e_{it}^* \quad (5)$$

Where $y_{it}^* = y_{it} - \bar{y}_i$, $x_{it}^*(\gamma) = x_{it}(\gamma) - \bar{x}_i(\gamma)$ and $e_{it}^* = e_{it} - \bar{e}_i$.

All the data and errors of the second phase and the following get stacked up and can be defined as follows:

$$y_i^* = \begin{bmatrix} y_{i2}^* \\ \vdots \\ y_{iT}^* \end{bmatrix}, x_i^*(\gamma) = \begin{bmatrix} x_{i2}^*(\gamma)' \\ \vdots \\ x_{iT}^*(\gamma)' \end{bmatrix}, e_i^* = \begin{bmatrix} e_{i2}^* \\ \vdots \\ e_{iT}^* \end{bmatrix}$$

Based on the above definition, $Y^* = y_i^*$, $X^*(\gamma) = x_i^*(\gamma)$, $e^* = e_i^*$, therefore, Eq. (5) can be rewritten into the following:

$$Y^* = X^*(\gamma)\beta + e^* \quad (6)$$

For any given γ , the slope coefficient β can be estimated by ordinary least square (OLS).

That is:

$$\beta(\gamma) = (X^*(\gamma)' X^*(\gamma))^{-1} X^*(\gamma)' Y^* \quad (7)$$

The vector of regression residual is $\hat{e}^* = Y^* - X^*(\gamma)\beta(\gamma)$. Meanwhile, sum of squared error (SSE) is:

$$\begin{aligned} S_1(\gamma) &= \hat{e}^*(\gamma)' \hat{e}^*(\gamma) \\ &= Y^{*1} (I - X^*(\gamma)' (X^*(\gamma)' (X^*(\gamma))^{-1} X^*(\gamma)') Y^* \end{aligned} \quad (8)$$

Chan (1993) and Hansen (1999) recommended estimation of γ ¹⁴ by least squares. This is easiest to achieve by minimization of the concentrated SSE (8). Hence, the least squares estimator (LSE) of γ should be:

$$\hat{\gamma} = \arg_{\gamma} \min S_1(\gamma) \quad (9)$$

When threshold value $\hat{\gamma}$ is determined, it is possible that the numbers of observations in certain section are too few or null. Therefore, in the selection of the optimal threshold value $\hat{\gamma}$, limits can be added that 1% or 5% (or any percentage) observations should be included in-between two sections. As soon as the optimal

¹⁴The computation of the LSE of the threshold γ involves the minimization problem (9). Since $S_1(\gamma)$ depends on γ only through the indicator functions $I(q_{it} \leq \gamma)$, the $S_1(\gamma)$ is a step function with at most nT steps, with the steps occurring at distinct values of the observed threshold variable q_{it} . Thus the minimization problem (9) can be reduced to searching over values of γ equaling the (at most nT) distinct values of q_{it} in the sample. To implement the minimization, the following approach may be taken. Sort the distinct values of the observations on the threshold variable q_{it} . Eliminate the smallest and largest g% for some $g > 0$. The remaining N values constitute the values of γ which can be searched for $\hat{\gamma}$. For each of these N values, regressions (7) are estimated yielding the SSE (8). The smallest value of the latter yields the estimate $\hat{\gamma}$. In practice, N may be a very large number, and the optimization search describe above may be numerically intensive. A simplifying shortcut which yields nearly identical results is to restrict the search to a smaller set of values of γ . Instead of searching over all values of q_{it} (between the g% and (1-g) % quantile) the search may be limited to specific quantile, perhaps integer valued. This greatly reduces the number of regressions performed in the search. The estimates from such an approximation are likely to be sufficiently precise for most applications of interest.

threshold value $\hat{\gamma}$ is derived, the estimation of slope should be $\beta = \beta(\hat{\gamma})$, and residual vector should be $\hat{e} = \hat{e}^*(\hat{\gamma})$. The estimation of residual variances should be:

$$\hat{\sigma}^2 = \frac{1}{n(T-1)} \hat{e}^* \hat{e}^* = \frac{1}{n(T-1)} S_1(\gamma) \quad (10)$$

Similarly, when (γ_1, γ_2) is known in the multiple threshold model, the linear slope coefficients $(\beta_1, \beta_2, \beta_3)$ can be estimated with OLS to compute $S(\gamma_1, \gamma_2)$. However, the process is highly complex and it requires approximate $N^2 = (nT)^2$ to gradually identify by grid search. According to Chong (1994), Bai (1997) and Bai-Perron (1998) in the multiple change point model, the continuous estimates are fixed. Some of the logic seems applicable to the multiple threshold models. The process is as follows.

The first step is to let $S_1(\gamma)$ in Eq. (8) be the residual sum of square (RSS) of single threshold model. Also, let the minimum value of $S_1(\gamma) =$ optimal threshold value γ_1 . Chong and Bai suggest that $\hat{\gamma}_1$ will be consistent with either γ_1 or γ_2 in the double threshold model (depending which one has stronger effects). Fixing the first stage estimate $\hat{\gamma}_1$, the second stage criterion is:

$$S_2^*(\gamma_2) = \begin{cases} S(\hat{\gamma}_1, \gamma_2) & \text{if } \hat{\gamma}_1 < \gamma_2 \\ S(\gamma_2, \hat{\gamma}_1) & \text{if } \hat{\gamma}_1 > \gamma_2 \end{cases} \quad (11)$$

and the second stage threshold estimate is

$$\hat{\gamma}_2^* = \arg_{\gamma_2} \min S_2^*(\gamma_2) \quad (12)$$

Since it is undesirable to have a small number of observations in any given 'regime', restriction applied to search in (12) so that a minimum number of observations fall in each of the three regimes.

Bai (1997) finds that $\hat{\gamma}_2$ boasts gradual efficiency while $\hat{\gamma}_1$ does not. This is because $\hat{\gamma}_1$ is derived by computing the RSS in the single threshold model. Therefore, due to the fact effects of one threshold are neglected and $\hat{\gamma}_2$ boasts gradual efficiency, it is possible to further modify $\hat{\gamma}_1$ through the estimate of the third step.

The third step is to first fix the threshold estimate $\hat{\gamma}_2$ of the second stage. At this point, the selection criteria of thresholds in the third step are as follows:

$$S_2^r(\gamma_2) = \begin{cases} S(\gamma_1, \hat{\gamma}_2) & \text{if } \gamma_1 < \hat{\gamma}_2 \\ S(\hat{\gamma}_2, \gamma_1) & \text{if } \gamma_1 > \hat{\gamma}_2 \end{cases} \quad (13)$$

Further refined threshold estimate are as follows:

$$\hat{\gamma}_1^r = \arg_{\gamma_1} \min S_1^r(\gamma_1) \quad (14)$$

Bai (1997) pointed out that refined threshold estimate $\hat{\gamma}_2^r$ boasts gradual efficiency at change point estimation.

3. TESTING FOR A THRESHOLDS

It is very important to test whether threshold effects exist. The hypothesis of no threshold effect in (1) can be expressed by the linear constraint as $H_0: \beta_1 = \beta_2$. Under H_0 the threshold γ is not identified. This type of testing yields non-standard distributions. As an answer to this problem, Hansen (1996) suggests that the approximations derived from bootstrapping simulations that are similar to distributions are more effective than testing. Therefore, under the H_0 , the model (5) can be modified into the following:

$$y_{it} = u_i + \beta_1' x_{it} + e_{it} \quad (15)$$

After the fixed-effect transformation, we derive:

$$y_{it}^* = \beta_1' x_{it}^* + e_{it}^* \quad (16)$$

Where regression coefficient β_1 can be estimated with OLS, therefore, it is possible to derive $\hat{\beta}_1$, residual (\hat{e}_{it}^*) and SRS ($S_0 = \hat{e}^* \hat{e}^*$). At this point, the likelihood ratio test of H_0 is based on:

$$F_1 = \frac{S_0 - S_1(\hat{\gamma})}{\hat{\sigma}^2} \quad (17)$$

The asymptotical distribution of F_1 is non-standard, and strictly dominates the χ_k^2 distribution. Unfortunately, it appears to depend in general upon moments of the sample and thus critical values cannot be tabulated. However, Hansen (1996) shows that a bootstrap procedure attains the first-order asymptotic distribution, so p-values constructed

from the bootstrap¹⁵ are asymptotically valid. Therefore, F_1 using bootstrapping under the H_0 is close to p-value. When p-value is smaller than threshold value, then H_0 is rejected.

In the context of Eq. (2), it is possible that there may be no threshold, only one threshold or two thresholds. If F_1 reject the null of no threshold, it should be further tested to discriminate between one and two thresholds. The minimizing SSE from the second stage threshold estimates is $S_2^*(\hat{\gamma}_2^*)$ with variance estimate $\hat{\sigma}^2 = S_2^*(\hat{\gamma}_2^*) / n(T-1)$. Thus, an approximate likelihood ratio test single versus double thresholds can be based on Eq. (18) and the hypothesis of one threshold is rejected in favor of two thresholds if F_2 is large.

$$F_2 = \frac{S_1(\hat{\gamma}_1) - S_2^*(\hat{\gamma}_2^*)}{\hat{\sigma}^2} \quad (18)$$

According to Chan (1993) and Hansen (2000), the threshold effects of the regressions do exist. In other words, when coefficient $\beta_1 \neq \beta_2$, the estimated threshold value $\hat{\gamma}$ and the actual threshold value γ_0 will be consistent. At this time, due to the presence of nuisance parameter, asymptotic distribution exhibits a highly non-standard pattern. Hansen (1997) suggested that it is necessary to construct a no-rejection region of confidence interval to test γ . When the value of $LR_1(\gamma_0)$ is big enough so that p-value falls outside the confidence intervals, it means that we can significantly reject null hypothesis H_0 . This means that threshold estimated value $\hat{\gamma}$ does not equal to the actual threshold value γ_0 . The testing method is as follows.

¹⁵Given the panel nature of the data Hansen (1996) recommends the following implementation of the bootstrap. Treat the x_{it} and q_{it} as given, holding their values fixed in repeated bootstrap samples. Take the regression residuals \hat{e}_{it}^* and group them by individual. Treat the sample $(\hat{e}_1^* \hat{e}_2^* \dots \hat{e}_n^*)$ as the empirical distribution to be used for bootstrapping. Draw (with replacement) a sample of size n from the empirical distribution and use these errors to create a bootstrap sample under H_0 . (Notice that the test statistic F_1 does not depend on β_1 under H_0 , so any value of β_1 may be used.) Using the bootstrap sample, estimate the model (16) and alternative (5) and calculate the bootstrap value of the likelihood ratio statistic F_1 (17). Repeat this procedure a large number of times and calculate the percentage of draws for which the simulated statistic exceeds the actual. This is the bootstrap estimate of the asymptotic p-value for F_1 under H_0 .

The first step is to test the null hypothesis $H_0 : \gamma = \gamma_0$ and the maximum approximation of estimates is:

$$LR_1(\gamma) = \frac{S_0(\gamma) - S_1(\hat{\gamma})}{\hat{\sigma}^2} \quad (19)$$

Eq. (17) and Eq. (19) are different. $LR_1(\gamma_0)$ is to test whether $H_0: \gamma = \gamma_0$. In other words, it is to test whether threshold estimate value equal to the actual threshold value. F_1 is to test whether $H_0: \beta_1 = \beta_2$, which means it is to test whether threshold effects exist. Hansen (1999) pointed out that when null hypothesis $H_0: \gamma = \gamma_0$ stands and meets with the assumptions, $LR_1(\gamma_0) \rightarrow_d \xi$, when $n \rightarrow \infty$, ξ is a random variable of a probability distribution:

$$P(\xi \leq \chi) = (1 - \exp(-\chi/2))^2 \quad (20)$$

If there are no nuisance parameters, according to Eq. (20), the asymptotical distribution of likelihood ratio statistic is not standard. When $n \rightarrow \infty$, $\beta_2 - \beta_1 \rightarrow 0$; this implies that the larger the sample size, the smaller the variances becomes between the slopes of the two sections. However, if the threshold effects are significant, threshold values (regardless of the levels) can be accurately estimated.

The asymptotic distribution derived from Eq. (20) is critical. Approximate confidence intervals can be derived from Eq. (20). The inverse function of Eq. (20) can derive the following:

$$C(\alpha) = -2(1 - \sqrt{1 - \alpha}) \quad (21)$$

Eq. (21) can derive the threshold value. When the confidence interval is α and when $LR_1(\alpha_0) > C(\alpha)$, we can reject $H_0: \gamma = \gamma_0$, i.e. the actual threshold value not equal to threshold estimate value.

Similar to single threshold model it is necessary to construct a confidence interval for the two threshold parameters $\{\gamma_1, \gamma_2\}$. Bai (1997) uses change point models and finds that the refined threshold estimates and that of single threshold model share the same asymptotic distribution. Therefore, it is suggested that confidence interval should be constructed in the same way that single threshold model is constructed. Therefore,

$$LR_2^{\gamma}(\gamma) = \frac{s_2^{\gamma}(\gamma) - s_2^{\gamma}(\hat{\gamma}_2)}{\hat{\sigma}^2} \text{ and } LR_1^{\gamma}(\gamma) = \frac{s_1^{\gamma}(\gamma) - s_1^{\gamma}(\hat{\gamma}_1)}{\hat{\sigma}^2} \quad (22)$$

Where $S_2^{\gamma}(\gamma)$ and $S_1^{\gamma}(\gamma)$ are defined in Eq. (11) and Eq. (13) respectively. Therefore, the confidence interval of $(1 - \alpha) \%$ of γ_1 and γ_2 can be defined as $LR_1^{\gamma}(\gamma) \leq C(\alpha)$ and $LR_2^{\gamma}(\gamma) \leq C(\alpha)$.

The estimator $\hat{\beta} = \hat{\beta}(\hat{\gamma})$ depends on the threshold estimate $\hat{\gamma}$, which appears to complicate inference on β . As Chan (1993) and Hansen (2000) indicated, when threshold estimate is equal to the actual threshold value $\hat{\beta} = \hat{\beta}(\hat{\gamma})$, then, $\hat{\beta}$ is close to normal distribution and its covariance matrix is as follows:

$$\hat{V} = \left(\sum_{i=1}^n \sum_{t=1}^T x_{it}^*(\gamma) x_{it}^*(\gamma)' \right)^{-1} \hat{\sigma}^2 \quad (23)$$

In estimating the confidence interval for γ , errors should meet with the iid assumptions; however, in estimating slope parameters, the assumptions can be broadened. If the allowed error exists conditional heterogeneous variances, the covariance matrix of $\hat{\beta}$ is as follows:

$$\hat{V}_h = \left(\sum_{i=1}^n \sum_{t=1}^T x_{it}^*(\gamma) x_{it}^*(\gamma)' \right)^{-1} \left(\sum_{i=1}^n \sum_{t=1}^T x_{it}^*(\gamma) x_{it}^*(\gamma)' (\hat{e}_{it}^*)^2 \right) \left(\sum_{i=1}^n \sum_{t=1}^T x_{it}^*(\gamma) x_{it}^*(\gamma)' \right)^{-1} \quad (24)$$

