Abstract

The Co-operative Credit Union Movement of Trinidad and Tobago: An Evaluation of Its Financial Performance

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This paper traces the evolution of the credit union movement of Trinidad and Tobago from its emergence in the pre-independence era to the present day. With the aid of the PEARLS financial ratios, the paper analyses the financial performance of a sample of the eight largest Credit Unions in the movement against the backdrop of the country's economic cycle. With the aid of a translog stochastic cost frontier, efficiency estimates were generated for the period 1990 to 2012 for large and very large credit unions. The results indicate that large and very large credit unions have exhibited increases in cost efficiency over the period under investigation.

Contents

1 Historical Evolution of the Co-operative Credit Union Movement of Trinidad and Tobago

The Co-operative Credit Union Movement of Trinidad and Tobago has a history which dates back prior to both financial and national independence. From modest beginnings, the movement has grown to become a noteworthy player in the financial system of Trinidad and Tobago. The development of the cooperative movement might be contextualised in the struggles of the underprivileged in the post-emancipation era and follows on the establishment of numerous other models of small scale investment and savings institutions. A substantial evolution can be traced from its emergence to the present day.

Formal financial intermediaries of the post emancipation era catered mainly to the financial needs of those in the upper classes. As a result, a number of informal financial intermediaries emerged to cater to the financial needs of a broader class of people (D. Brown 1989). With simple procedures, minimal collateral requirements and low transaction costs these institutions mobilized the savings of the underprivileged and catered to the needs of clients with any level of savings (Malaki 2005). These institutions were prevalent in substantial numbers throughout Trinidad and Tobago and were seen to complement and in some cases compete with certain formal financial intermediaries.

One such arrangement that gained notable traction in Trinidad and Tobago was the "Sou-Sou." The "Sou-Sou" is a Rotating Savings and Credit Association (ROSCA) established among a group of participants who make an agreement to regularly contribute to a common fund which is given to each of the participants in rotation, either in part or in full (Levin 1973). This type of informal institution saw its origins in West Africa where it is known as "Esusu" and was introduced to the Caribbean by Yoruba slaves during the post-emancipation era (Malaki 2005). This era also saw the emergence of other types of ROSCAs including the Chitty and the Hui, which were introduced by indentured labourers that were brought from India and China to fill the gap in labour supply left by emancipation (Levin 1973).

Another noteworthy development was the adoption of the Friendly Society which was encouraged by some, familiar with the model as it operated in 19th century Britain. The relative absence of philanthropic organisation combined with marked insufficiency in assistance for the deprived prompted the emergence of the Friendly Society. Based on the activities of the Wesleyan churches and through voluntary subscription, Friendly Societies centred on the provision of relief for members and their families during widowhood, injury, illness and death. The Friendly Society also made provisions for the maintenance of orphans and acted as a primitive type of social security system for the underprivileged (Odle 1972).

There was recognition of the need for banking facilities. In the face of financial exclusion, a group of coloured and black middle-class professionals collaborated to form the Trinidad Co-operative Bank in 1914 (D. Brown 1989). The "Penny Bank" as it was known, catered to the needs of urban and semi-urban markets in Trinidad and Tobago and was founded on the premise that every person, not just a select few, ought to appreciate the benefits of credit and savings (Levin 1973).

The post-emancipation era also saw the formation of a number of thrift institutions including the Building Society and the Post Office Savings Bank. The Building Society was formed under the Building Societies Ordinance Chap.8, No. 1, proclaimed on December 31st, 1890 (De Silva and Forde 1994). The institution is a mutual organisation that operated as a

savings and investment institution and specialized in the area of mortgage lending. Through the provision of affordable mortgage loans, the Building Society catered to the financial needs of the underprivileged, and made it possible for those of lesser means to construct new homes and refurbish existing ones. The year 1935 saw the formation of the Post Office Savings Bank by the colonial government. In keeping with the expressed objectives of the apprenticeship system, the colonial government moved to establish a government savings bank along the lines of the one proposed for the recently emancipated in the century before (D. Brown 1989). Through the support of a government guarantee, the Post Office Savings Bank promoted a spirit of thrift among the labouring classes and accepted deposits from the urban and rural working class (De Silva and Forde 1994). The formation of cooperatives continued this tradition of informal and formal mutual self-help that had been practised by the underprivileged in the post-emancipation era.

The 1930s witnessed marked social upheaval and labour unrest in the islands of the British West Indies. In the midst of the Great Depression, a series of violent labour rebellions erupted throughout the English speaking Caribbean. In Trinidad, conflicts commenced in the oil fields and gradually spread to the sugar belt and neighbouring towns. The escalating unrest prompted the appointment of the West India Royal Commission in 1938, led by Lord Baron Moyne, to examine and put forward recommendations to ameliorate the appalling conditions in the region (Moyne, Benn and West India Royal Commission 1938-1939 2011). The report, popularly known as the Moyne Commission Report, detailed comprehensively the deplorable conditions faced by populations in the British West Indies and was derisive in its disapproval of British Colonial Policy in the Caribbean region. Emanating out of recommendations put forward in the report and in reaction to the rising socioeconomic conditions of the late 1930s and 1940s, the Cooperative Credit Union Movement emerged in Trinidad and Tobago and developed an economic democracy of the underprivileged. The onset of the Second World War brought both a sharp increase in the cost of living and a severe shortage of consumer goods which drove the community into the investigation of new methods through which credit could be mobilized to meet basic needs (Girvan and Girvan 1993). Given the dominance of foreign banks, which served the purpose of supporting commerce and trade with metropolitan countries, the emergence of the Credit Union was seen as an adaptive response by the "historically disadvantaged" who aimed to improve their social and economic wellbeing (D. Brown 1989).

Under the guidance Father Peter John Sullivan, the Boston Jesuit Priest credited with the establishment of the first Caribbean Credit Union in Jamaica, a group of pioneers including Thomas Malcolm Milne, Father Long, George Lera, L. Valdez, F.E. Farrell, P.H. Roach, N.P. Brown, L.F. Ambrose Cedeno and Doctor James Waterman established the first Credit Union in Trinidad and Tobago. Milne maintained the belief that the Credit Union Movement would lead to the "economic emancipation of the people" (Co-operative Credit Union League of Trinidad & Tobago 2013). With the introduction of the Credit Union Cooperative Societies Ordinance, No. 48 of 1945, Credit Unions became a legal entity with Malcolm Milne assigned as the first Registrar of Credit Unions (D. Brown 1989). At that time however, a number of Credit Unions had already been established and were in operation. The Health Services Credit Union was the first to be registered on the 6th of August 1946 and catered to the financial needs of those employed in the field of medicine.

The years following the introduction of the ordinance witnessed not only a proliferation in the formation of new Credit Unions, with the registration of ninety new Credit

Unions between the years 1945 and 1950 (Central Bank of Trinidad and Tobago 1993), but also the formation of several key organizations. In April 1947 the Co-operative Credit Union League of Trinidad and Tobago was established. Guided by Cooperative principles, the League acted as an umbrella organisation for the country's Credit Unions and promoted the development of its members through the provision of training, education and consultancy support (G. A. Khan 1991). The Cooperative Department was later established by the Government in 1949 as a part of an administrative structure to guide, supervise and promote the movement. The department provided training and advice to the cooperative sector and at times even financial assistance (Forde and Joseph 1997). Three years onward, the designations of both the Department and its administrative head were changed to adequately reflect the Department's developmental thrust (Central Bank of Trinidad and Tobago 1993). The retitled Department of Cooperative Development was then headed by a Commissioner for Cooperative Development, who also served as Registrar for all categories of cooperatives in existence. At this nascent stage of development, the movement was characterised by a small asset base, a strong common bond, a substantial dependence on volunteers, and the provision of elementary loans and savings products[1].

In order to cater to the needs of Credit Unions and its membership, the ordinance was revised to become the Credit Union Societies Amendment ordinance No. 18 of 1952 which made provision for the registration and recognition of the Co-operative Credit Union League of Trinidad and Tobago and the Credit Union Cooperative Bank (G. A. Khan 1991). The Credit Union Cooperative Bank was established in the mid-1950s with the aim of serving as a central finance facility for the credit union movement. Nevertheless, the bank faced challenges in effectively discharging its function due to poor support from the movement in combination with internal management and financial challenges (Central Bank of Trinidad and Tobago 1993). The proliferation in the formation of new Credit Unions continued well into the 1950s, with the registration of a further 192 Credit Unions between the years 1950 and 1960 (Central Bank of Trinidad and Tobago 1993). This decade also saw the formation of an additional umbrella organisation. In affiliation with CCULTT, CUNA Mutual Insurance Society commenced its operations in Trinidad in 1958. This organisation offered support to the movement through the provision of loan protection and life insurance.

The year 1970 represented a turning point in the nation's social, financial and economic history. From an economic and political standpoint, that year was an integral part of the nation's transition from a colonial dependency to a recently independent nation (Forde and Joseph 1997). In the budget speech for the year 1970, the Minister of Finance announced as follows:

"Our long run objectives are to make our economy subject to greater national control; economic diversification in the sense of strengthening the sectors of the economy other than petroleum; and more employment. These objectives can only be achieved by the effective mobilization of local savings for productive investment at home; the building up of new and nationally controlled financial and other institutions."

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[1] With the aid of organizational life-cycle theory, (Ferguson and McKillop 2000) developed a classification typology for the stages of credit union movement development. This typology assumed that a credit union movement went through three distinct growth phases in its evolutionary development; namely Nascent, Transition and Mature. The authors maintained that credit unions could be characterized by a variety of organizational and financial attributes in each of the three stages.

The government articulated this policy, which advocated the necessity to generate internal dynamic, in its three Five-Year Development plans. Nevertheless, social and political upheaval of the late 1960s and early 1970s led by the Black Power Movement gave additional incentive to the government's plans for the localization of important sectors including the financial sector and for economic diversification. These socio-political disturbances, which generated strong criticism of the foreign banking sector, led to the expression of the need for a "People's Sector", comprised of small scale operations from among the people (D. Brown 1995).

Cooperatives formed a segment of the "People's Sector", which included a variety of cooperatives including Agricultural Cooperatives, Consumer Cooperatives, Fishing Cooperatives and Cooperative Credit Unions. It was in this context that the Cooperative Societies Act (CSA) of 1971 was established. This act represented an important milestone in the evolution of the country's Credit Union movement since it not only prepared the institutional infrastructure that would facilitate the proliferation of this segment of the People's Sector but also signalled the Government's commitment to the promotion of cooperatives (Kairi Consultants Limited 2008). This act combined the three distinct laws that governed cooperatives of the time and designated supervisory responsibilities to the Minister of Labour and Cooperatives. Moreover, this act gave the Commissioner of Cooperatives the authority to "wind up" mishandled or failing cooperatives and even the authority to remove the board of directors. Though the act established reporting requirements for cooperative societies, no provisions were made for penalties in the event of non-reporting (Forde and Joseph 1997).

In this environment, financial institutions experienced notable growth in profitability, revenue, savings and loans disbursed. The experience of the Cooperative Credit Union movement was no different, with substantial growth in both resources controlled and numbers being observed. From an asset base of TT$ 20.8 million in 1970, the decade saw the movement's growth to TT$ 52.7 million in 1975 and ultimately to TT$ 210.5 million in 1980 (De Silva and Forde 1994). The registration of an additional forty-seven Credit Unions over this period the decade ended with approximately 400 Credit Unions (De Silva and Forde 1994). Nonetheless, of the 400 registered Credit Unions, merely ninety-five complied with statutory reporting requirements.

A considerable economic decline commenced in the 1980s. The weakening of the price of oil in the early 1980s caused the economy to quickly slip into a prolonged and deep recession with an array of substantial external payments and fiscal deficits. The unemployment rate, which was on average ten percent in the oil boom decade, increased to almost twenty-five percent by the late 1980s (Forde and Joseph 1997). In this environment, a policy of stabilization commenced. Both the establishment of a marginal reserve requirement with a reserve ratio of seventeen percent and an increase of the discount rate from 6.00 to 7.5 percent were observed in 1983 (De Silva and Forde 1994). As liquidity in the financial system was restricted, the commercial banking sector began to ration credit, which led to great difficulty in obtaining loanable funds from the commercial banks. Consequently, those in need of financing turned to a number of other formal and informal financial intermediaries. In addition to this, with the aim of promoting the growth of the movement, the government

implemented a [2]tax deduction up to TT$ 2500 to individuals on annual increases in Credit Union shares in 1982, which in the economic conditions of the 1980s further facilitated the proliferation of the movement as individuals were driven to seek a variety of tax shelters (D. Brown 1989) and (Central Bank of Trinidad and Tobago 1993). As a result, the decade witnessed the growth of the movement's asset base to TT$ 695.3 million in 1985 and ultimately to TT$ 1,722.4 million in 1990 (De Silva and Forde 1994).

Nevertheless, the movement contended with range of internal difficulties. Weaknesses in the existing legislation led to a high level of non-compliance with statutory reporting requirements. It is estimated that in the years leading to 1989 over forty percent of Credit Unions registered with the Cooperative Department failed to comply with statutory reporting requirements (Silva and Forde 1994). Furthermore, weak management information systems and the prevalence of underqualified and unqualified personnel within the movement manifested in the high rate of dormancy and the high rate of mortality of Credit Unions observed in the late 1980s (Forde and Joseph 1997). During that period, most Credit Unions in the movement as well as the regulatory agency were not computerized, in spite of tremendous data processing requirements. Also, very few persons in managerial positions had been exposed to training in financial management or tertiary level education. The years leading to 1990 witnessed approximately half of all registered Credit Unions in the movement being recorded as inactive, with only 164 of the 353 registered Credit Unions at that time being officially recognized as being active (De Silva and Forde 1994).

The 1990s witnessed significant changes to the domestic financial sector. Coming out of the prolonged recession and structural adjustment efforts of the 1980s, the economy saw the onset of financial liberalization in Trinidad and Tobago which encompassed both the elimination of guidelines which affected the allocation and cost of credit and the abolition of constraints on the operations of financial markets. The Financial Institutions Act was passed by the Parliament which provided for enhanced regulation of banks and other deposit taking financial institutions. However, the Credit Union Industry was excluded from that regulatory and legal reform programme. Moreover, during this period of transition the country also witnessed the relaxation of exchange controls in 1990 and subsequently the flotation of the country's exchange rate in 1993, which had been pegged to the US dollar since 1976 (Ministry of Finance 2003).

Since the Credit Union movement was large both in terms of financial system assets, approximately TT$ 1.3 billion in 1992, and in total membership, over 300,000 members at the end of 1992, the difficulties faced by the movement in the 1980s raised burning questions about the existing regulatory framework guiding credit union movement. Consequently, the Credit Union Task Force Committee was established in 1992 with the aim of evaluating the

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[2] *"In the 1980s, the most significant tax policy developments were those which gave certain asset categories and institutions favoured status. This policy sought to create space for new and non-traditional assets and institutions and was aimed at widening and deepening the financial sector. The most important included the tax incentives granted to credit unions and Unit Trust members for increasing their investments in these institutions, this in an attempt to make these institutions more attractive to consumers vis-à-vis commercial banks. Credit unions had already benefitted from the high rates of growth in the late 1970s and early 1980s and from exception from corporate tax. This, together with the introduction of the tax deductibility of contributions in 1982 helped the credit unions to compete more effectively with commercial banks. These developments increased the level of competition in the sector and forced the banks to modify their strategies to meet the challenges from these institutions"* (Seerattan 2006)

operations of the movement and generating pertinent recommendations that would treat with concerns such as prudential criteria, accounting standards, governance, delinquency and the enforcement of the power of the Cooperative Department. Emanating out of this review was the dissonance faced by the Commissioner for Cooperative Development in equitably allocating the departments resources between regulation and Cooperative Development. The report underlined that, in practice, the Department's regulatory function had been substantively compromised. Furthermore, in addition to the 350 registered Credit Unions under the purview of the Commissioner, there were also 884 other primary and secondary cooperatives of various types, which placed an onerous responsibility on the administration of the Department (Central Bank of Trinidad and Tobago 1993). Accordingly, later in that year the decision was made to transfer the responsibility of supervision from the commissioner for Cooperative Development to the Ministry of Finance, which was believed to have the resources necessary to adequately supervise the movement at that time (Forde and Joseph 1997). At this developmental stage of transition, the movement was characterized by a sizeable asset base, an evolving supervisory and regulatory framework, the development of centralised facilities and a notable emphasis on efficiency and growth.

In response to this, the Credit Union movement made the decision to establish the Trinidad and Tobago Credit Union Stabilisation Fund (TTCUSF) in 1994. This fund was established both with the aim to strengthen self-regulation and also to ensure the protection and stability of the movement through the provision of a degree of deposit protection. The Fund was originally a division within the Cooperative Credit Union League, but was formally registered in July 1999 (Kairi Consultants Limited 2008). TTCUSF provided stability to the movement through curative and preventative assistance, engaging in the financial analysis of member Credit Unions using the PEARLS system to ensure that any labouring Credit Unions took the appropriate measures to remain in good financial health. Membership with the fund however was voluntary, since there was no provision in the Credit Union act at that time.

In an attempt to improve the responsiveness of the sector to the needs of its membership, the Co-operative Credit Union League of Trinidad and Tobago Limited, the Government of Trinidad and Tobago and the Inter-American Development Bank signed a technical co-operation agreement in 1996. This agreement made provisions for the training of credit union staff and the establishment of a self-monitoring unit for the purpose of enhancing the skillset of those on the board as well as those in managerial positions. Furthermore, technical assistance was provided to the Ministry of Finance to aid in its supervisory role and to review the legal sphere within which credit unions operated. This institutional strengthening project commenced in 1999.

Taking into account the sustained liberalisation and modernization observed in the financial sector and the identification of the need to achieve a developed nation status by the year 2020, the Cabinet made the decision to appoint a committee to review the financial sector of Trinidad and Tobago in 2002. In acknowledgement of the integral role that the financial sector would play in the future development of the country, the Cabinet believed it was fitting to pinpoint key players and craft strategies which would not only promote the sector's development but also contribute to its stability (Ministry of Finance 2003).

Given the prominence of the credit union movement, a detailed review was conducted and relevant policy recommendations put forward. At that time, there were 143 Credit Unions registered with a total asset base of approximately TT$ 2.6 billion. Of those

formally registered Credit Unions, only 126 were recognized as being active and only ninety-six complied with statutory reporting requirements. A high concentration of assets was noted in the movement with the six largest credit unions accounting for approximately fifty percent of all credit union assets, and the top seventeen credit unions controlling approximately seventy-five percent of all the assets of the credit union sector. The review recognised the operations of a number of supervisory and umbrella organisations including the Department for Cooperative Development, the Credit Union Supervisory Unit, The Credit Union Stabilization Fund, The Credit Union League, CUNA Caribbean and the Central Finance Facility. The report underlined, however, that due to inadequate funding and voluntary membership the CCULTT, TTCUSIF and the CFF were not able to effectively carry out their developmental and promotional agenda. Additionally, the green paper acknowledged the difficulty in undertaking a comprehensive analysis of the financial performance of the movement as a whole due to the paucity of data. Nevertheless, with limited available data, the committee acknowledged the movement's outstanding performance in the realm of savings mobilisation and in the provision of loanable funds for education, housing and the establishment of small businesses. At that time, only sixty percent of the members of CCULTT had accepted the PEARLS system and computerized their operations (Ministry of Finance 2003).

In considering the existing regulatory framework, the report emphasized that the existing legislation needed sweeping reform. The committee asserted that the extant legislation hindered the progress of the sector and that further provisions should be made for delinquency, financial reporting, the election of officers and the registration of societies (Ministry of Finance 2003). The committee maintained that inadequate record keeping and data management, poor asset quality, weak management and operating systems and slow growth in membership and share capital were the key weaknesses facing the sector. The review also identified a number of opportunities and challenges for the movement. The committee advocated the need for the movement to raise its profile since, at that time, it was believed the image of the sector hindered its capacity to attract middle and higher income savers.

Moreover, a number of Credit Unions were involved in non-core activities which often operated at a loss and were consequently subsidized by operational earnings derived from core activities. The committee underlined that this trend could challenge the profitability of the movement. Furthermore, even with limited data, it was recognised that the movement faced high operating costs. Where the international standard of excellence for income to expenditure was in the range of twenty-five to forty percent, the average for most credit unions stood between fifty and sixty percent. Additionally, expanding liquidity in the commercial banking sector put downward pressure on interest rates, creating greater competition for the movement which had mobilized significant membership due to its competitive interest rates. In summary, the committee affirmed that in spite of the dominance of commercial banks in the financial landscape, the movement continued to be very relevant and as a result saw the need to nurture its development in order to cater to the needs of the "historically disadvantaged" (Ministry of Finance 2003).

The year 2003 witnessed the appointment of a committee to review and strengthen the green paper, in order to establish a White Paper which would serve as the blueprint for the reform of the financial sector of Trinidad and Tobago. The green paper was subsequently published and circulated to relevant stakeholders by the Central Bank requesting comments and feedback. In response to this, CCULTT, in collaboration with the IDB and members of the

movement, conducted a workshop to review its implications for the Credit Union Sector. The CCULTT took the opportunity to feature its own initiatives towards the development of the sector that were proceeding concurrently and, in view of these undertakings, acknowledged the timeliness of the Government's drive to review the extant legislation. In this regard, the movement welcomed the Green paper and sanctioned most of its recommendations. Nevertheless, the League stated that given its co-operative philosophy and its obligation to cater to the needs of the underserved in society, particular recommendations presented a challenge. In light of human resource deficiencies, the movement believed that training should commence from within the movement, in order to groom a pool of skilled professionals who understood the "co-operative" philosophy and who would continue to promote this philosophy. In summary the League advocated the need for the sector to continue to strategically improve its overall competitiveness while promoting and maintaining its "co-operative" philosophy (Co-operative Credit Union League of Trinidad & Tobago Limited 2003).

The year 2004 saw the culmination of this process in the publication of the White Paper on Financial Sector Reform. The White Paper put forward seven key policy recommendations for the Credit Union sector as well as a plan and schedule for the implementation of the recommendations emanating out of it (Swan-Daniel 2004). The policy recommendations included legislative reform, the inclusion of provisions for mergers and acquisitions, the introduction of continuous monitoring systems using the PEARLS standard, the reform of the election process to ensure that elected officials met established fit and proper criteria, the retention of tax exemptions for the movement with quinquennial reviews, the integration of the supervision of the sector under the aegis of the Central Bank of Trinidad and Tobago and finally the exposure of large credit unions that engaged in non-core financial activities to the same standard of supervision faced by other financial institutions. A number of legislative priorities were established to mobilise recommendations put forward for the sector. The key priority emanating out of the White Paper was the need to review the dated Co-operatives Societies Act, Chap 81:03. The proposed amendments had a focus on the consolidation of extant supervisory authorities, the inclusion of the requirement for adherence with the IFRS and the establishment and implementation of relevant criteria with minimum standards (Ministry of Finance 2004).

As a result, the year 2005 witnessed the decision by Cabinet to incorporate the regulation of the financial activities of the credit union movement under the direction of the Central Bank of Trinidad and Tobago. In line with the recommendations put forward in the White Paper the year before, the decision was made to revise the Co-operative Societies Act, Chap 81:03 to eliminate this responsibility from the portfolio of the Commissioner for Co-operative Development. Further to this, the Central Bank moved to establish a Credit Union Act (CUA) which, when passed, would designate supervisory responsibilities to the Central Bank of Trinidad and Tobago (Central Bank of Trinidad and Tobago 2009). With an understanding of the co-operative philosophy that guided the movement, the Central Bank deemed it inappropriate to impose regulations intended for other financial institutions on the Credit Unions and acknowledged the need for distinct legislation that catered for the co-operative philosophy. Accordingly, the Policy Proposal Document (PPD) was drafted and functioned as the basis for consultation and discussion with stakeholders around the country. The Policy Proposal Document refined a variety of perspectives put forward by members of the credit union movement and other agents during the participatory process. The PPD

cogently detailed proposals regarding the supervisory system, the supervisory entity, the business of a credit union, registration, certification, governance and prudential criteria. The document also outlined transition periods for compliance with provisions made.

A clear delineation of the roles of the Central Bank and the Commissioner for Cooperative Development was made. Under the proposed Credit Union Act, the Central Bank would be charged with the responsibility of supervision and prudential regulation which included the determination of the financial soundness of credit unions, the supervision of the movement to ensure compliance with regulatory requirements of the CUA and to contribute to the overall stability of the movement and by extension the financial System of Trinidad and Tobago. On the other hand, the Commissioner would be charged with the responsibility of Non-Prudential Regulation and Development which included the registration and de-registration of credit unions, mediation of membership issues, the conduct of annual general meetings and elections, the resolution of internal disputes and compliance with the CSA (Central Bank of Trinidad and Tobago 2009).

In response to this, TECU Credit Union Cooperative Society Limited, the largest Credit Union in the movement, sponsored a study with a view to assess the impact of the proposed regulatory framework on the Credit Union Movement in 2008. The assessment acknowledged that the PPD, in its then form, could lead to greater accountability and transparency in the operations of credit unions. Nonetheless, the study contended that the constraints imposed by the PPD had the potential to not only lead to larger operational costs in the provision of services to members, but also to hinder the institution's efficacy in the mobilisation of finance among lower income groups. Through an impact analysis, the study demonstrated that while compliance with requirements put forward in the PPD would be practicable for larger credit unions, compliance by smaller credit unions may necessitate the liquidation of assets since annual surpluses were not sufficient to service new requirements (Kairi Consultants Limited 2008).

Through a participatory process with a range of stakeholders, and with a sensitivity to the movement's co-operative philosophy, the study put forward two other possible options in respect of achieving a major improvement in the regulatory environment, without compromising the movement's developmental role. The first of option suggested the formation of a new Statutory Agency with a board derived from the Ministry of Labour, the Ministry of Finance and the Central Bank, to be headed by a supervisor for Cooperative Credit Unions and to be chaired by a person that satisfied established fit and proper criteria. Alternatively, the study suggested a variation to the first option, where the Department for Cooperative Development would be elevated and provided both with the legislative authority and resources needed to properly carry out its mandate. This option also necessitated legislative amendments which clearly delineated credit unions as financial cooperatives, distinct and apart from other types of cooperatives (Kairi Consultants Limited 2008).

A number of new support organisations were also established over this period. The year 2000 saw the formation of a Credit Union Supervisory Unit (CUSU) under the aegis of the Ministry of Finance. CUSU was established with the purpose of crafting a harmonised surveillance system for the movement, which would ensure compliance with all statutory requirements regarding prudential criteria and performance, and also monitor the stability of the Credit Union sector. Nevertheless, an absence of legislation governing the unit in tandem with limitations imposed by scarce human resources left the unit unable to effectively

discharge its functions (Swan-Daniel 2004). The unit eventually saw its demise six years later. The Central Finance Facility (CFF) was founded in 2002 and served as a support organisation for the credit union movement. The organisation aimed to provide a degree of stability to the movement and served as a lender of last resort to Credit Unions that struggled with unforeseen or unusual liquidity gaps. Like the League, membership with the CFF is voluntary and as a result the institution faced difficulty in effectively carrying out its developmental role (Ministry of Finance 2003). Through collaborative efforts of the largest Credit Unions in the movement, LinCU Ltd was established in 2005. This organisation was established with the objective of supplying the movement with data and financial system services. The LinCU Visa Debit Card provided the movement with an inexpensive turnkey electronic medium which made it possible for members to access their funds throughout Trinidad and Tobago and around the world (LinCU Ltd 2014). Collective dissatisfaction within the movement stemming from the operations and performance of the movements secondary promotional organisation, the Cooperative Credit Union League, led to the formation of the Association of Cooperative Credit Union Presidents of Trinidad and Tobago (ACCUPTT) in October, 2007 (Kairi Consultants Limited 2008). With the expressed aim of providing a forum for Credit Union Presidents and associated bodies to maintain the integrity of the movement, ACCUPTT provided similar services to the league, but was comprised of Credit Unions formerly affiliated with the League.

By the end of the decade, the asset base of the Credit Union movement had grown roughly to TT$ 9.2 billion. This period saw the registration of only seven new Credit Unions, which brought the total number of registered credit unions up to 130 in 2010. The progress of the movement was complemented by a variety of new services and products, particularly in the realm of non-financial services. Despite the fact that the costs involved in the acquisition of highly skilled individuals remained beyond the reach of smaller credit unions, there was a notable increase in the employment of technically skilled personnel by larger Credit Unions (Forde 2013). The advancement towards the implementation of the Credit Union Act was protracted and over the decade there was no fundamental change to the Cooperative Societies Act. Nevertheless, given its diversified product portfolio, the implementation of electronic technologies, the professionalisation of senior management, the formation of a deposit insurance organisation and greater advocacy for prudential regulation, the movement entered its mature stage of development.

In November 2011 the Draft Credit Union Bill was issued by the Central Bank of Trinidad and Tobago and circulated to relevant stakeholders in the movement. The Bill acknowledged the movement's democratic structure, ethos of cooperativism and developmental agenda and outlined proposals in line with this awareness. Firstly, in acknowledgement of the movement's democratic structure, the bill made provisions for the democratic election of external auditors and fit and proper directors as well as the approval of audited financial statements. Furthermore, with a sensitivity towards the movement's ethos of volunteerism, the bill put forward no requirements for a minimum number of independent directors on the board. Moreover, given movement's democratic structure which ensures one vote per member notwithstanding the quantity of shares owned, the bill removed requirements pertaining to the regulation of a "controlling shareholder". What's more, in line with the movement's tenet of "service to members", provisions were made for Credit Unions to engage in non-core activities within certain limits tied to assets and revenues. If, however, the non-financial activities outgrew stipulated limits, members of the credit

union would be obligated to issue a directive to the board for the formation a new cooperative to maintain the provision of the said service. Finally, the bill made non-compliance with statutory requirements a criminal offence against the director/officer responsible and the credit union as a whole (The Central Bank of Trinidad and Tobago 2014).

It can be seen that the Cooperative Credit Union movement of Trinidad and Tobago has applied the principles of cooperation established by the Rochdale Pioneers to its socioeconomic context for more than sixty-eight years. Substantial evolutionary development can be traced from its formative stages to the present day and given extant organisational and financial attributes, it can be seen that the movement is into its mature stage of development. In keeping with its co-operative philosophy, the movement has not only supported its membership in the development of good savings habits and the attainment much needed financial literacy but has also catered to the financial needs of a broader class of people. In 2013, the movement had a following of over 500,000 members, which represented roughly one third of the country's population. What's more, with an asset base of approximately TT$ 10 billion, which represented almost four percent of all financial system assets, the movement has mobilised a considerable volume of household savings which have been utilised to extend affordable credit to its membership for a variety of purposes, including productive investments (Howai 2014). Credit Unions can therefore be viewed as a dynamic and progressive people's institution which has contributed to the deepening of the country's financial sector and which will continue to play a vital part in the future development of the country.

2 Stylised Facts

2.1 Credit Unions vis-à-vis the Financial System

The onset of liberalisation in Trinidad and Tobago in the early 1990s witnessed not only a period of continuous economic growth but also substantial development of the country's financial sector. Over the subsequent decades, the government placed marked emphasis on the modernization and reform of the regulatory and legal framework governing the financial system. Consolidation and mergers have characterized the commercial banking sector over the last two decades and within the credit union movement, the largest societies operate in a manner that places them in direct competition with commercial banks. The impact of technological advancement has also changed the type of financial products and services that have been offered.

In spite of the existence of large numbers of Credit Unions, the movement remains a relatively small part of the financial system, which continues to be dominated by eight foreign owned commercial banks, see Table 2.1. More recently, the movement has been comprised of 131 active credit unions with an estimated collective membership of 351,966. As at 2012, commercial bank branches (135) exceeded the number of Credit Unions actively in operation (131) in Trinidad and Tobago. Nevertheless, both Credit Unions and Commercial Banks exhibit a wide geographic dispersion and penetration into rural areas which allows these institutions to be well within the reach of those in need of financial services

Table 2.1: The Financial System of Trinidad and Tobago

Type of Institution	1990	1995	2000	2005	2010	2011	2012
Central Bank	1	1	1	1	1	1	1
Commercial Banks	8	8	6	6	8	8	8
(Number of Branches)	(121)	(117)	(123)	(119)	(133)	(133)	(135)
Finance Companies and Merchant Banks	12	10	9	12	11	11	10
Trust and Mortgage Finance Companies	7	6	5	6	7	7	7
Development Banks	3	2	2	2	2	2	2
Credit Unions	400	398	356	129	131	131	131
Insurance Companies	56	42	56	59	31	33	31
Thrift Institutions	4	4	-	3	3	3	2
National Insurance Board	1	1	1	1	1	1	1
Trinidad and Tobago Stock Exchange	1	1	1	1	1	1	1
Trinidad and Tobago Unit Trust Corporation	1	1	1	1	1	1	1
EXCICO/EXIM	1	1	1	1	1	1	1
Reinsurance Company	1	1	1	1	1	1	1
Deposit Insurance	1	1	1	1	1	1	1
Home Mortgage Bank	1	1	1	1	1	1	1
Ombudsman Office	-	-	-	-	1	1	1
Credit Rating Agency	-	-	-	-	1	1	1

Source: Central Bank of Trinidad and Tobago.

The financial system continues to be dominated by the commercial banks, which have represented roughly thirty five percent of the total assets of the financial system over the last four years. As a group, occupational pension plans, insurance companies, non-bank financial

institutions and commercial banks represented 76.6 per cent of total financial system assets. In contrast, with a combined asset base TT$ 9.9943 in 2012, the credit union sector accounted for approximately three percent of total financial system assets, see table 2.2. Nevertheless, the movement's asset base is larger than the than that of the Development Banks, Thrift Institutions and is approximately equal to that of the Nonbank Financial Institutions. As mentioned previously, recent developments in the sector revolved around regulatory reform, and in this regard, the year 2005 witnessed the decision to transfer the supervision of the financial activities of the sector under the aegis of the Central Bank of Trinidad and Tobago.

Table 2.2: Financial System Assets by Financial Institution

Institution	1990	1995	2000	2005	2010	2012
Central Bank	20.90%	16.30%	14.74%	17.42%	22.77%	20.47%
Commercial Banks	36.30%	42.75%	38.89%	28.71%	35.72%	36.58%
Nonbank Financial Institutions	8.93%	12.46%	16.48%	11.73%	3.86%	2.78%
Credit Unions	4.92%	4.32%	2.76%	3.12%	3.18%	2.97%
Life Insurance Companies	10.99%	11.65%	11.83%	10.75%	8.94%	11.16%
Occupational Pension Funds	6.06%	n/a	n/a	11.86%	9.78%	10.50%
Development Banks	3.21%	2.14%	1.59%	1.09%	1.28%	1.24%
Thrift Institutions	0.30%	0.17%	0.09%	0.03%	0.03%	0.03%
National Insurance Board	7.20%	7.00%	7.88%	6.66%	6.65%	7.01%
Unit Trust Corporation	1.00%	2.81%	5.22%	8.21%	7.23%	6.89%
Deposit Insurance Corporation	0.20%	0.41%	0.52%	0.41%	0.55%	0.61%

Source: Central Bank of Trinidad and Tobago.

Historically, Credit Unions have acted as niche players in the domestic financial services sector, providing financial services which commercial banks and other financial intermediaries did not. Nevertheless, the short term loans to small borrowers traditionally provided by credit union sector have been challenged over the past three decades by the mainstream financial services sector. Through the introduction of Automatic Teller Machines and Credit Cards the commercial banking sector effectively commenced competition with the credit union sector in the provision of short term funds. Through the provision of these services, the commercial banking sector allowed for more ready access by consumers to savings, previously an area in which credit unions played a significant role.

What's more, several retail providers also began extending credit and near-credit facilities for small to medium-scale purchases, which presented further competition to the niche previously dominated by credit unions. Nonetheless, as primarily consumer lenders, catering primarily to the needs of the household sector, Credit Unions command an important share of this market. With simple procedures, minimal collateral requirements and low transaction costs these institutions are thought to have a comparative advantage in the market which has historically been unattractive to commercial banks because of the high fixed costs and small average size of loans to individuals.

2.2   Regulatory and Supervisory Structure of the Credit Union Sector

The Credit Union sector is currently regulated by the Co-operative Societies Act 1971 (Chap. 81:03) and the Co-operative Societies Regulations. According to the act, the

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[3]Source: The Co-operative Development Division, May 2014.

Commissioner for Cooperative Development, who heads the Co-operative Development Division, is given general powers of supervision and regulation of the affairs of cooperative societies and the duties of registrar of societies. All cooperative societies, both financial and non-financial, are supervised by the Co-operative Development Division and its Commissioner reports directly to the Minister of Labour and Small and Micro Enterprise Development. Other areas of responsibility for the Commissioner include registration, de-registration, dispute resolution and the promotion of cooperative development. The Commissioner also has powers of intervention where a cooperative society may have mismanaged its affairs. As directed by the Commissioner, Credit Union boards must submit audited financial statements to the Cooperative Development Division on an annual basis. It should be noted, however, that the act makes no provisions with respect to penalties for non-compliance with statutory reporting requirements.

The local Credit Union Movement is supported by five secondary bodies, see Figure 2.1. These include the following:

- The Co-operative Credit Union League of Trinidad and Tobago Limited (CCULTT)
- CUNA Caribbean Insurance Society Limited
- Trinidad & Tobago Credit Union Deposit Insurance Fund Co-operative Society Limited (TTCUDIF)
- Central Finance Facility Cooperative Society of Trinidad and Tobago Limited (CFF)
- LinCU Limited (LinCU)

The League was the first local umbrella organisation to be established, and saw its formation in 1947. The league provides training, education and consultancy support while promoting the principles of co-operativism and sound business practices. The League also has a major focus on advocacy to ensure the continued development of the Credit Union Movement and the sustenance of the unique and distinctive nature of Credit Unions. The League itself is a registered cooperative, and as such membership with the League is voluntary.

CUNA Caribbean Insurance Limited is the leading provider of group insurance to the Credit Union movement of Trinidad and Tobago. This society is a subsidiary of the CUNA group based in the United States and provides insurance products and services such as loan protection and life and general insurance. This society is a vital part of the sector and is regulated as part of the insurance industry in Trinidad and Tobago. Like CCULTT, membership with CUNA is also voluntary.

The Trinidad and Tobago Credit Union Deposit Insurance Fund Co-operative Society Limited, which was established in 1994 and registered in 1999, was formed with the expressed aim of protecting members' shares and deposits, maintaining a fund that not only guarantees members' shares and deposits but also supports services that protects the fund itself, and finally the provision of preventative services to enhance credit union self-reliance. The TTCUDIF was initially a department within CCULTT. The fund has grown via annual contributions from its members, a contribution which is tied to the annual growth in its member credit union's own shares and deposits.

Furthermore, the Central Finance Facility Cooperative Society of Trinidad and Tobago Limited (CFF) was established in 2001 not only to maximize the returns on investments for deposited credit union funds, but also to facilitate wealth creation for the movement and provide loans to its members. Like TTCUDIF, the CFF aims to engender confidence in the movement and promote the philosophy of co-operativism in the movement.

Lastly, LinCU Limited is a limited liability company established in 2005 by four of the largest Credit Unions in the Movement – TECU, Teachers', Rhand and Trinidad and Tobago Police Services Credit Unions. This company was established with a view to provide the movement with affordable turnkey electronic payment services that would enable members to enhance their access to funds not only throughout the country but globally.

Figure 2.1: Structure of the Co-operative Credit Union Sector under the Co-operative Societies Act of 1971 Chapter 81:03
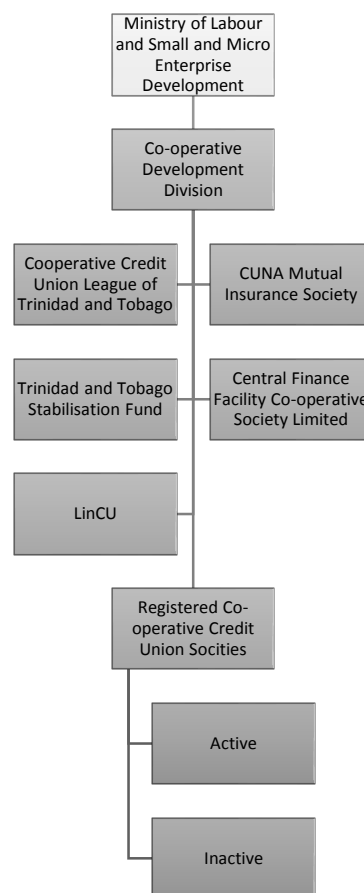
Under the proposed dispensation, the regulation and supervision of Co-operative Credit Unions will be shared between the Co-operative Development Division and the Central Bank of Trinidad and Tobago, see figure 2.2. In line with the new Credit Union Act (CUA), the Central Bank will be responsible for the Supervision and Prudential Regulation of Credit Unions. This responsibility will be managed by the Deputy Inspector of Financial Institutions within the Financial Institution Supervision Department and will include the authorization of operating certificates, the approval of non-financial business activities, the winding up of mismanaged societies, and compliance with prudential criteria, regulations and guidelines. On the other hand, the operations of the Co-operative Development Division will be guided by the amended Co-operative Societies Act (CSA), and the Commissioner will be charged with

the responsibility of non-prudential regulation and development. Under the new dispensation, the Commissioner will be responsible for the registration and deregistration of credit unions, membership issues, managing meetings (such as Annual General Meetings, Special Meetings and Elections), dispute resolution, and compliance with all other aspects of the amended CSA.

The umbrella/support organisations will continue to provide developmental and financial services to the movement under the new dispensation. However, since most support organisations were formed as Co-operative credit unions, these secondary bodies will be subject to the same regulation as other members of the credit union movement. As such, any support organisation that engages in the operations of a credit union would not only have to be issued an operating certificate by the Central Bank, but will also be regulated by the CBTT under the CUA in the same manner as other societies.

Figure 2.2: Structure of the Credit Union Sector under the proposed Credit Union Act
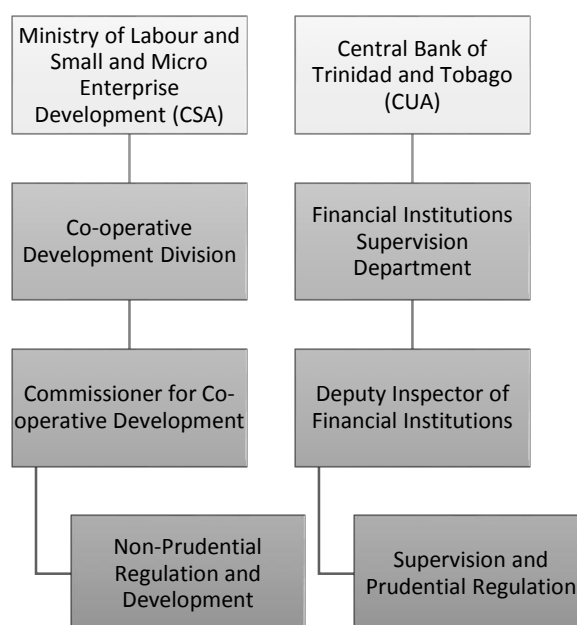
2.3 Size and Concentration Characteristics

In 2012, there were one hundred and thirty one (131) Credit Unions operating in Trinidad and Tobago, which ranged in size from under TT$ 10 million in assets to just over TT$ 1.5 billion, see figure 2.3. Very Large Credit Unions, which held an asset base of TT$ 500 million or more accounted solely for four percent of all active Credit Unions in the movement. Conversely, Small Credit Unions, with an asset base of under TT$ 10 million, accounted for over fifty percent of all active Credit Unions in the movement. It can be seen that the vast majority of active Credit Unions in the Movement held an asset base of TT$ 100 Million or less. The small modal size of Co-operative Credit Unions may reflect the fact that the majority are industrial societies with narrow fields of membership.

Figure 2.3: Co-operative Credit Union Societies by Asset Base
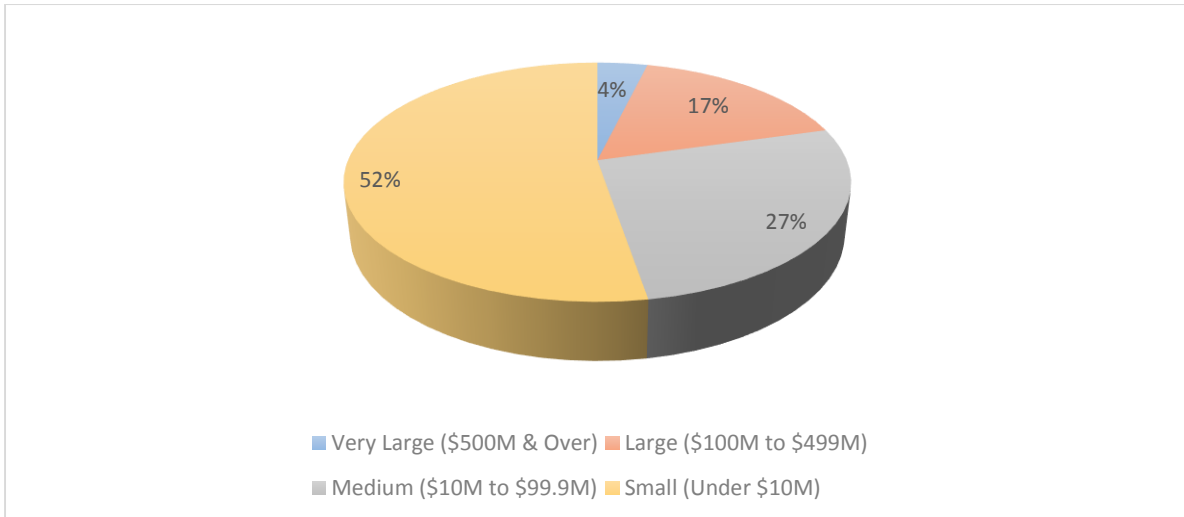
Source: Co-operative Development Division, May 2014

It should be noted however that the distribution of assets is highly concentrated in the largest credit unions in the movement. In 2012, the ten largest Co-operative Credit Union societies held an asset base of TT$ 6.659 billion, which given the sectoral total of TT$ 9.994 billion represented approximately 66.64 percent of the entire sector, see figure 2.4. This high concentration of assets has remained relatively consistent in the period under study. In 1992, the largest ten Credit Unions held approximately seventy percent of all assets in the sector (Central Bank of Trinidad and Tobago 1993).

Figure 2.4: Asset Concentration in the Credit Union Sector 2012
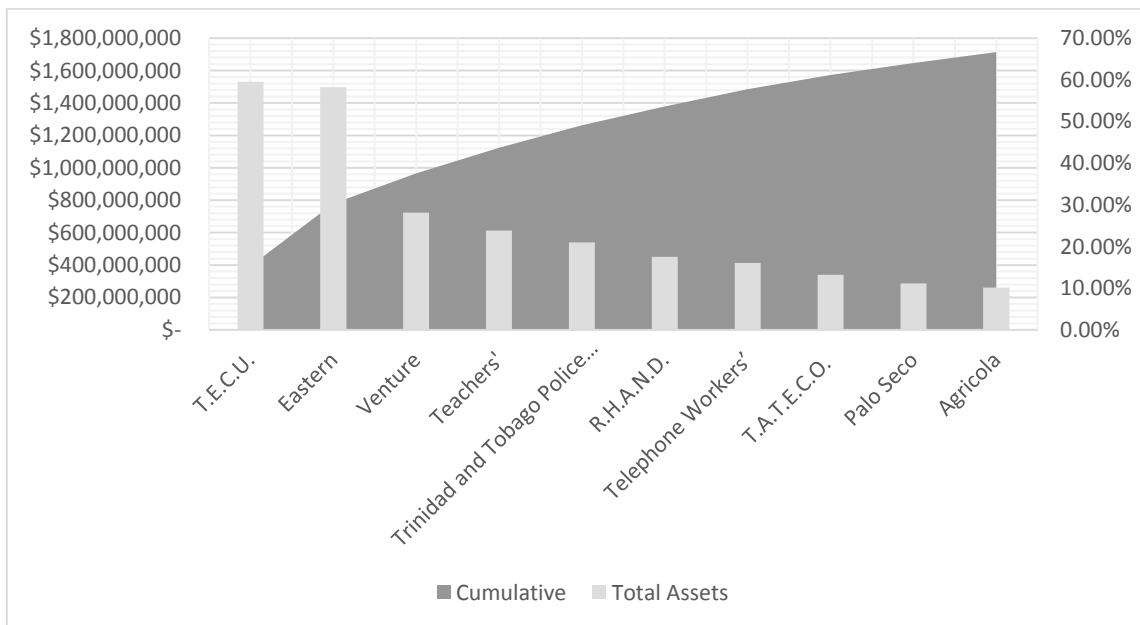
Source: Co-operative Development Division, Ministry of Labour and Small and Enterprise Development

2.4   Geographic Dispersion

Of the 131 Credit Unions actively in operation in 2012, the majority were located in the county of St. George, 61 percent, which may be due to the high concentration of the population and workplaces in the area. Conversely, the county of Nariva/ Mayaro was home only to a single Credit Union, the Guaymay Alliance Credit Union, which accounts for one percent of all active Credit Unions, see figure 2.5.

Figure 2.5: Credit Unions by County
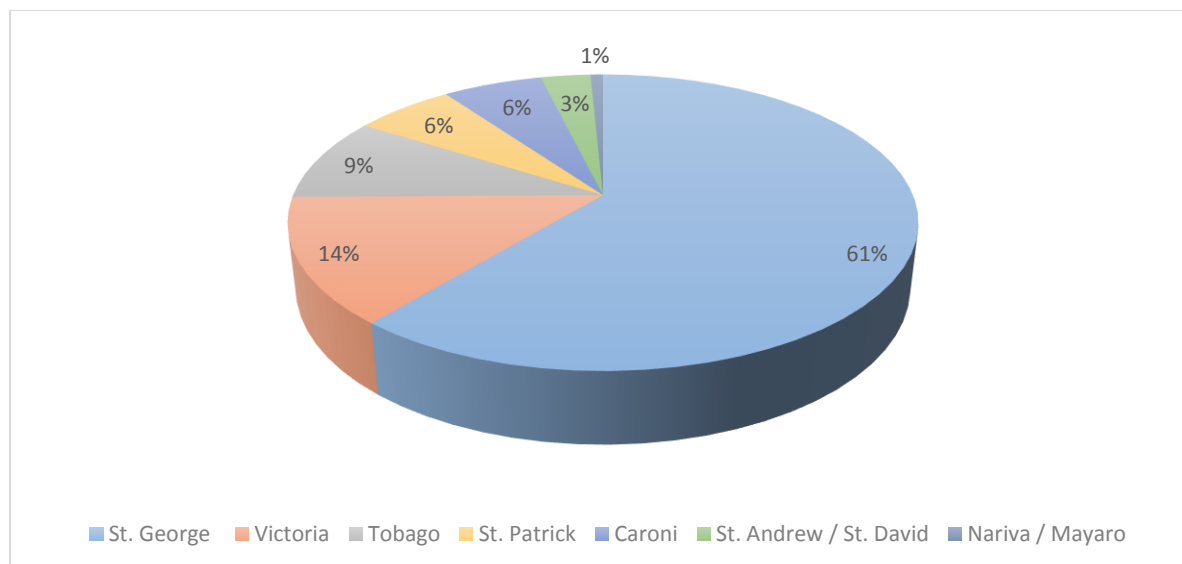
Source: Co-operative Development Division, May 2014

2.5   Bonds of Association

The common bond is the key defining characteristic of credit unions as co-operative organisations. By law, credit unions must provide evidence of some common bond of occupation or association, or of residence within a defined neighbourhood or district before they can be registered. The majority of local credit unions are either industrial/occupational or residential/community based. However, there are a few which were founded on the basis of religious association but these are generally classified as community based in the official statistics. Data proffered by the Co-operative Development Division revealed that of those Credit Unions actively in operation, forty-nine percent had a bond based on Industry or Occupation, while Community and Religious Based Credit Unions accounted for thirty four and fifteen percent respectively, see figure 2.6. The rapid growth of the movement in its nascent stages of development was in part due to the proliferation of "closed-bond", employer-based institutions. These institutions represented a particularly important alternative for the middle and low income population, which had been traditionally under-served by the commercial banking institutions.

Figure 2.6: Actively Operating Credit Unions by Type of Bond in 2012
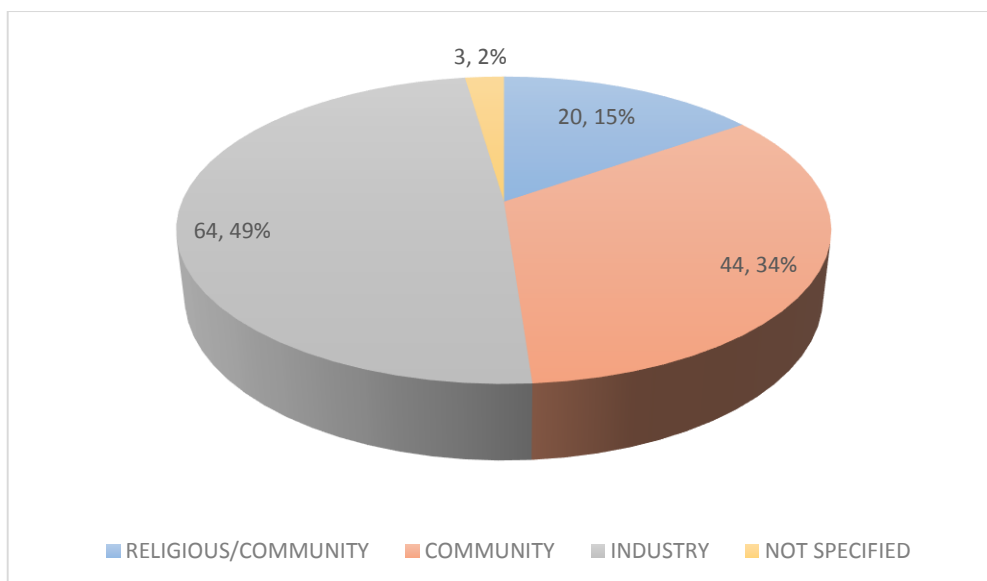
Source: Co-operative Development Division, May 2014

2.6   Loan Portfolio

The analysis of credit union lending from the sample of 8 Credit Unions over the period 2002 to 2012 revealed that loans for the purchase and repair of motor vehicles accounted for the largest proportion of Credit Union loans, 35.15 percent. Loans for the purchase of property (house and land) accounted for the second largest proportion of loans disbursed, 18.96 percent. Though credit unions are well positioned to provide loans for small business financing, the proportion of loans disbursed for business purposes only accounted for 1.55 percent of loans disbursed over the period under observation. This is interesting to note given that via collaborative efforts between the IADB, CCULTT, CBTT, MOF and the Credit Union movement, and with a view to expand the volume and quality of financial services available to micro, small and medium sized enterprises locally, a number of Credit unions entered into an arrangement with the Small Business development Company (SBDC) (which has since become The National Entrepreneurship Development Company Limited (NEDCO)) to guarantee loans offered by these Credit Unions to their members. Moreover, the proportion of loans that was disbursed for the purpose of the consolidation of debt accounted for 4.12 percent, which suggests that members have utilized the relatively inexpensive credit available via their credit unions to settle the debts of expensive loans taken elsewhere.

Figure 2.7: Loans Disbursed by order of Category
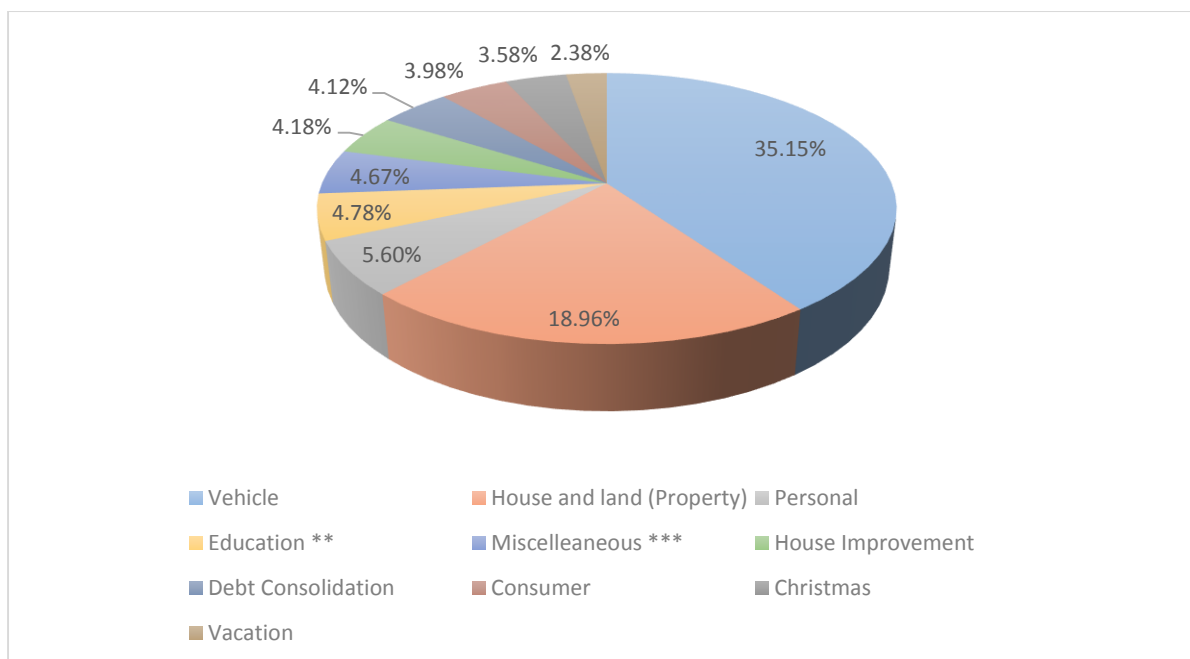
Source: Annual General Reports of Sample of Credit Unions

** Education - includes school loans, Computer Loans
*** Miscellaneous - includes Aid to relatives, Ceremonies, Insurance premium financing, MSDP Financing

2.7 Financial Performance

The financial performance of the sample of Credit Unions has been analysed using the PEARLS financial performance monitoring system. This system was originally designed and implemented by credit unions operating in Guatemala in the late 1980s (Evans 1997) and subsequently adopted by the World Council of Credit Unions (WOCCU) in 1990. The system was crafted not only to offer guidance to those in management, but also as a supervisory tool for regulators, providing a standardized tool through which credit unions could be analysed and compared. In Trinidad and Tobago, the system saw its origins following the Credit Union Strengthening Project implemented through the collaborative efforts of the MOF, the CCULTT and the IADB and its implementation has been championed by the CCULTT since the early 2000s.

The PEARLS system4 comprises forty-four quantitative financial indicators, a subset of which has been utilised for this study5, that are used to facilitate the analysis of the financial performance of Credit Unions. The wide range of financial indicators allows for the understanding of how changes in one area have implications in other areas of a credit union's operations, and signals issues to managers before the issues become injurious. Each indicator has a prudential norm or standard of excellence that has been established by WOCCU based on its field experience working to promote savings-based growth and to modernise and

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[4] Calculations and analysis were based upon the monograph prepared by David C. Richardson titled *"PEARLS Monitoring System,"* World Council of Credit Unions Toolkit Series Number 4, which can be accessed at http://www.woccu.org/documents/pearls_monograph.
[5] The subset of financial ratios utilized were selected based on the availability across the sample of the data needed to calculate the ratios.

strengthen credit unions. The standards of excellence have been set such that if met, depositors can rest assured that the credit union is indeed safe and sound.

2.7.1   Protection

The Protection ratios assess the extent to which Credit Unions can protect their members' deposits. The Solvency ratio in particular measures the relative value of a dollar of members' savings after accounting for probable and known shortfalls. The ratio determines the degree to which the credit union can protect its members' shares and savings in case of unforeseen liquidity shortfalls and overall liquidation of a society's liabilities and assets. Of the sample under consideration, all but four credit unions remained at and above the goal of 110 percent for the period under study, indicating that the overall solvency for the sample of credit unions remained very strong. Those that fell below the standard of excellence set by WOCCU in the early 1990s also faced notable delinquency challenges at the time, which forced those institutions into vulnerable positions. Nevertheless, it is encouraging that the sector average remained above the recommended levels for the period under consideration and at 2012, the value for this ratio was 116.63 percent.

Figure 2.8: P6. Solvency (Net Value of Assets/Total Shares & Deposits)
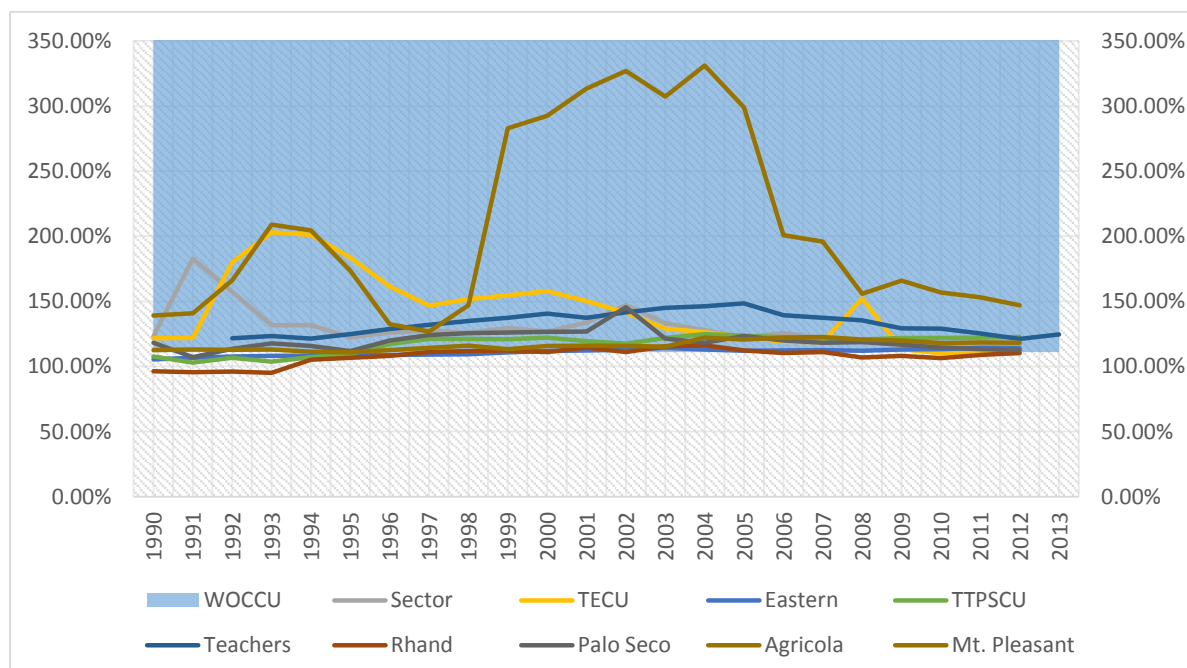
2.7.2   Effective Financial Structure

A Credit Union's financial structure is critical in determining the levels of efficiency, profitability and growth that can be maintained. This suite of ratios emphasizes a credit union's sources of funds (external credit, shares, savings and institutional capital) and the uses of these funds (loans, financial investments liquid investments and non-earning assets). According to the PEARLS system of financial ratios, a credit union that is composed of ninety-five percent productive assets, such as loans and investments, and five percent unproductive assets (such as fixed assets) faces the greatest chance of maximizing returns. Given that the loan portfolio yields the greatest profits to a credit union, it is recommended that productive assets be comprised of seventy to eighty percent loans and ten to twenty percent liquid investments.

Though the loan portfolio of four credit unions under investigation commenced the period within the recommended range, the portfolio of only two of those credit unions remained consistently within the suggested range for the entire period under study, see figure 2.9 below. One credit union in particular commenced the period with the largest proportion of assets allocated in its portfolio of loans, and sustained its ratio above and within the recommended range for the entire period under investigation. In contrast, loans accounted for a substantially smaller proportion of the asset mix observed at one large and very large credit union. This may be owing to the fact that these credit unions are saver-dominated credit unions (where the interests of savers dominate), and as such, the observed asset composition contains a substantially smaller proportion of loans to members. The sector total however remained just below the standard of excellence set by WOCCU and ranged between seventy and forty-seven percent for the period under study.

Figure 2.9: E1. Net Loans / Total Assets
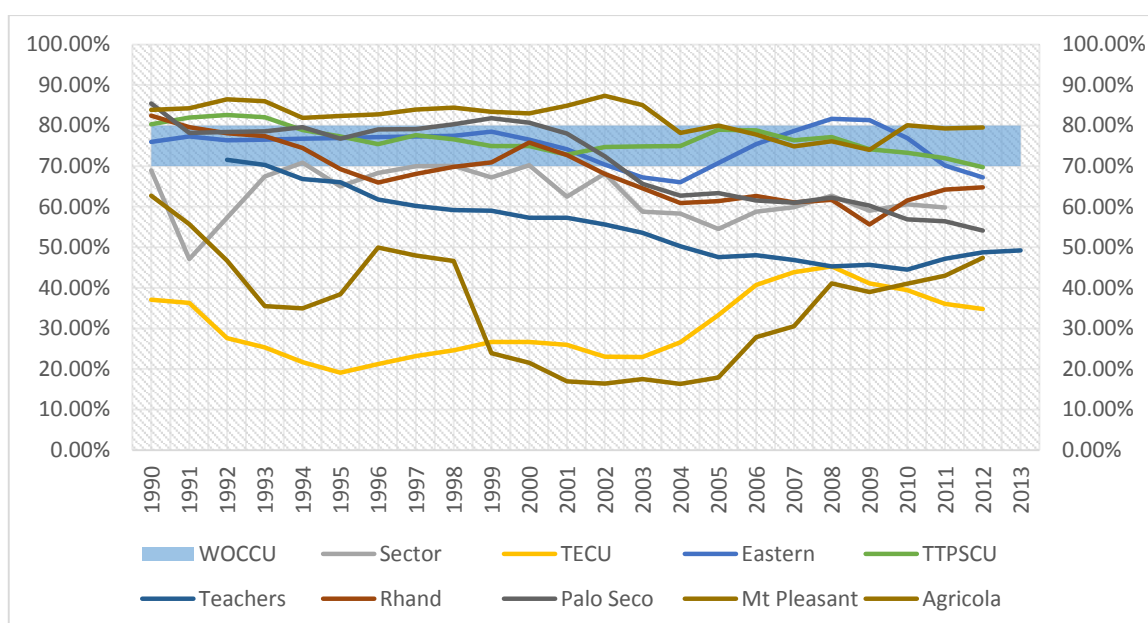
Given that the margins on liquid investments, such as savings deposits, are substantially smaller than those earned from credit union loans, excess liquidity is generally discouraged. Regulators argue in favour of the maintenance of an ideal balance between unproductive and productive assets, and propose increases in the volume of productive assets as the most appropriate solution. As seen in figure 2.10 below, the ratio of liquid assets to total assets remained within the acceptable levels for five Credit Unions over the twenty two year period. One credit union in particular demonstrated a level of liquidity that was both above the levels observed in in the sample as well as the levels recommended by WOCCU.

Figure 2.10: E2. Liquid Investments / Total Assets
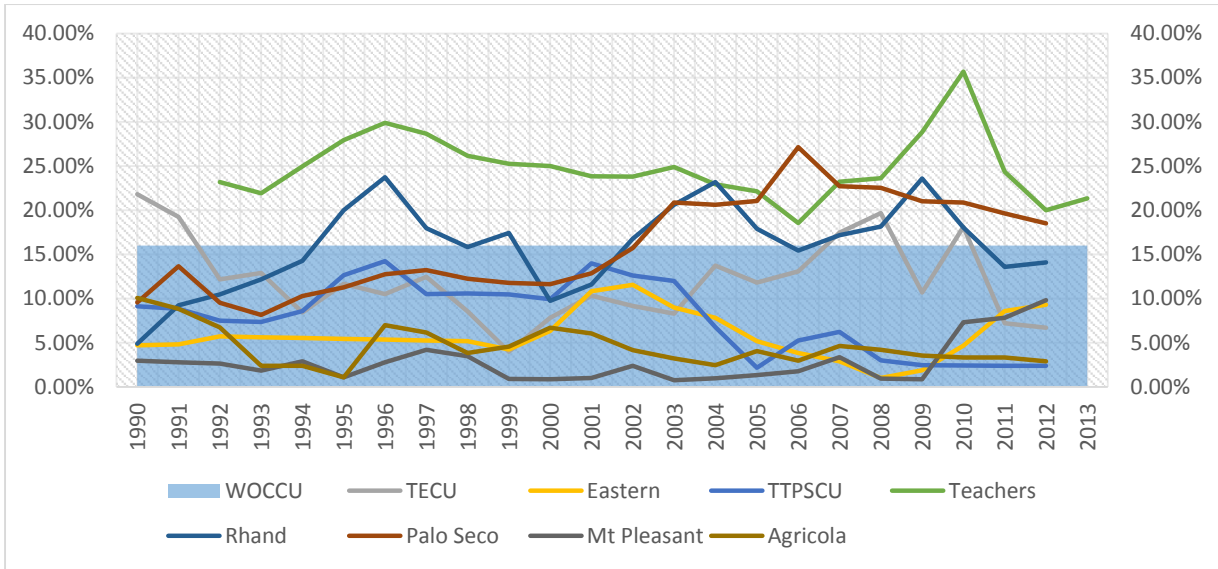
Though seven credit unions began the period with a proportion of financial investments well within recommended levels, as time progressed, a steady upward trend was observed, see figure 2.11 below. This trend was also observed for the movement as a whole, which steadily increased from approximately five percent in 1990 to just over thirty percent in 2012. One notable outlier in this analysis was the largest credit union in the sector, which given its predominantly saving-oriented membership, invested a substantial amount of its funds in financial investments. The percentage of that credit union's total assets placed in financial investments ranged between sixty three and nineteen percent over the period under investigation, and ended 2012 at approximately thirty seven percent. The system of financial ratios indicates that this upward trend could both compress operating margins of credit unions and impact on levels of income observed. However, this has not been observed in this sample of credit unions under investigation.

Figure 2.11: E3. Financial Investments / Total Assets
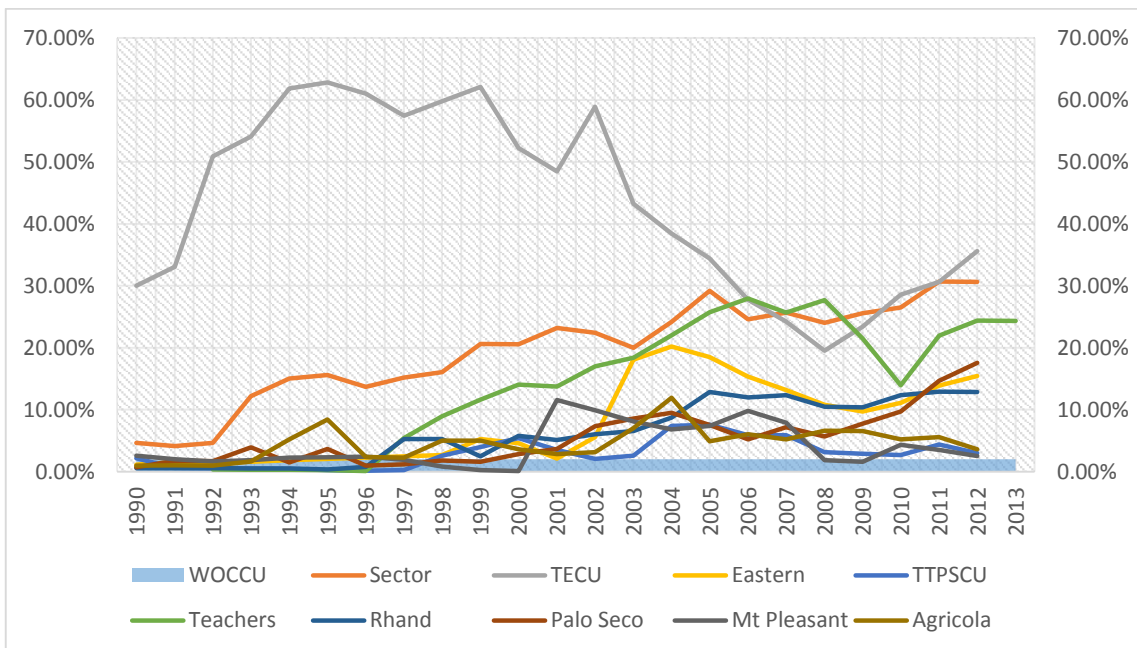
The Non-financial Investments / Total Assets ratio measures the proportion of total assets that have been invested in non-financial investments (such as beach houses, insurance companies, travel agencies, residential housing developments etc.). The prudential norm for this indicator set by WOCCU is zero percent, while the CBTT has maintained the proportion of non-financial investments must not exceed five percent. While the movement has argued that financial co-operatives should have the option to provide non-financial services to their members, regulators have justified the prudential norms for this indicator on the basis that the inclusion of non-financial activities in a credit union's financial statements has the capacity to adversely affect it given a number of factors including contagion risk from other sectors or a lack of demand for the service/product offered.

Though most credit unions in the sample do engage in some degree of non-financial activity, information on these activities has largely been captured outside of the audited financial statements and annual general reports. Consequently, the sample for this indicator is limited. Moreover, in accordance with the recommendations put forward by the CBTT, two credit unions have established legally distinct co-operatives, which were formed to provide a variety of non-financial services to their members, while remaining under the aegis of original credit unions.

Nevertheless, as seen in the chart below, though two credit unions under investigation remained near to the prudential criteria set by WOCCU and well within the range recommended by the CBTT, a substantial proportion of the assets of one credit union was invested in non-financial assets, particularly real estate and residential housing developments. Over the period under investigation, the non-financial assets of this credit union have ranged from eighteen to seventy three percent, and in 2012 accounted for approximately twenty five percent of the credit union's assets. Though this proportion of non-financial assets is well beyond the prudential norm, its investments are indeed earning assets which have not only provided a steady income to the credit union but have allowed the credit union to contribute to the socioeconomic needs of its members, by providing housing and real estate at an affordable price to members that otherwise faced challenges in that regard.

Figure 2.12: E4. Non-financial Investments / Total Assets
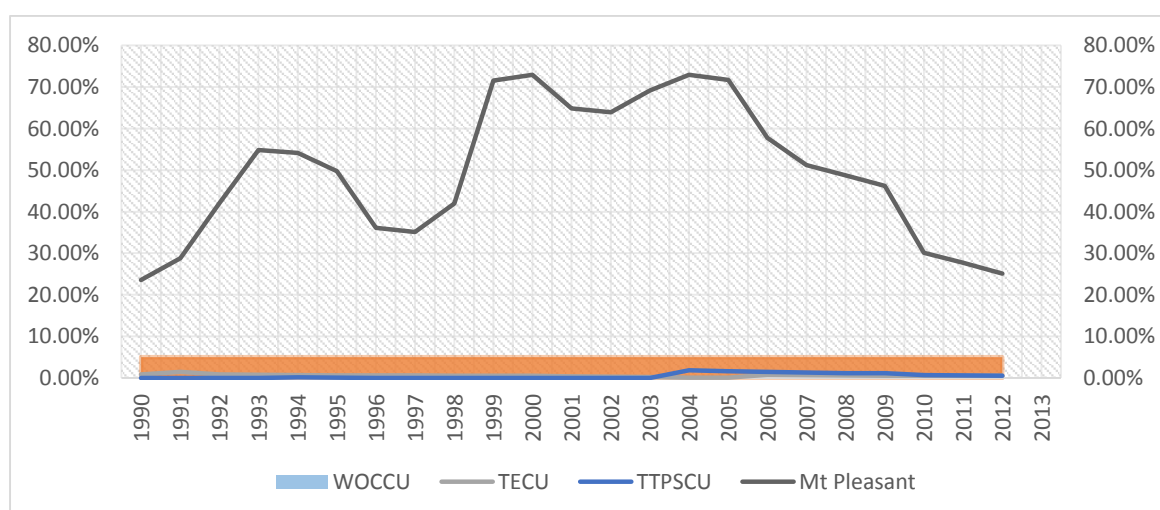
Furthermore, a credit union is deemed to exhibit an effective financial structure if assets, as funded by savings deposits, earn adequate income to preserve capital adequacy,

meet operating costs, and finally to offer competitive rates on savings. A large proportion of savings deposits indicates not only that the credit union is on track towards attaining financial independence but that its members are no longer "saving" to take out loans, but rather are saving due to the competitive interests rates offered. As can be seen in figure 2.13 below, five of the credit unions under investigation maintained a savings deposits to total assets ratio within and above the recommended range for the entire period under investigation. Three credit unions under investigation fluctuated within the recommended range for short periods, but have displayed a trend towards the prudential norm over the twenty three year period. Nevertheless, it is encouraging that the indicator for the sector remained within and above the recommended range for the majority of the time period under investigation.

Figure 2.13: E5. Savings Deposits / Total Assets
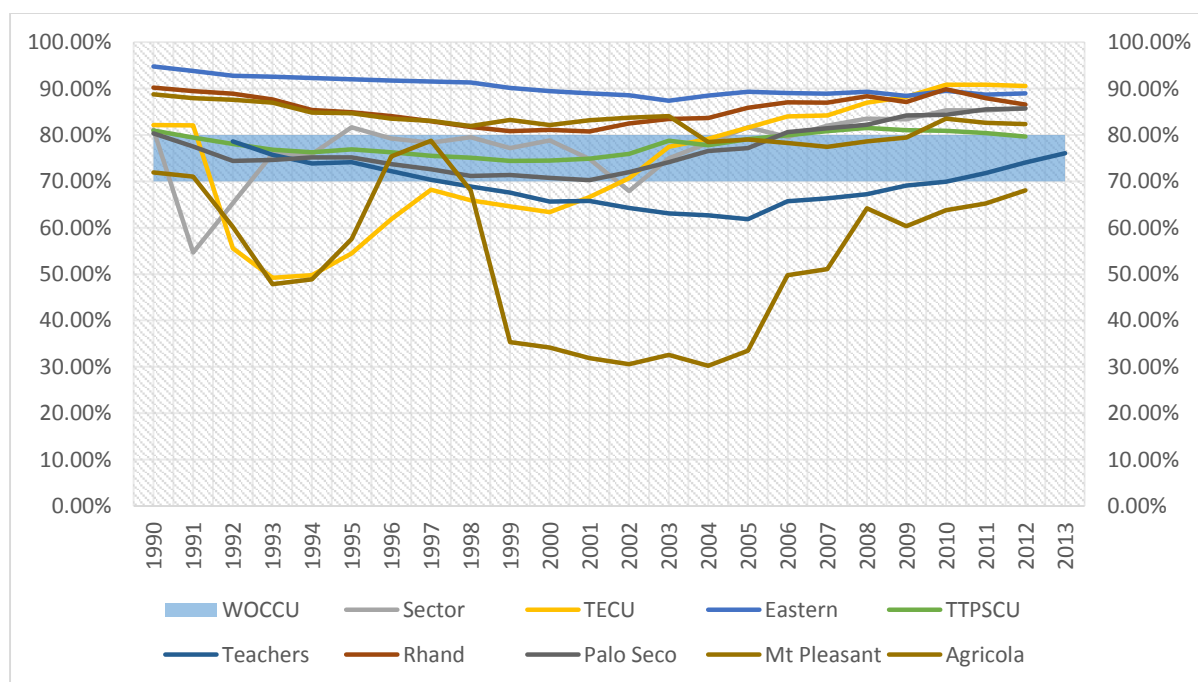
Under the capitalisation system set by the PEARLS framework, the emphasis has moved from members' shares towards institutional capital. Institutional capital has three key functions, firstly to fund all non-income generating assets of the credit union (such as property, plant and equipment), secondly to improve earnings and finally to absorb losses. Institutional capital can be used both as a last line of defence to absorb unexpected losses from operational deficits or loan delinquency and can also be made available to creditors in the event that a credit union is wound up, protecting members' deposits and shares. The prudential norm set by WOCCU suggests that societies should sustain a minimum level of institutional capital equivalent to ten percent, while the prudential criteria set by CBTT mandates a minimum of eight percent.

Of the eight credit unions investigated, six have maintained levels of institutional capital beyond the minimum suggested by WOCCU for the majority of the period under study and above the levels mandated by the CBTT for the entire duration, see figure 2.14. One credit union in particular exhibited levels of institutional capital below the prudential criteria set by the CBTT in the 1990s, while another credit union fluctuated around the prudential criteria over the same period. Nevertheless, since the early 2000s, both credit unions have remained above the stipulated levels. The indicator for the sector has remained safely above both

prudential norms for the entire duration, ranging roughly between nine and seventeen percent, and ending 2012 at approximately twelve percent.

Figure 2.14: E8. Institutional Capital / Total Assets
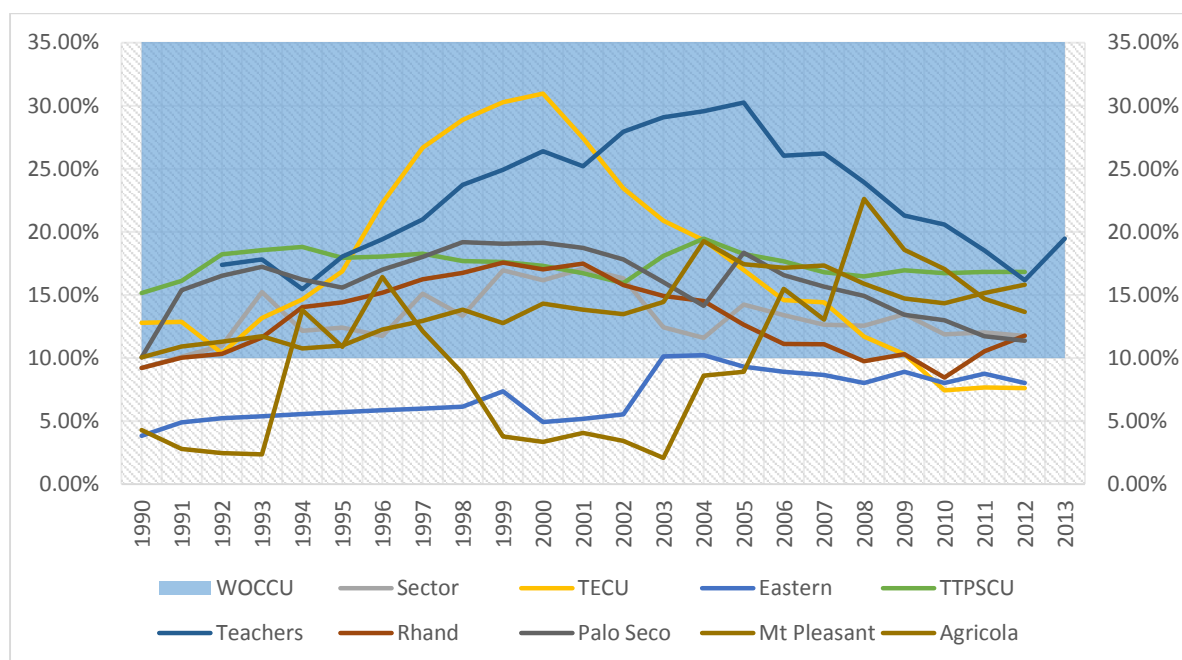
2.7.3   Asset Quality

The quality and composition of a credit union's assets has implications for a credit unions capacity to generate earnings. Of the suite of ratios offered by the PEARLS framework, the delinquency ratio is indeed the best indicator of institutional weakness since a credit union's level of delinquency impacts on a range of other vital areas of a credit unions operations. It is generally recommended that the delinquency rate remain below five percent of total loans outstanding.

A countercyclical trend was observed in the total delinquency indicator. The high levels of delinquency observed for three credit unions at the start of the period speak to the effects of the considerable economic decline that occurred in the 1980s. The decade witnessed not only a substantial increase in unemployment but also a precipitous decline in the price of oil which caused severe balance of payments challenges and triggered the implementation of a structural adjustment programme that encompassed a ten percent cut in the salaries of public servants. Consequently, delinquency was a major challenge faced by a large number of Credit Unions in the early 1990s, particularly those that served the financial needs of public servants. Accordingly, the movement pursued an aggressive approach to its credit administration function and the efficient management of its loan portfolio, particularly in terms of the review and follow up processes. As such, the levels of delinquency have steadily declined over the period under study. It should be noted, however, that delinquency rates are not recorded in audited financial statements, and are not routinely made available in the annual general reports. Consequently, data were not available for some credit unions over the entire time series.

Figure 2.15: A1. Total Loan Delinquency / Gross Loan Portfolio
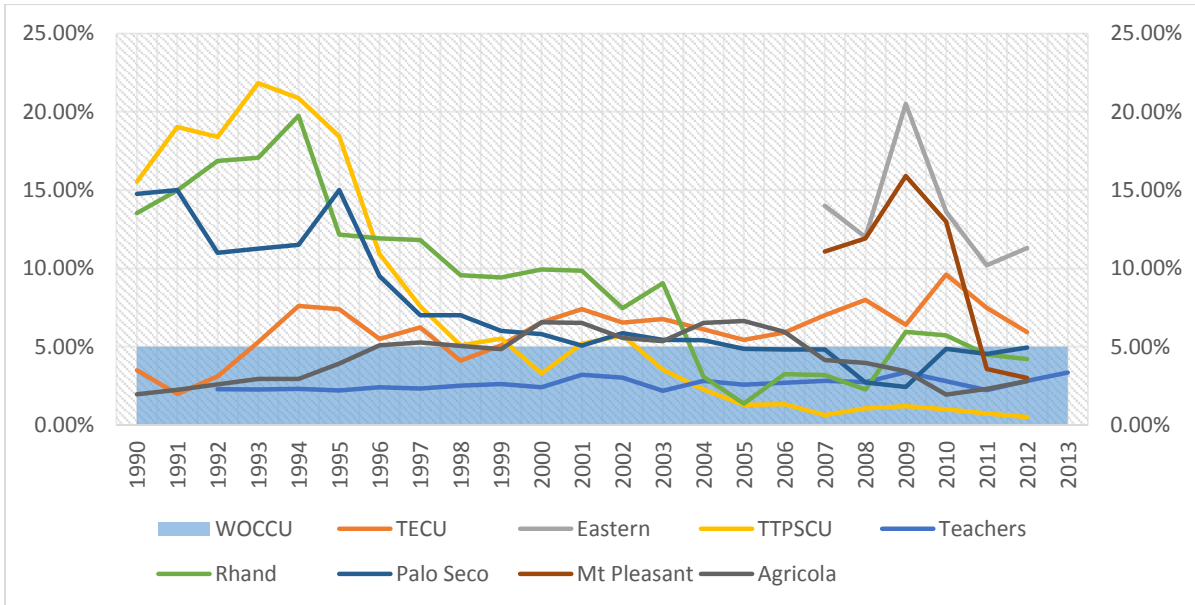
The proportion of non-earning assets is a key indicator of a credit union's capacity to generate income. The greater the proportion of non-earning assets, the more challenging it is to generate adequate earnings. It is generally recommended that a credit union invests its sources of funds in assets that will generate greater returns and as such the goal for the credit union is to limit this indicator to a maximum of five percent of its total assets.

As can be seen in figure 2.16, only three credit unions in the sample demonstrated the capacity to limit their non-earning assets to the suggested range at various points over the last twenty three years. Levels of non-earning assets ranged between five percent and thirty two percent in the sample selected, but generally remained below twenty percent. The aggregate indicator for the sector ranged between eight and nineteen percent, ending in 2012 at approximately twelve percent. A general upward trend was observed both at the macro and micro level from the early 2000s.

Figure 2.16: A2. Non-earning Assets / Total Assets
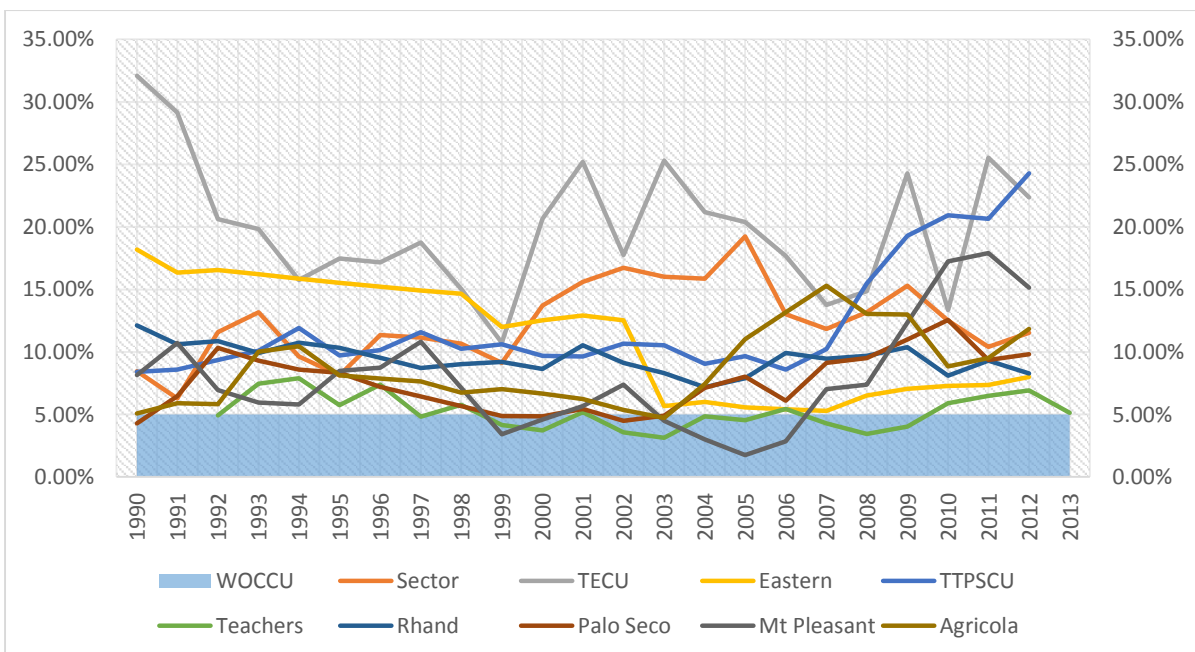
2.7.4   Rates of Return & Costs

This suite of indicators under this heading measure the earnings generated from each category of asset (use of funds) in addition to the cost of each category of liability (cost of funds). In analysing these indicators, one can determine which assets generate the greatest (or least) earnings as well as the sources of funds that incur the largest (or smallest) expenses. By comparing the financial structure of those credit unions investigated with their yields, one can determine how effectively these credit union are able to allocate their resources into investments that generate the greatest returns. These indicators are of particular importance since costs faced and earnings generated impact directly on the capacity of a credit union to grow.

The goal of the first indicator in this suite, Net Loan Income to Average Net Loan Portfolio, is for entrepreneurial rates of interest to be made. Though loans constituted a relatively smaller proportion of the total assets of three credit unions under investigation, the reliance on loan interest income throughout the movement is undeniable based on the predominance of the loan portfolio in most credit unions in the movement. It is expected that the loan yield should be similar to the lending rate of the credit union. There was no significant divergence in the results observed, where all but one credit union in the movement maintained net loan income to average net loan portfolio above ten percent for the entire period under investigation. It is difficult to determine the performance of the loan portfolio given that the interest rate charged varies from credit union to credit union, see figure 2.17. One credit union in particular observed the average rate of return declined from the early 2000s which may have been due to increasing levels of delinquency observed over that period.

Figure 2.17 : R1. Net Loan Income / Average Net Loan Portfolio
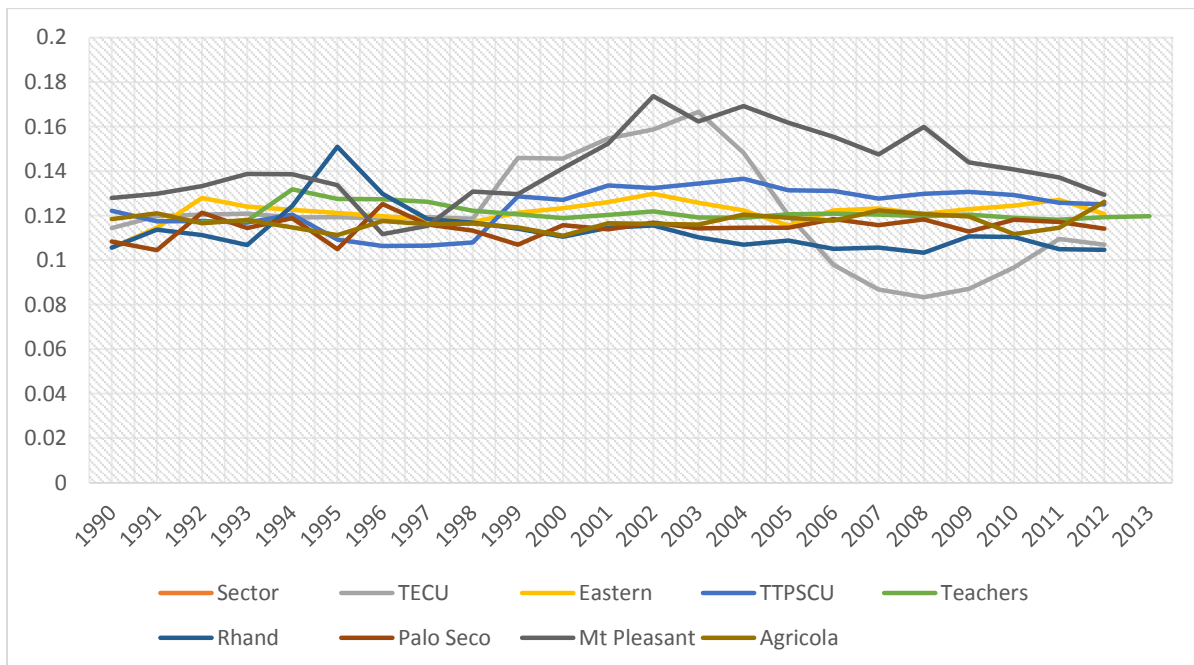
As demonstrated previously, credit unions have increasingly invested excess liquidity into financial investments (such as stocks and government securities) that generate higher returns than deposits at banks or other liquid investments. As can be seen in figure 2.18, financial investments have safely generated moderate returns for those credit unions investigated. Over the twenty three year duration, however, a general downward trend was

observed in the returns made from financial investments. At the end of 2012, the returns from financial investments ranged between 2.12 percent and 8.45 percent in the sample selected.

Figure 2.18 : R3. Fin. Investment Income / Avg. Fin. Investments
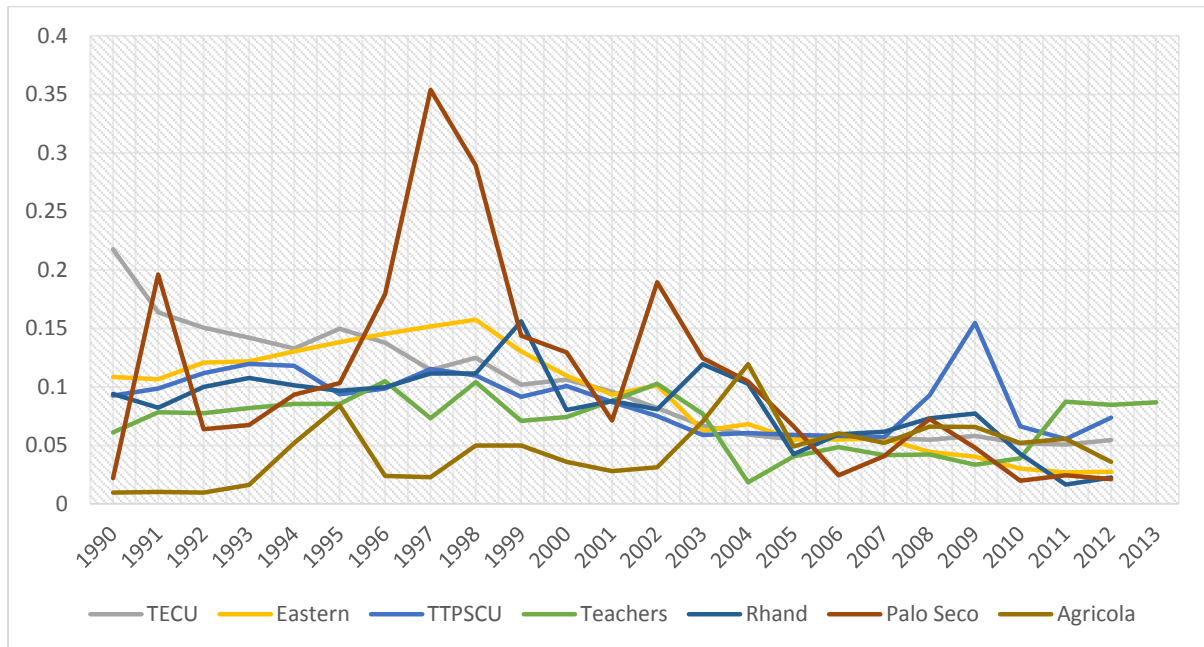
Considering that that credit unions under investigation are in the large and very large category, these institutions displayed the greatest capacity to generate steady returns. The gross margin to average assets ratio assesses the gross income margin generated, conveyed as a yield on total assets, prior to subtracting provisions for loan losses, operating expenses and other extraordinary items. As seen in figure 2.19, though gross margins observed varied between credit unions, these margins remained relatively stable within each credit union over the entire period under investigation. The margins observed ranged between two and thirteen percent for most of the period under consideration, and at 2012 the gross margin for the sector was 8.49 percent.

Figure 2.19 : R8. Gross Margin / Average Assets
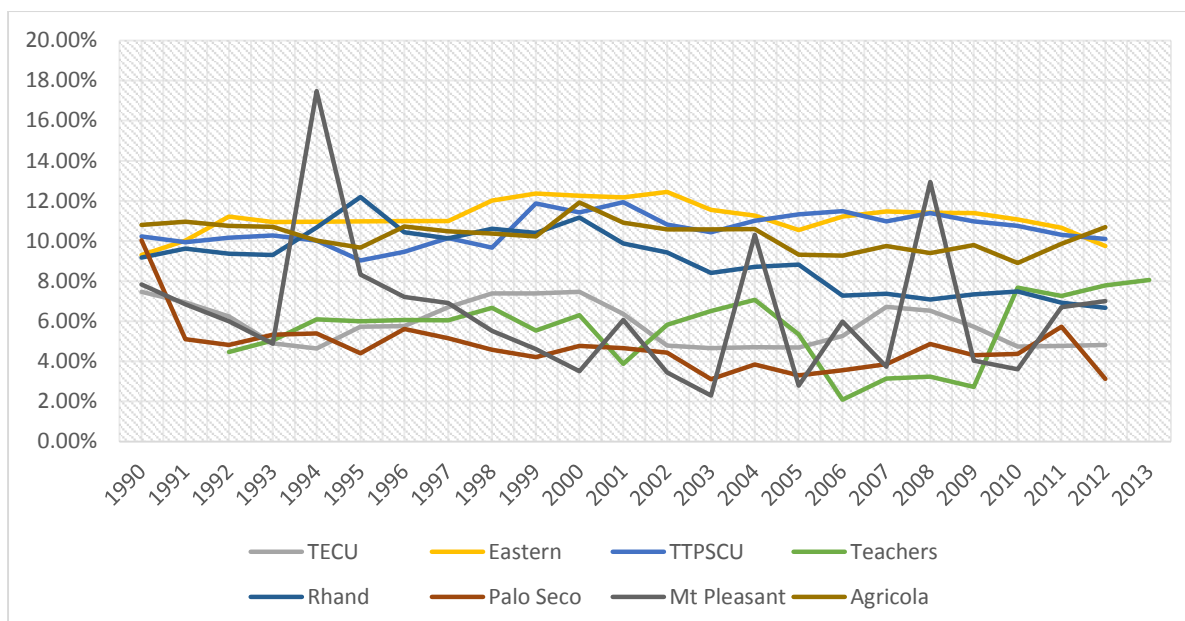
In order to evaluate the costs associated with the management of all credit union assets, the following indicator is utilised. With a prudential norm of five percent, this indicator measures operational costs as a proportion of total credit union assets and is indicative of the degree of operational inefficiency or efficiency. Again considering the size of the credit unions under investigation, these institutions face direct competition from commercial banks, particularly with respect to interests on loans and deposits. In the case of credit unions, however, the literature reveals that operational costs faced generally tend to be higher on a per unit bases due to the smaller modal loan size. Though credit unions are indeed not for profit, high operational costs are one factor that may hinder a credit union's capacity to attain and sustain high levels of profitability. While social consequences are of considerable importance to a credit union, the need for cost control is also quite pertinent to profitability

In the sample selected, the proportion of operating expenses observed remained fairly constant throughout the duration under investigation and ranged from a low of 0.88 percent to a high of 8.66 percent, see figure 2.20 below. Three credit unions under investigation remained well within the prudential norm, suggesting that these credit unions are indeed well managed. Three other credit unions however crossed the five percent barrier simultaneously at various points over the twenty- three year period, indicating that exogenous factors beyond the control of management may have impacted on the operating costs of these credit unions. The operating expenses of the last credit union were higher than the standard of excellence maximum of five percent. Nevertheless, the management and staff at this credit union have been able to keep operating expenses below ten percent and consistently between 8.66 and 6.08 percent.

Figure 2.20 : R9. Operating Expenses / Average Assets
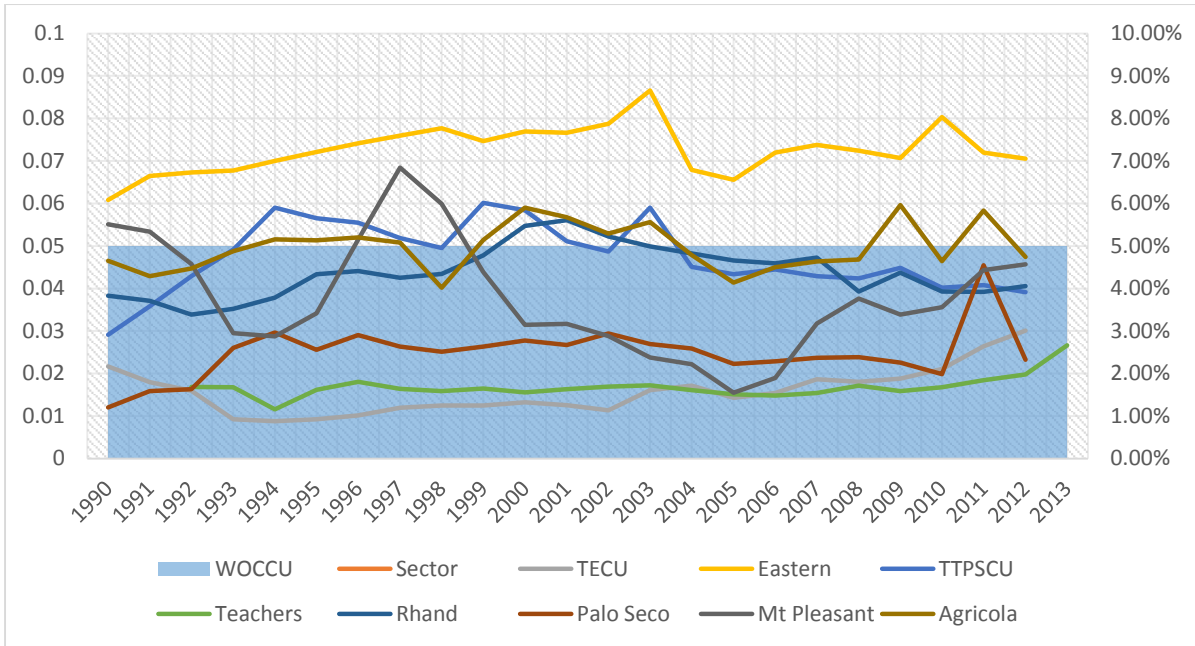
This return on average assets indicator is important since it not only speaks to the adequacy of earnings but also to a credit unions capacity to accumulate institutional capital. As can be seen in figure 2.21 below, acceptable levels of performance were observed among the credit unions investigated and, with the exception of one credit union, remained positive for the entire twenty three year duration. The return on average assets ranged between approximately thirteen percent and negative four percent in the sample selected. Nevertheless, it remains encouraging that over the twenty three year period average for the sector was approximately 10.12 percent and at the end of 2012 was 8.49 percent. This compares favourably what is obtained in other segments of the financial sector.

Figure 2.21: 12. Net Income / Average Assets (ROA)
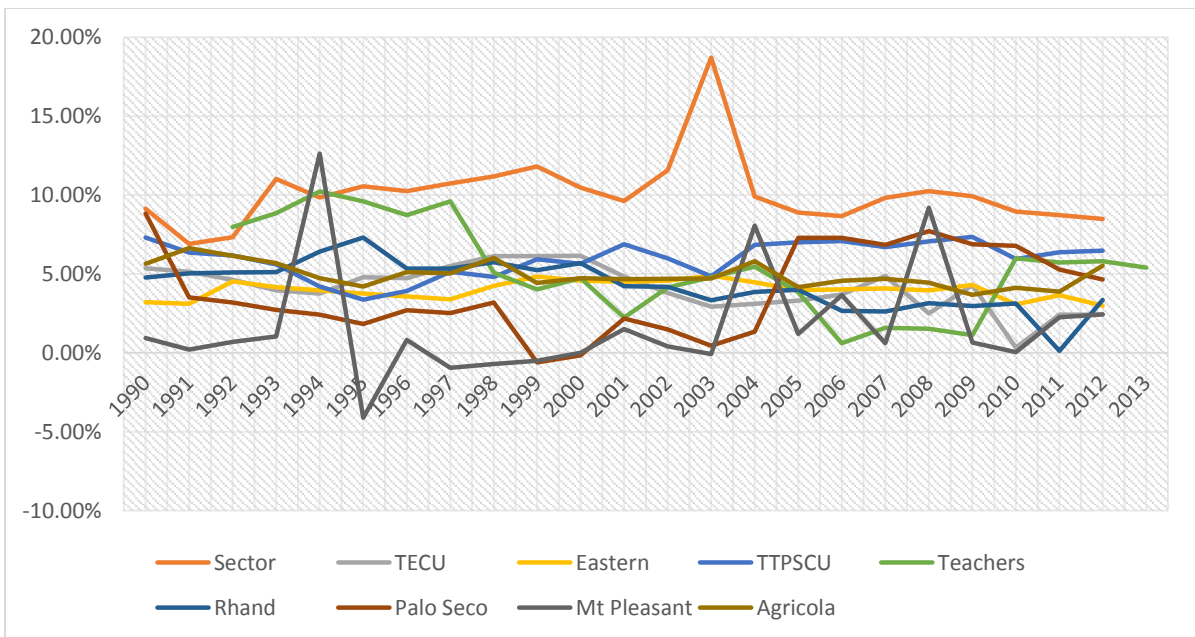
2.7.5 Liquidity

In the administration of deposit taking savings institutions, the effective management of liquidity becomes ever more important as the financial structure of a credit union shifts from members' shares to less stable savings deposits. The WOCCU credit union model deems the maintenance of sufficient liquid reserves as an integral to sound financial management. This suite of indicators demonstrates whether a credit union is managing its liquid resources efficiently such that it could meet not only liquidity reserve requirements but also deposit withdrawal requests.

In order to assess the adequacy of a credit union's liquid cash reserves that would be used to meet deposit withdrawal requests after accounting for all other short term obligations, the following indicator is used. It is recommended that credit unions maintain a minimum of fifteen percent after accounting for all short term obligations. As seen in figure 2.22 four credit unions under investigation had results below the fifteen percent minimum. Three other credit unions under investigation remained at the margin until the early 2000s then subsequently remained safely above the recommended minimum. The last credit union had liquid assets well beyond the recommended minimum for the entire period under consideration.

Figure 2.22 : L1. Liquid Assets - ST Payables / Total Deposits
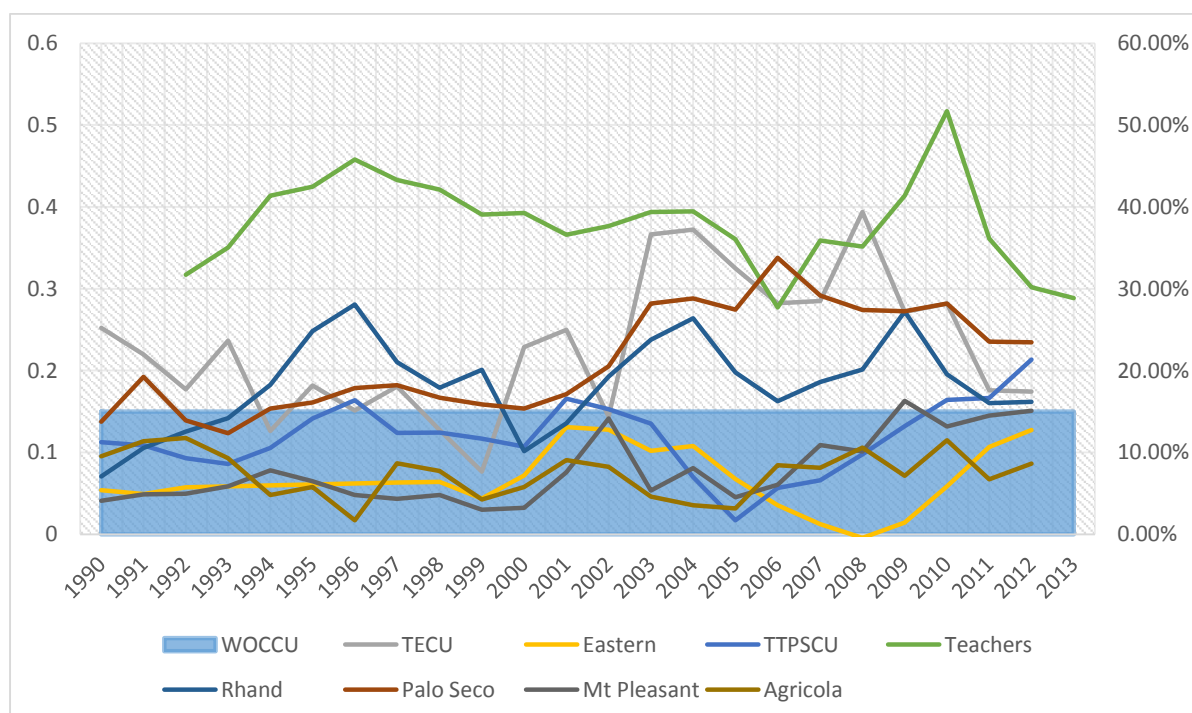
The liquidity reserve indicator evaluates the level of compliance with statutory reserve requirements set by the sector's regulatory body. Though WOCCU's standard of excellence for this indicator sets a goal of ten percent of total liquidity reserves, in Trinidad and Tobago, credit unions are obliged to maintain a reserve fund of at least one-tenth of the net surplus of the society each year. Consequently, if no surplus is made, then it is not required for transfers to be made to the statutory reserve fund. Nevertheless, the sample investigated demonstrated a steady upward trend until 2002, then subsequently a steady downward trend

to the present day, see figure 2.23. Only four credit unions investigated accumulated liquidity reserves to the magnitude of ten or more percent for a short time over the twenty three year period. The aggregate result for the sector ranged between 3.74 percent and 14.66 percent and ended 2012 at approximately 6.05 percent.

Figure 2.23 : L2. Liquidity Reserves / Total Savings Deposits
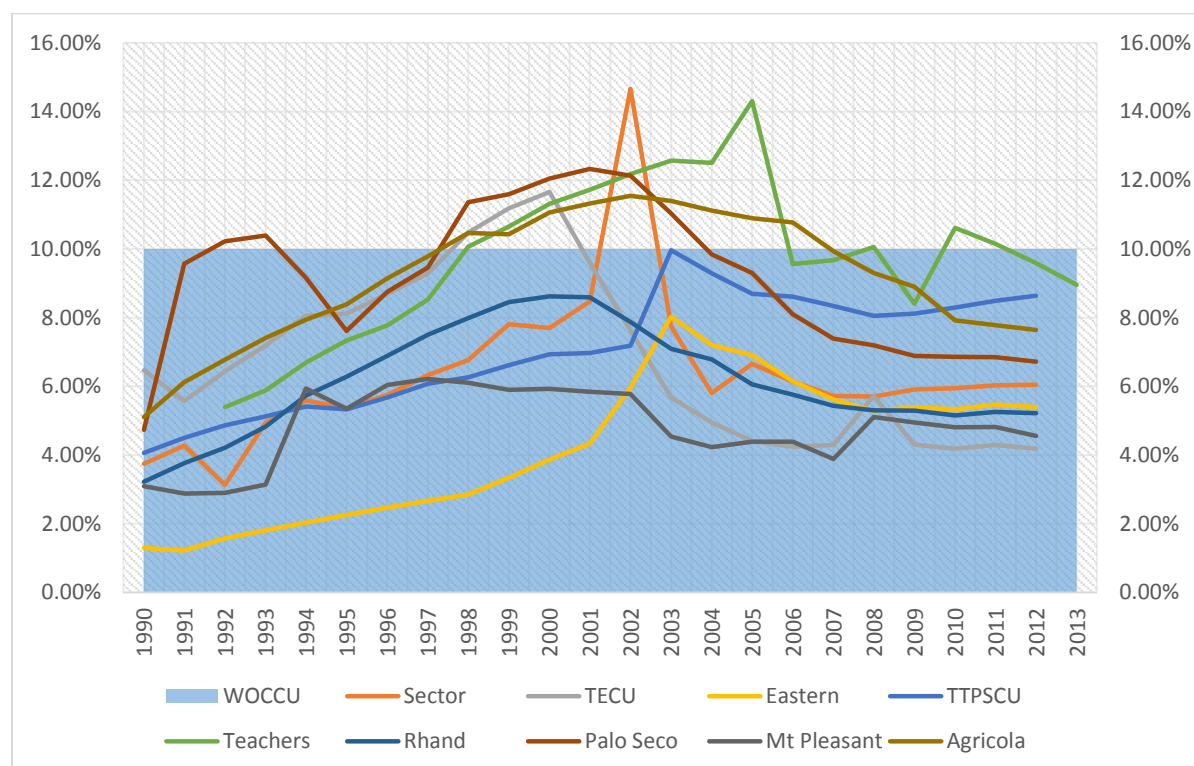
2.8   Conclusion

The financial performance observed within the sample of credit unions and across the sector can be contextualised against the backdrop of periods of expansions and contractions in the overall economy. Over the last twenty three years, the economy of Trinidad and Tobago witnessed four phases in its economic cycle. Coming out of a protracted recession in the 1980s, the period spanning 1990 to 1994 was characterised by continued structural adjustment efforts. In the post 1994 period, the austerity measures on the part of national authorities brought about a prolonged period of stabilisation that spanned 1995 to 2003. Indeed, the period subsequent to 2003 was characterised by rapid growth, with an annual average increase in economic activity of roughly 7.5 percent over the period 2004 to 2008. Lastly, the spill over effects of the global economic crisis led to a period of economic decline that started from 2009 and has continued to the present day (Craigwell and Maurin 2012).

Societies throughout the sector demonstrated unmistakeably the capacity to protect members' deposits. Though three Credit Unions in the sample faced solvency challenges during the period of structural adjustment, one of which faced solvency challenges once more during the most recent economic decline, on average, large societies, very large societies and at the sectoral level attained and maintained recommended levels of solvency throughout the periods of structural adjustment, economic stabilisation, rapid growth and economic decline.

The financial structure of societies investigated revealed a gradual change in asset composition over the twenty three year period. The proportion of assets held as loans gradually decreased while the proportion of assets held in long-term financial investments progressively increased. Though large societies demonstrated the capacity to achieve the standard of excellence of seventy to eighty percent for loans during the period of structural adjustment, on average the sample of credit unions and the sector did not maintain the recommended levels over the entire twenty three year period. This has the potential both to compress operating margins and impact on levels of net income observed. The same was true for long term financial investments, where large societies controlled proportions of financial investments within two percent of total assets during the period of structural adjustment, but not thereafter. While at the sectoral level and within the sample, the standard of excellence was not met in the period under investigation. The average proportion of total assets invested in short term investments remained within the standard of excellence both for large and very large credit unions, indicating that credit unions in the sample avoided excess levels of liquidity.

While savings deposits have remained on average within recommended levels through the periods of structural adjustments, economic stabilisation and rapid growth for large and very large credit unions, savings deposits exceeded recommended levels for the sector from the period of rapid growth into the period of economic decline. This trend was also observed in large and very large credit unions during the period of economic decline. Though the movement and the sample of large credit unions demonstrated the capacity to maintain adequate levels of institutional capital, very large credit unions in the movement failed to attain the standards set during era of structural adjustment and the most recent economic decline.

The Asset Quality of the sample investigated since raised concerns since on average, the sample of credit unions not only failed to keep non-earning assets within recommended levels, but also encountered challenges in controlling levels of delinquency. With regards to non-earning assets, neither large nor very large credit unions demonstrated the capacity to limit this indicator to the five percent limit set by WOCCU over the twenty three year period under investigation. As it pertains to delinquency, average levels for the sample only met the criteria set by WOCCU during the period of rapid growth, which was indicative of the countercyclical relationship between delinquency and the economic cycle. However, differences in the capacity to control delinquency were observed between large and very large credit unions. During the period of structural adjustments, very large credit unions were able to control levels of delinquency to recommended levels, but not thereafter. While large credit unions struggled to control delinquency during the periods of structural adjustment and stabilisation, but through aggressive credit administration the efficient management of loan portfolios in tandem with favourable economic conditions in the years post 2004 witnessed average delinquency levels being driven down to recommended levels.

In the administration of deposit taking institutions, the effective management of liquidity is an essential task. Though the sample of credit unions faced challenges in maintaining short-term investment liquidity in the structural adjustment period, the average for the sample during the periods of stabilisation, rapid growth and decline demonstrated that these credit unions had the capacity to respond to member-client withdrawal and disbursement demands. This observation was favourable since member dissatisfaction was usually expressed by way of resignation from the society, which could both precipitate a

vicious cycle of lower cash flows and lower share capital and also lead to the impairment of the society's capacity to meet loan demands. Moreover, though all societies under investigation demonstrated a steady upward trend in their liquidity reserves, on average the sample of credit unions failed to attain the recommended level of ten percent over the entire period under investigation. This was also true at the sectoral level. Lastly, though one society maintained a ratio of costly non-earning liquid assets to less than 1 percent of total assets, within the sample of societies investigated as well as at the aggregate level for the sector, this capacity was not demonstrated.

3 Literature Review

3.1 Theoretical Literature Review

Credit Unions are mutual aid organisations that operate with the aim of promoting thrift and extending loans to their members. Credit unions are generally established by individuals having a common bond. That bond may exist among the members of a church, the residents of a community or any other well defined geographical area, the employees of a firm or members of the same association. Individuals from within these groups may join the credit union regardless of creed, colour or race. Credit Unions are democratic organisations in that each member has only one vote regardless of the number of shares that individual may have with the Credit Union. These institutions contribute to the development of their membership through the provision of training in financial management and through experience gained from serving on committees and the board.

Credit Unions can be seen as vital contributors to the process of financial intermediation since they make provisions for the access of financial services to a section of the society that would otherwise have very limited access, or none at all (G. A. Khan 1991). In spite of their unique structure, Credit Unions are indeed deposit taking financial institutions, holding as their primary security consumer loans and as their secondary security credit union shares. However, unlike other financial institutions, Credit Unions do not face the burden of concurrently fulfilling the needs of dissimilar customers and the profit expectations of shareholders. These organisations operate with the expressed aim of maximizing the socioeconomic needs of its membership, a philosophy that has been effectively captured by their motto "Not for Profit, Not for Charity, But for Service."

These atypical characteristics have presented challenges to those who wish to understand the economic behaviour of these co-operative organisations. Due to the lack of an outright profit motive, neoclassical theories of the firm have generally been insufficient in capturing the economic behaviour of these unique financial intermediaries. Several theories have been put forward in the literature to explain the economic behaviour of Co-operative Credit Unions and a substantial evolution can be traced from preliminary works to the present day. The earliest efforts at modelling the economic behaviour of credit unions generally focussed on the attainment of equilibrium in the allocation of benefits between savers and borrowers (McKillop and Wilson 2011).

Some preliminary work in the development of a theoretical framework to analyse Credit Union behaviour was carried out by Smith in the early 1970s. In his investigation, he assumed that Credit Unions were basic financial institutions which offered homogeneous dividends and standardised loan rates (P. F. Smith 1971). For this model, Smith maintained that an objective function of size maximisation was indeed the most appropriate and suggested that through adjustments in rates offered to savers and lenders, alongside long run competitive pressures, credit unions would aim to maximize their size. Smith paralleled this with the intersection between average revenue and average cost observed in other financial institutions and argued that it would not only deliver an outlet for the greatest quantity of savers at the maximum rate of interest but also accommodate the greatest quantity of borrowers at the lowermost rate of interest.

Subsequent work by (Taylor 1971) proffered an integrated theoretical approach which emphasized the equilibrium between the interests of borrowers and savers. Taylor

recognised the challenge that credit unions face in allocating benefits between savers who want high dividends and borrowers who want lower rates of interest, and asserted that both objectives could not be concurrently achieved since higher rates of return on savings could only be attained by imposing higher rates of interests on loans. In his view, an inevitable conflict would arise between current borrowers and savers at the Credit Union.

In order to investigate the conflict faced by a credit union in satisfying the needs of varying members, Taylor evaluated three scenarios. The first scenario was one of neutrality where neither borrowers nor savers interests dominated. In this case, Taylor demonstrated that the equilibrium level of output, as captured by its total assets) should allow for the difference between interest received for loans disbursed and dividends paid on shares to be equal to the total operating cost of a credit union. Taylor maintained that under a situation of neutrality, this equilibrium would allow for the interests of all members to be maximised. The second scenario presented by Taylor was one where the interests of borrowers dominated. In this situation, Taylor argued that the credit union would always act in the best interests of its borrowers and as such would openly welcome new saving members since these members represented the least costly source of funds to the society. Finally, Taylor investigated the scenario of a credit union where the interest of saving members dominated. In this case, Taylor maintained that the credit union would aim to maximise its average net return. Under these conditions, new borrower-members would be welcomed since these members would contribute to gross margins, and be complementary to their own interests. Existing members will not, however, be as welcoming to new saver members, since dividends would consequently be shared among a larger pool of members.

In their seminal paper (Smith, Cargill and Meyer 1981) presented an economic theory of a credit union. In light of the dearth of theoretical research done on Credit Union behaviour, the authors presented the simple components of a risk free theoretical model for a co-operative credit union society. Smith et al pointed to the fact that since a credit union's members are both the owners and the consumers, who provide both the supply of and demand for demand funds, theories that analysed the behaviour of profit oriented financial intermediaries could not adequately treat with the unique characteristics of co-operative societies. The theoretic methodology introduced in their paper endeavoured to formalise and assimilate earlier work but with a more accommodating financial structure than typically utilised.

The main downside of the early literature was a lack of consideration of the impact of statutory reserves on the distribution of benefits among borrowers and savers as manifested by the interest and dividend rates delivered. An ensuing study by (Taylor 1979) treated specifically with this issue and revealed that maintaining an optimal level of reserves involved a trade-off in the benefits enjoyed by current and future members. In order to generate revenue levels sufficient enough to contribute to the statutory reserve fund, Taylor identified that preceding members must not only receive lower dividends but also pay higher rates of interest on their loans. Furthermore, research done by (Davis 1994) and (Davis 1997) both revealed that statutory reserve requirements acted as a hindrance to a Credit Union's growth and as a deterrent to the formation of new Credit Unions.

Due to the nature of the financial environment within which contemporary Credit Unions operate, a recent review of the literature has revealed a shift in the objective function from one that emphasizes the attainment of equilibrium in the allocation of benefits between

savers and borrowers towards one that is more commercially oriented and reflective of their need to compete with other dominant financial intermediaries. Work by (Worthington 2004) in the investigation of CUS in Australia suggested that increased competition from new market participants (such as insurance companies and mortgage specialists) has lead increasingly to the adoption of a more commercial objective function. He acknowledged that the need to survive in a modern highly competitive financial environment has restricted the capacity of Credit Unions to discharge any pre-existing ideological obligations.

In keeping with the perception of greater competition, many attempts have been made [(Feinberg 2001), (Tokle and Tokle 2000), (Hannan 2003) and (Belgrave, Craigwell and Moore 2006)] to measure the influence of Credit Unions on the level of competition observed among local financial intermediaries. In their analysis of the effect of savings and loan and credit union competition on bank behaviour in particular U.S. states, Tokle and Tokle found evidence that competition presented by thrifts, particularly co-operative credit unions, resulted in higher rates of interest for bank certificates of deposits. Work by (Feinberg 2001) proffered a mechanism through which the impact of rates of interest offered by credit unions on those offered by banks could be explored and drew attention to the vital role Credit Unions had in challenging the dominance of commercial banks in the provision of small scale credit. Building on the work of Tokle and Tokle, (Hannan 2003) investigated the impact of the operations of Credit Unions on the behaviour of thrift institutions and commercial banks operating within the same financial system. This study revealed that in financial systems where Credit Unions, Thrifts and Commercial Banks coexisted, Thrifts and Commercial banks offered more competitive returns on deposit accounts when compared to financial systems that did not have a dominant presence of credit unions.

Moreover, Work by (Jackson 2006) paralleled loan and deposit pricing behaviours of commercial banks and credit unions and came to the conclusion that unlike banks which adjusted interest rates to maximize profits, credit unions adjusted interest rates to ensure a consistent margin between deposit interest rates and loan interest rates. In Barbados, research by (Belgrave, Craigwell and Moore 2006) examined the competitive relationship between commercial banks and credit unions to determine how credit union operations impacted on the objective functions of commercial banks and vice versa. Their investigation revealed not only that the operations of credit unions do not significantly sway the market power of commercial banks in Barbados, but also that the operations of commercial banks had no impact on credit union activity. The authors concluded that commercial banks and credit unions in Barbados effectively served non-overlapping and hence non-competing markets (Belgrave, Craigwell and Moore 2006).

In recent years there has been growing interest in the development of a dynamic theory of credit union behaviour. Building on the work of (Smith, Cargill and Meyer 1981), (Rubin, et al. 2013) presented a dynamic theoretical model that departed from traditional static model of credit union behaviour in the investigation of credit unions operating in the United States. The model presented examined dynamic operations for a U.S. credit union, and established a structure that elucidated on issues such as inter-temporal rate policy and optimal equity retention, which was a major shortcoming of preliminary theoretical work on credit union behaviour. With the aid of an inter-temporal framework, the theory granted the model credit union with control both over the magnitude and timing of the allocation of benefits to its members and examined the trade-off between the allocations of benefits to members with dissimilar wants at different points in time. Provided with initial conditions,

the model fashioned a path from those preliminary conditions to a state of equilibrium, and in the process realized values for deposit, loan and equity rates. The authors concluded that the timing of benefit allocation had a direct impact on the magnitude of the discount rate that could be applied on future benefits.

In conclusion, given the unique characteristics of Credit Unions, the literature has revealed several attempts to explain credit union behaviour. Preliminary theoretical work placed great focus on the attainment of equilibrium in the distribution of benefits among borrowers and savers, and the extent to which exogenous factors disturbed that equilibrium. A more recent review of the literature has revealed a more commercially oriented analysis of credit union behaviour. The literature has revealed that the objective function of a credit union could range from size maximisation to cost minimisation and even to interest rate spread minimisation. The objective function of a Credit Union depends largely on its stage of development. Nascent Credit Unions, which may not directly face significant competition from other financial intermediaries may best be modelled utilising a size maximisation objective function. In contrast, Mature Credit Unions that directly compete with other financial intermediaries may have certain commercial objectives as a priority and as such would best be modelled using a cost minimisation or interest rate spread minimisation objective function.

3.2   Empirical Literature Review

The decades following the Washington Consensus have witnessed a substantial evolution in financial systems worldwide. From the deregulation of financial markets and the resultant escalation in competition, to the development of innovative financial products and the adoption of information technology, deposit-taking financial institutions now operate in a highly competitive financial environment (McKillop and Wilson 2011). Accordingly, a considerable amount of literature has investigated the productivity and efficiency of financial institutions and their capacity to endure in this modern and competitive financial environment. Though a substantive part of the literature has addressed the efficiency of the commercial banks, the need to examine the efficiency of other financial intermediaries, such as co-operative financial institutions, is just as prominent. A growing body of literature has evaluated the productivity and efficiency of Co-operative Credit Unions and a substantial evolution can be traced from early studies to the present day.

Preliminary work in this field utilized either production/cost functions or ratio analyses to measure a Credit Union's financial operations. The first investigations into Credit Union efficiency and productivity were carried out by Croteau. In his investigation into the efficiency of large American Credit Unions, and with the aid of financial ratio analysis, Croteau concluded that American Credit Unions presented evidence of scale economies (Croteau 1956). In later years, work by (Cox and Wingham 1984) and (Kohers and Mullis 1988), using similar methodology, also concluded that CUs in the US exhibited increasing returns to scale. Subsequent studies done by (Fry, Harper and Stansell 1982), (Wolken and Navratil 1980), (Taylor 1972) and (Dran 1971), carried out with the aid of the Cobb-Douglas production function, revealed similarly that US CUs exhibited increasing returns to scale.

Preliminary work in regions outside of the US have demonstrated less consistency (McKillop and Wilson 2011). With the aid of the Cobb-Douglas production function, the first investigations into the efficiency of CUs in Australia were conducted by (Crapp 1983) and (Brown and O'Connor 1995). Both studies revealed that Australian CUs exhibited decreasing returns to scale. In contrast, subsequent work by (Esho, Scale Economies in Credit Unions: Accounting for Subsidies Is Important 2000) presented strong evidence supporting the existence of scale economies by means of a multi-product translog function. Unlike previous investigations, (Esho, Scale Economies in Credit Unions: Accounting for Subsidies Is Important 2000) incorporated subsidies, and suggested that the neglect of subsidies in previous studies may have biased results towards finding decreasing returns to scale. Initial investigations conducted in the United Kingdom and New Zealand were carried out by (McKillop, Ferguson and Nesbitt 1995) and (Sibbald and McAlevey 2003) respectively. Utilizing a paired difference approach, these investigations presented strong evidence supporting the existence of scale economies of UK and New Zealand CUs. Some preliminary work was carried out on the Credit Unions of Canada in the 1980s by (Kim 1986) and (Murray and Robert 1983). Employing a multi-product translog function, these studies demonstrated that the Credit Unions of Canada present evidence supporting the existence of scale economies.

In the Caribbean region, challenges in accessing reliable and up to date data on the movement has led to a dearth of authoritative research on the movement. Preliminary work in the region has been largely exploratory in nature, however, a handful of researchers have investigated CU performance and efficiency. In Trinidad and Tobago, work by (G. A. Khan

1991) utilised financial ratio analysis to analyse a representative sample of 20 CUs, divided into 5 groups according to asset base. His analysis revealed that smaller credit unions have exhibited greater levels of efficiency than larger ones, specifically with regards to their efficiency of intermediation and their capital adequacy (G. A. Khan 1991). In the examination of CUs in the Eastern Caribbean, (Adrien 1996) employed financial ratio analysis to analyse sample of 80 CUs. His study provided support for the existence of scale economies in the Credit Unions of the Eastern Caribbean. His investigation revealed that in spite of notable growth in the movement, the financial health of several CUs remained a cause for concern, particularly among micro and small credit unions. Double digit delinquency rates precipitated high expense ratios and consequently spurred low levels of earnings observed among Micro and Small Credit Unions. Adrien suggested that through mergers, micro, small and medium sized credit unions could gain much needed scale economies. Nevertheless, it can be noted that these preliminary investigations into the performance and efficiency of CUs have demonstrated that in most countries, Credit Unions exhibit increasing returns to scale.

A more recent review of the literature has revealed a substantial shift in the methodologies used to measure productivity and efficiency. Contemporary literature has made the move towards the utilization of non-parametric and parametric frontier efficiency measurement approaches (Worthington, Frontier Efficiency Measurement in Deposit-Taking financial Mutuals: A Review of Techniques, Application, and Future Research Directions 2009). These approaches involve the consideration of three types of economic efficiency namely allocative efficiency, technical efficiency and productive efficiency. Once an empirical investigation has revealed a particular form of efficiency, researchers then seek to establish the degree to which regulatory, firm-specific and geographic factors influence assessed efficiencies. In order to measure the efficiency of the Credit union, it is presumed that the frontier of efficiency is known. However, since this may not be possible, researchers have employed non-parametric mathematical programming approaches and parametric econometric approaches to estimate the frontier of efficiency.

Several studies have employed parametric econometric frontier approaches in the measurement of Credit Union efficiency. This approach involves the specification of a production function and assumes that movement away from the frontier, as captured through a disturbance term, can be separated into inefficiency and random noise (Worthington, Frontier Efficiency Measurement in Deposit-Taking financial Mutuals: A Review of Techniques, Application, and Future Research Directions 2009). The literature has shown the Stochastic Frontier Approach (SFA) to be the most popular version of this approach. Work by (Worthington 1998) and (Esho 2001) on the Australian Credit Union movement employed the parametric SFA in their investigations. Worthington concluded that large, well-capitalised credit unions which had a small number of branches tend to exhibit greater efficiency, while work by (Esho 2001) revealed marginal increases in efficiency over the period under study. Work by (Frame and Coelli 2001) and (Glass and Mckillop 2006) on the US Credit Union Movement employed the SFA to examine the cost efficiency of Credit Unions in different financial environments. The study by (Glass and Mckillop 2006) revealed that the bond of the credit union influenced its level of efficiency and that larger multiple group credit unions benefit from greater cost efficiencies than relatively smaller CUs. Work by Frame and Coelli in 2001concluded that over 90% of US Credit Unions presented strong evidence for scale economies and that those that had a greater proportion of financial investments in their asset portfolio were the most efficient (Frame and Coelli 2001). In assessing the British Credit Union

Movement (Mckillop, Glass and Ward 2005) also employed the SFA and concluded that CUs in the UK present substantial opportunities for efficiency gains.

On the other hand, given empirical and theoretical advantages, much of the work on credit union efficiency measurement has been done using mathematical programming approaches. This approach involves the evaluation of the efficiency of a Credit Union as compared to other Credit Unions in the movement, rather than against an idealized standard as is the case with econometric frontier approaches. Applications of this approach include Data Envelopment Analysis (DEA), Full-Disposal Hull (FDH) and Malmquist productivity indexes (MIs). DEA and FDH are both non-stochastic approaches and assume that all movements away from the frontier are due to inefficiency (Worthington 2009). In assessing the Credit Unions of Australia, (Worthington 1998) utilized DEA to analyse a sample of sixty three CUs in 1995. His study revealed not only that scale inefficiencies are a critical issue but also that rankings of CUs based on DEA estimation and financial ratios indicated major shortcomings with respect to suitability of the latter to financial co-operatives. Furthermore, utilizing DEA, (Brown, Brown and O'connor 1999) investigated the performance of CUs in Victoria in the early to mid-1990s and found no evidence to demonstrate the movement of the average CU towards the frontier of efficiency. Subsequent work by (Worthington 2000) on a sample of the 200 largest Australian Credit Unions in 1997 revealed that the typical CU faced costs 30 percent above that which would be considered efficient based on observed best practice. Investigation into the performance of CUs in the UK by (McKillop, Glass and Ferguson 2002) employed DEA to get non radial and radial input cost efficiency measures. Through the utilization of a variety of input-output combinations, the study demonstrated that the CUs of the UK have considerable scope for efficiency gains. In assessing the Credit Union movement of the United States, (Fried, Lovell and Turner 1996) employed FDH techniques and found considerable evidence in support of their hypothesis that CUs affiliated with universities, due to the prevalence of highly qualified membership and staff, operate at a higher level of efficiency than other Credit Unions.

In the evaluation of productivity and efficiency of Co-operative Credit Unions, a substantial evolution can be traced from preliminary work to the present day. Taken together, the review of the literature revealed greater consistency in the findings of preliminary investigations which utilized production/cost functions and ratio analyses as opposed to contemporary studies which employed frontier efficiency measurement approaches (McKillop and Wilson 2011). The territory investigated and methodology utilized greatly influenced the outcomes observed. The literature revealed that the efficiency of Credit Unions is influenced by a wide assortment of factors including the developmental stage of the Credit Union, the regulatory environment within which it operates, the magnitude of its branch network and the extent of merger activity (Worthington 2009). While some investigations presented evidence supporting the existence of scale economies, the greater majority found negligible evidence to support an empirical relationship (McKillop and Wilson 2011). Lastly, there has been no investigation on the productivity and efficiency of Credit Unions which paralleled the efficiency of Credit Unions to comparable financial institutions, such as small banks.

3.3   Credit Unions in the Developing Context

A well-developed financial sector that is comprised of a variety of financial institutions and assets is of vital importance both in sustaining and increasing savings rates in the region and in providing the most ideal conditions for the efficient allocation of these savings. In the developing context, the financial needs of a large proportion of households and businesses are provided by alternative financial institutions such as microfinance institutions and co-operative credit unions. Though commercial banks are indeed the most prominent in the provision of financial services regionally, their relative significance varies substantially from country to country. Co-operative Credit Unions have emerged in all corners of the developing world as leading suppliers of financial services with a client base concentrated in those who have historically been financially excluded (McKillop and Wilson 2011). In order to appreciate the role Credit Unions in the developing context, it is essential to begin by considering the connection between the financial sector and economic growth and development.

3.3.1   The Financial System, Economic Growth and Development

The connection between finance, a country's financial system and economic development has been well established in the literature (Gurley and Shaw 1955), (Goldsmith 1975) and (McKinnon and Shaw 1976). These early authors maintained that financial system development plays an integral role in the process of capital accumulation through the transfer of surplus funds to capital short sectors of an economy from capital rich sectors. Schumpeter (1911) theorised that a sound financial system could accelerate economic growth and technological innovation by way of the delivery of funds and financial services to entrepreneurs with the greatest chance of implementing innovative processes and products. For Schumpeter, economic progress was driven by the entrepreneur. Though many would fail, some would succeed, and obsolete practices and methods would be continually supplanted by innovative techniques.

Sir William Arthur Lewis (1955) contended that the relationship between economic growth and financial system development operated in both directions. He maintained that as the economy grew, increasing development would be observed in the financial system, and this in turn would act to stimulate further economic growth. Nevertheless, the causality between the two remained a key issue (Lewis 1955). Goldsmith (1969) underscored the relationship between the real sector and the financial sector and maintained that the financial system fostered growth in the real sector through the efficient allocation of resources through time.

These early authors highlighted that financial system development encouraged growth through two channels. Firstly, via the process of capital accumulation, which comprised both physical and human capital, and secondly, through its impact on the rate of technological development. By way of these channels, resources are allocated towards productive endeavours and lead to investments in research and development, training and physical capital (Spratt 2009). These early investigations identified that a well-structured financial system was a necessary element in the process of economic development. An efficient financial system guides surplus funds to sectors that are considered to be high productivity sectors, and without it, rapid sustainable growth would not be possible.

The process of guiding funds efficiently through the financial system however is quite intricate. The financial system functions by collecting funds from surplus units and allocating to deficit units. Funds are transferred between agents indirectly via financial intermediaries

and directly via financial markets. Financial intermediaries act as mediators between borrowers/investors and savers, mobilising savings and allocating credit. In addition to guiding resources indirectly from the capital-rich to the capital-poor, the financial system enables individuals to move surplus resources directly through the financial markets. Deficit units obtain needed funds directly from surplus units through the sale of securities or financial instruments.

3.3.2   Credit Unions and Financial Inclusion

A growing body of literature has investigated the relationship between the poverty, economic growth and a nation's financial system. The generally held position that emerges is that in the fight against poverty, the pursuit of economic growth led by the development of a sound financial system is indeed an effective approach to reducing and ultimately eliminating poverty in developing countries (Department for International Development 2004). The empirical and theoretical work done in this area reveals that the development of the financial sector acts to reduce poverty through two pathways. Firstly, financial sector development contributes directly to the reduction of poverty via the provision of services to the financially excluded (Balkenhol 1999), (Jalilian, Kirkpatrick and Sinclair 2002) and (Department for International Development 2004). Secondly, via its influence on rates of economic growth, the development of the financial sector contributes indirectly to the reduction of poverty levels (Kraay 2006) and (Lopez 2005).

Financial inclusion describes the provision of financial services at an affordable cost to a broader class of people across the society. This issue has increasingly gained traction among researchers, policy makers and other relevant stakeholders worldwide. At a national level, supervisory and regulatory bodies are increasingly being charged with the responsibility of enhancing access to finance in respective countries. The heightened interest observed worldwide comes from the growing recognition that access to financial services has a critical role to play both in the fight against poverty and in the support of inclusive and sustainable development. In this regard, financial co-operatives have had a key role, both in the Caribbean Region and across the world, since these institutions have been predominant in the provision financial services to a broader class of people.

Contemporary research has consistently asserted that in light of their organisational capacity, Credit Unions are well positioned within the financial system to cater to the needs of those of lower socioeconomic brackets (Collard, Kempson and Dominy 2003) and (HM Tresury 2007). Work conducted in United Kingdom by (Collard, Kempson and Dominy 2003) revealed that lower income consumers would rather interact with institutions that are based within their local community, such as Credit Unions, in part due to the relative ease of access but also due to a general distrust of mainstream financial institutions such as commercial banks. Furthermore, (Jones 2008) identified that in the path towards financial inclusion, Credit Unions have contributed through the provision of affordable loans, simple transaction and savings accounts, and the delivery of education on financial management and prudence. Nevertheless, contemporary empirical research on the relationship between financial inclusion on economic development and poverty has revealed that the degree of influence is contingent upon the type of financial service being provided (The World Bank 2014).

Traditional Credit Unions in the UK saw the provision of affordable loans as the primary approach to aid persons in their pursuit of financial stability, however, Burger and Zellmer argued that emphasis on the provision of affordable loans was akin to putting the cart

before the horse (Burger and Zellmer 1995). The authors asserted that this approach did not lead an individual towards greater financial stability but rather encouraged further dependence on credit in the future and affirmed that the accumulation of savings contributed more directly to transitioning individuals out of poverty. Work by (Richardson 2000) maintained that it is both hypocritical and heretical to speak about the eradication of poverty without incorporating savings accumulation. Richardson firmly believed that the doctrine of micro-savings was the sole foundation upon which poverty could truly be eradicated (Richardson 2000). An empirical review of the literature confirmed that access to basic savings accounts does indeed contribute to increases in productive investment (Dupas, et al. 2012), consumption, and income.

3.3.3 Credit Unions and SME Financing

As mentioned previously, one of the core functions of financial systems is the allocation of funds to the most productive uses. The development of the financial system is not an end in itself, but rather a mechanism through which developmentally beneficial activity in the real economy could be fostered, and by extension could contribute to poverty reduction and economic growth (Spratt 2009). In the context of developing economies, it is critical to consider how the financial system transmits financing to the private sector, and specifically to small and medium sized enterprises (SMEs).

The emphasis on the SME sector emanates out of the belief that the sector boosts free enterprise and growth and therefore contributes to efficiency, innovation and productivity growth throughout the economy (Beck and Demirgüç-Kunt 2004). Moreover, SMEs are assumed to extend an assortment of opportunities for self-employment with room for substantial backward linkages to other sectors in the economy (D. R. Brown 1995). Enterprises in this sector are generally more labour intensive, and as a result, growth within the sector tends to boosts employment by a greater extent than the growth of large enterprises (Beck and Demirgüç-Kunt 2004). Moreover, SMEs tend to be considerably less import-dependent than larger enterprises, and employ local resources more productively (D. R. Brown 1995). It can be seen that the ability of the private sector to access finance is thus a key driver of economic development and is of vital importance in the exploitation of the benefits of investment and trade by developing economies. The challenge that presents itself in developing countries however is that while large enterprises and public sector entities may easily obtain needed financing, enterprises in the private sector, particularly SMEs have faced substantial challenging in acquiring funding needed to finance their operations.

In the region, Commercial banks are the pivot of local financial systems. Not only are commercial banks generally the largest formal financial institutions, but their services extend to the broadest array of economic activities and transactions (Bourne and Ramsaran 1988). In Trinidad and Tobago, the commercial banking sector has sustained a wide network and consequently, the local populace has excellent access to financial services with a branch for every 10,510 persons (Forde, The Evolution of the Financial Sector in Trinidad and Tobago (1996 - 2007) 2013). Owing to their dominance, borrowing from commercial banks has been the largest source of credit for businesses and consumers in the Caribbean region. Nevertheless, SMEs still face considerable challenges in accessing finance through these institutions. A survey done by (Brewster 2006) on Finance for Small and Medium Sized Enterprises in the Caribbean revealed that commercial bank financing has accounted for a comparatively small proportion of a firm's overall financing, especially small enterprises, which continue to face challenges in gaining access to sufficient supplies of capital. Moreover,

nearly half of the financial institutions surveyed did not provide long-term finance to SMEs. The low level of access was related to SMEs' low level of cash flow and insufficient collateral (Brewster 2006).

However, the commercial banking sector continues to exhibit an overwhelming aversion to risky endeavours. As a result, commercial banks have had a tendency tube financiers of trade as opposed to financiers of industry, since the credit allocated by these institutions tends to be short term in nature (D. R. Brown 1995). Work by Birchwood has drawn attention to the fact that informational asymmetries have hampered the allocation of credit by the commercial banks. The implication of his work is that credit is often not allocated to those ventures which provide the optimal combination of risk and return (Birchwood 2003). He observed that commercial banks have allocated credit by excluding borrowers from credit markets regardless of the rate of interest that they were prepared to pay and concluded that the problem of information asymmetry has led to market failure, causing credit to be allocated in a manner that is not socially optimal under free market conditions (Birchwood 2003).

Furthermore, Brown underscored the fact that the structure of formal financial intermediaries allows them to handle the larger individual transactions in a more cost effective manner than the small transactions required by SMEs. He identified that even the most efficient commercial banks face overheads that cause the transactions required by small firms to be excessively expensive in a way that could not be recompensed by sufficient spreads over the cost of funds (D. R. Brown 1995). Commercial banks often do not lend to microenterprises because the operational costs of lending to these firms are high relative to the revenue generated by the small loan amounts. SMEs typically suffer from a lack of sufficient capital to pledge against commercial bank loans

In contrast, Credit Unions present a number of structural advantages in the provision of financial services of this nature. Due to their structure, these institutions have a comparative advantage in the execution of small transactions. Depending on the size of the Credit Union in question, the cost to screen potential borrowers would be negligent (Balkenhol 1999). These informational advantages allow Credit Unions to screen borrowers at a price that is usually much more reasonable than NGOs or commercial banks. These informational advantages enable credit unions to accommodate SMEs who would otherwise not qualify for access to bank facilities. Moreover, Credit Unions adapt mechanisms such as social collateral and peer pressure in the delivery of financial services. Credit Unions also present cost advantages in regards of loan collection, since as opposed to having to carry out costly legal procedures, these institutions can employ a variety of social sanctions in order to have loaned funds repaid. Furthermore, due to voluntary service by some managers and administrative staff, the spectrum of overhead costs that might be faced by credit unions may be substantially smaller.

3.3.4 The Role of Credit Unions in Financial Intermediation and Development in the Caribbean Region

Owing to the prominent role of Co-operative Credit Unions in the delivery of micro financial services in the Caribbean, these institutions have been examined widely throughout the region. In Jamaica, work by Girvan and Girvan in 1993 opened a small window on an extremely important era in the history of the island and highlighted how Jamaica pioneered community development in a major way. Girvan describes successful efforts over an extended

period to empower the poor through the formation of Co-operative Credit unions (Girvan and Girvan 1993).

Further work in Jamaica by Kirton in 1991 investigated the Performance, Problems and prospects of the island's Credit Union Movement. Kirton recognised that credit unions have historically encouraged good savings habit, and given the importance of the mobilisation of savings in the development process, were of particular importance to those developing countries with limited access to foreign funding. Furthermore, given that Credit Unions were more sensitive towards members' needs than formal financial institutions, he argued that these institutions allocated funds to sectors of the society that would otherwise be neglected. Kirton believed that since loans are restricted to credit union members who were predominantly of the lower income category, it was reasonable to assume that a percentage of borrowers were involved in micro-enterprise activity which had been the source of considerable employment creation and income generation in Jamaica (Kirton 1991).

In the Bahamas, Deveaux examined the Role of Credit unions in Financial Intermediation and Economic Development. Acknowledging the difficulty in observing their contribution to development given their focus on consumer lending, Deveaux maintained that through the promotion of economic activity in depressed rural areas, the funding of micro enterprises, and the provision of financial services to the underprivileged, these institutions contribute contributed to the objectives of economic development (Deveaux 1998). In Barbados, work by Downes revealed that Co-operative Credit Unions contributed to the economic empowerment of working class Barbadians. Though when compared to the other islands of the English Speaking Caribbean, the Credit Union movement of Barbados was slow to develop due to their lack of appeal to the middle class, the movement contributed to the process of development through the provision of finance to establish business, small scale agriculture and for basic social welfare needs such as housing (Downes 2010).

In St. Lucia, Venner underscored the critical socioeconomic role which the movement has played and will continue to play in the region. Venner acknowledged that the movement's market was being challenged by the commercial banking sector, and given the active solicitation of the public by the commercial banks, he argued that credit unions should carve out a niche for themselves, focussing on areas such as small personal loans, education, housing, retirement, loans to SMEs and financial counselling to members. Through the mobilisation of savings and the facilitation of investment in critical and competitive sectors of the economy, Venner maintained that the movement exerts its influence on the process of development (K. Dwight Venner 2007).

In Trinidad and Tobago, Khan saw Credit Unions as presenting a considerable challenge to the hegemony of commercial banks and other financial institutions, particularly with regards to the mobilisation of savings and consumer credit. Through empirical work he demonstrated that the movement had performed significantly in the mobilisation of savings among small scale savers in society but noted, however that too substantial a proportion of the loan portfolio was allocated towards unproductive uses (G. A. Khan 1991).

4   Methodology

Considering the rapid structural changes being observed in the financial services sector, the investigation of the revenue and cost efficiency of the nation's changing financial institutions is of vital importance. The efficiency of a credit union has implications not only for its financial performance (as captured by levels of solvency, profitability and competitiveness) but also for the strain imposed on regulatory and supervisory authorities, and by extension tax payers, in the delivery financial services with minimal risk (Worthington 1998). In the examination of the efficiency of Credit Unions, the literature has revealed a common step-by-step empirical process that firstly specifies the objective function, secondly identifies a particular approach to measuring the frontier of efficiency, and finally specifies the institutional outputs and inputs to satisfactorily capture the relationship using the selected efficiency measurement approach.

4.1   Modelling the objective function

In order to analyse the relative cost efficiency of domestic credit unions, the correct objective function must be accurately specified. However, given the lack of an outright profit motive in Co-operative credit unions, neoclassical theories of the firm have generally been insufficient in capturing the economic behaviour of these unique financial intermediaries. The literature has revealed that the objective function of a Credit Union depends largely on its stage of development. Credit Unions that are at a nascent stage of development, and as such do not directly face significant competition from other financial intermediaries, may best be modelled utilising a size maximisation objective function. In contrast, credit unions that are at a mature stage of development, and compete directly with other financial intermediaries, may have certain commercial objectives as a priority and as such would best be modelled using a cost minimisation objective function. Furthermore, in the presence of prudential criteria that set requirements with respect to capital adequacy that constrain the volume of output a credit union can produce within any set time period, the suitability of the behavioural objective of cost minimisation becomes more apparent (Worthington 1998). Building on the work of (Frame and Coelli 2001), the sample of credit unions will be modelled as providers of financial services that aim to minimise operating costs given institutional input prices faced, namely the prices of labour, capital and deposits, the levels of output produced, and the prevailing production technology. Through this approach, an attempt is made to reconcile the objectives of the co-operative credit union with prevailing analysis of cost efficiency in depository institutions.

4.2   Cost frontier efficiency measurement approach

In the application of efficiency measurement approaches, it is assumed that the frontier of the fully efficient credit union is known. However, since this may not always be the prevailing situation, the frontier of cost efficiency will be estimated with the aid of sample data. In order to estimate the efficient cost frontier, an econometric approach will be utilized. This approach utilizes a parametric function fitted to the data, in a manner where no observations would lie outside of it. A cost function is specified and identifies divergence from the prevailing levels of technology, as captured by the disturbance term, as being comprised of two components, one that captures inefficiency, u_{it}, and another that represents statistical noise, v_{it}. The random error (statistical noise) in this model is assumed to capture all factors beyond the control of the credit unions, including econometric errors (such as data measurement errors and misspecification of the cost function) and those factors that directly impact the actual cost function (for instance varying operating settings).

For this investigation, a stochastic cost frontier will be utilised to measure the efficiency of eight credit unions over the period 1990 – 2012. This approach has been selected since it allows both for the calculation of efficiency estimates and also for the explanation of the variation in the efficiency estimates observed between credit unions. In order to measure cost efficiency, a cost function is defined which makes provisions for individual heterogeneity between institutions and through time:

$$\ln TC_{it} = \ln C(Q_{it}, P_{it}) + u_{it} + v_{it}$$

Where t = 1, …, T time periods and i= 1,…, N credit unions. In this function, the dependent variable, ln TC, describes the natural logarithm of total operating cost and C (Q_{it}, P_{it}) is a cost function where input prices and output quantity are represented by P_{it} and Q_{it} respectively. The terms u_{it} and v_{it} represent the cost efficiency term and the disturbance term. The component of cost efficiency is made up of non-negative random variables which are assumed to be independently distributed, while the disturbance term is white noise with a truncated normal distribution iidN+(μ,σu2).

4.2.1   Selection of a Functional Form

In order to estimate the frontier of efficiency, a particular functional form must be defined for the relationship between institutional outputs and inputs. Once an appropriate functional form is selected then the parameters of the function can be estimated with the aid of econometric techniques. Applied economics literature reveals the employment of the normalised quadratic, Cobb-Douglas, linear and translog functional forms. However, the translog specification has been used predominantly in the investigation of the efficiency of financial institutions using parametric methods (Frame and Coelli 2001).

For this investigation, a translog cost function will be utilised. The translog functional form is not only flexible (first order and second order flexible) and linear in the parameters (made linear by taking the logarithms of both sides of the function), but also regular (when a simple restriction is imposed on the parameters to ensure that the property is satisfied) and parsimonious. It can be seen below as follows

$$\ln TC_{it} = a_0 + \sum_{i=1}^{N} \alpha_i \ln P_{it} + \sum_{y=1}^{N} \alpha_y \ln Q_{yt} + \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \beta_{ij} \ln P_{it} \ln P_{jt}$$
$$+ \sum_{i=1}^{N} \sum_{y=1}^{N} \beta_{iy} \ln P_{it} \ln Q_{yt} + \frac{1}{2} \sum_{y=1}^{N} \sum_{z=1}^{N} \beta_{yz} \ln Q_{yt} \ln Q_{zt} + u_{it} + v_{it}$$

In order for the Translog cost function to be concave in its inputs, linearly homogeneous and non-decreasing, the following restrictions must be imposed upon the estimated coefficients.

$$\sum_{i=1}^{N} \alpha_i = 1 \ and \ \sum_{i=1}^{N} \beta_{ij} = \sum_{y=1}^{N} \beta_{iy} = \sum_{z=1}^{N} \beta_{iz} = 0$$

Furthermore, advances in technology give rise to changes economic relationships over time. Given that the panel data set of observations for the sample of eight credit unions over a twenty two year period, technological change will be accounted for through the inclusion

of a time trend into the model. Furthermore, in order to ensure that the model is indeed flexible, linear in the parameters, regular and parsimonious, the required linear input price homogeneity and symmetry restrictions will be imposed on the model. Consequently, the translog cost function must be reformulated as follows:

$$\ln TC_{it}^* = a_0 + \sum_{i=1}^{N} \alpha_i \ln P_{it}^* + \sum_{y=1}^{N} \alpha_y \ln Q_{yt} + \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \beta_{ij} \ln P_{it}^* \ln P_{jt}^*$$

$$+ \sum_{i=1}^{N} \sum_{y=1}^{N} \beta_{iy} \ln P_{it}^* \ln Q_{yt} + \frac{1}{2} \sum_{y=1}^{N} \sum_{z=1}^{N} \beta_{yz} \ln Q_{yt} \ln Q_{zt} + u_{it} + v_{it}$$

Where TC$_{it}$* = TC$_{it}$/P$_{kt}$, Pit*=P$_{it}$/P$_{kt}$ and P$_{jt}$*=P$_{it}$/P$_{kt}$.. In order to obtain the homogeneity constrained Translog Cost Frontier Model, Total Cost and Input Prices are divided by one input price. In this investigation, the price of savings was used to impose homogeneity on the sample.

4.2.2   Measuring Cost Efficiency

Drawing upon the work of Koopmans and Debreu, in 1957 Farrell defined the first basic measure of firm efficiency that could account for multiple inputs (Debreu 1951), (Koopmans 1951) and (Farrell 1957). Farrell suggested that an organization's efficiency was comprised of two elements allocative efficiency, which captured the firm's capacity to utilize its inputs in an optimal manner, given prevailing prices and technology, and technical efficiency, which captured a firm's capacity to obtain the maximum output from given institutional inputs. When combined, these two elements provide a measure of total economic efficiency.

With the aid of the figure 4.1 below, Farrell provided a basic example which considered firms that produced a single output, y, with two inputs, x1 and x2, with the prevailing assumption being one of constant returns to scale. Technical efficiency could be measured if the isoquant of the fully efficient firm, represented by SS', was known. If a particular firm utilized the quantity of inputs, as specified by P, to create a unit of output, then the technical inefficiency of that firm is captured by dividing OQ by OP, which is the percentage decrease in both inputs that may be realized without a decrease in output. The point Q, however, is a point of technical efficiency, due to the fact that it falls on the isoquant of the fully efficient firm. If the ratio of input prices AA' is indeed known, the level of allocative efficiency at the point P is found by dividing OR by OQ, there the length RQ is the decrease in the cost of production that may happen if production happened at the technically and allocatively efficient point Q', as opposed to the allocatively inefficient yet technically efficient point Q. Therefore overall economic efficiency is found by dividing OR by OP, where the decrease in cost that can be achieved is captured by the distance RP.

Figure 4.1 : Technical and Allocative Efficiencies
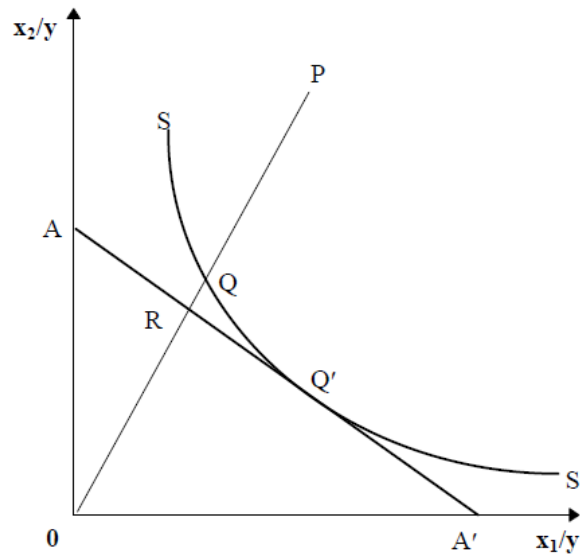
Farrell's proposal that inefficiency could be captured by deviations away from frontier of the fully efficient firm presented the foundation for the modern empirical analysis, that is, inefficiency may be captured by disturbances in an econometric model. Of the many approaches that have emerged to estimate the frontier of efficiency, one that has remained popular in the literature is the stochastic frontier approach, which employs the two component error structure.

Using the compact form, we can see the above translog cost function expressed as follows

$$\ln TC_{it}^* = x'\beta + v_{it} + u_{it}$$

However, given that the distribution of v_{it} is symmetric, we get

$$-\ln TC_{it}^* = -x'\beta + v_{it} - u_{it}$$

In line with (Coelli 1995), the cost inefficiency of the ith credit union is derived by dividing the minimum cost by the observed cost, which is given by the following

$$CE_{it} = \exp(-u_{it})$$

The calculated inefficiencies range over the interval zero to one, with a score of zero indicating full efficiency, and a score of one indicating full inefficiency. Efficiency analysis is based on the assumption that Credit Unions seek to minimise the costs of producing a given level of loans and financial investment.

4.3   Specification of Inputs and Outputs

The literature has revealed three major approaches in defining the input-output relationships of Credit unions: namely, the asset approach, the production approach and the intermediation approach, see table below. In the production approach, the society is viewed as a creator of deposit and loan accounts; where the inputs include expenditure on capital and the number of employees, while the outputs include the type and number of deposit accounts produced along with associated financial transactions. Moreover, the asset approach views the main function of a credit union as the creation of loans, where inputs are defined as capital and labour costs, and interest on members' deposits and the institutional

output is defined strictly by loan assets. Finally, the intermediation approach views credit unions as a financial intermediary, which converts and transfers financial assets to deficit units from surplus units. Under this conceptualisation, are designated as financial investments and loans, while inputs are defined by capital and labour costs, other borrowed funds and interest paid on members' deposits.

Inputs/Outputs	Production Approach	Intermediation Approach	Asset Approach
Conceptualisation	Credit Unions are producers of deposit accounts and loans	Credit Unions are intermediators, converting and transferring financial assets from surplus units to deficit units	Credit Unions primarily function as loan creators
Institutional Inputs	1. Number of Employees (Labour) 2. Capital Expenditure on Fixed Assets 3. Capital Expenditure on Other Material	1. Labour Costs 2. Capital Costs 3. Interest on Members' Deposits 4. Interest on External Credit	1. Labour Costs 2. Capital Costs 3. Interest on Members' Deposits 4. Interest on External Credit
Institutional Outputs	1. The number and type of deposit/loan accounts 2. Associated transactions	1. Loans 2. Financial Investments	1. Loans

For this investigation, a sample frame of all credit unions actively in operation in 2012, provided by the Co-operative Development Division, was utilised to select a sample of 8 Credit Unions were selected for investigation. These credit unions were selected on the basis of asset size, and were chosen from the Large (TT$ 100M to 499M) and Very Large (TT$ 500M and over) categories established by the division. In 2012, these eight credit unions, which represented 6.11 percent of credit unions actively in operation, had a collective asset base of 5,310,306,318, which accounted for 53.14 percent of the sectoral total. Of those eight Credit Unions investigated, seven were located around Trinidad and 1 was located in Tobago. The data were gleaned from the audited financial statements of the respective societies and were captured using a credit union reporting spreadsheet developed by the Credit Union Supervisory Unit. Using this instrument, all information from the balance sheet, comprehensive income statement and notes to the financial statements were captured for the period 1990 – 2012. The information collected from the financial statements allowed for the assembly of a data set that would not only allow for the analysis of the financial performance of the sample using the PEARLS framework of financial ratios, but also allow for the analysis of the cost efficiency of the sample of credit unions.

In specifying the input-output relationship in credit union behaviour of the sample of credit unions, the intermediation approach will be utilized. This approach has dominated the literature in part due to the fundamental limitations of the production approach to co-

operative organisations (Worthington 2009). Though this approach does not take into account inflationary bias, given that a panel data set will be utilized, this will minimize the effects. In spite of the fact that this approach mixes flow and stock variables, it has been shown to be robust instrument for the analysis of credit unions. For this investigation two institutional output variables and three institutional input variables were selected. As seen in the table 4.1 below, the institutional output quantities include unclassified loans to members (loans) and total financial investments (invest), while the institutional input prices selected include the price of deposits (psav), price of labour (plab), and the price of capital (pcap).

Table 4.1: Description of Specified Variables

Variable	Name	Definitions
Cost	Total Cost	Total operating and interest expenses
loans	Unclassified Loans to Members	Sum of personal, vehicle, property and other loans
invest	Total Investments	Sum of short-term investments and long-term investments
psav	Price of Deposits	Interest paid on members' deposits divided by members' deposits
pcap	Price of Capital	Sum of physical capital expenditures divided by net book value of total office premises and equipment
plab	Price of Labour	Total personnel expenses divided by the total number of full time employees

The descriptive statistics for the panel data set can be seen in the table 4.3 below.

Table 4.2: Descriptive statistics of panel data set

Variable	cost	loans	invest	psav	pcap	plab
Min.	$305,471	$9,409,000	$525,954	0.9547	0.5514	$8,260
1st Qu.	$2,272,760	$50,070,000	$8,187,663	6.5	1.5798	$29,373
Median	$4,634,375	$93,450,000	$22,636,452	7.474	3.0989	$44,754
Mean	$10,495,302	$156,800,000	$75,231,638	7.634	9.6276	$52,808
3rd Qu.	$11,628,862	$185,400,000	$94,806,041	9.4018	4.413	$69,489
Max.	$103,209,319	$1,020,000,000	$647,906,854	13.6039	86.1048	$162,709

5 Results and Significant Findings

A maximum likelihood process was employed to obtain parameters of each of the translog stochastic cost frontiers. By comparing the actual costs faced by the respective credit unions to the estimated frontiers of efficiency, one can evaluate the economic performance the respective co-operative credit unions. For this investigation, two models were specified. The first model specified a single institutional input and a single institutional output, homogeneity constrained price of labour and loans respectively. The second model specified multiple institutional inputs and multiple institutional outputs: namely labour costs, capital costs loans and investments. With a panel data set of 8 of the largest credit unions in the movement over the period 1989 to 2012, the parameters of the respective translog cost frontiers were estimated along with time varying inefficiencies.

5.1 Single Output Single Input Stochastic Cost Frontier

The maximum likelihood estimates for the parameters of the truncated normal translog cost frontier are given in the table below. The levels of significance and standard errors are also presented in the table. The parameter γ (gamma), which captures the proportion of the total deviation away from the frontier caused by inefficiency is .82. This result indicates that variation in the residuals that are accounted for by statistical noise is relatively small while the variation accounted by cost inefficiency is significantly large. A t-test of this parameter reveals that it is indeed statistically significantly different from zero.

Table 5.1: Maximum Likelihood Estimates of the Single Input Single Output Translog Cost Function

Variable	Parameter	Estimate	Std. Error	Pr(>|z|)	Sig
(Intercept)	α_0	0.7958	1.1654	0.4947	
log(loans)	α_1	-1.1784	0.3911	0.0026	**
log(plab/psav)	α_2	2.7087	0.7398	0.0003	***
I(0.5 * log(loans)^2)	β_{11}	0.2308	0.0465	0.0000	***
I(log(loans) * log(plab/psav))	β_{12}	-0.2583	0.0671	0.0001	***
I(0.5 * log(plab/psav)^2)	β_{22}	0.3114	0.1074	0.0037	**
sigmaSq	σ^2	0.2308	0.0792	0.0036	**
gamma	γ	0.8230	0.0349	0.0000	***
mu	μ	0.8716	0.3398	0.0103	*
time	t	0.0172	0.0036	0.0000	***
log likelihood value: 11.83374					
mean efficiency: 0.3245972					

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

It should be noted, however, that the parameter for γ is not a dependable estimate of the share of inefficiency. Consequently, the likelihood ratio test is used to confirm the result where the null hypothesis is H0: $\gamma = 0$ and H1: $\gamma \neq 0$. As can be seen in the table below, the likelihood test rejects the hypothesis that the fit of the OLS model (which makes the assumption that no inefficiency exists), is better than the fit of the translog error components frontier model, at the highest level of significance .1 percent (Coelli 1995).

Table 5.2: Likelihood Ratio Test of the Single Input Single Output Translog Cost Frontier

Model 1: OLS (no inefficiency)

Model 2: Error Components Frontier (ECF)						
	#Df	LogLik	Df	Chisq	Pr(>Chisq)	
1	7	-113.414				
2	10	11.834	3	250.5	0.00	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

The estimated model also allows for the calculation of technical change which had a statistically significant impact on observed inefficiencies of approximately 1.72 percent. With a mean inefficiency of .32, this translog cost frontier indicates that the average large credit union generates costs that are roughly 32 percent above the frontier of full efficiency.

5.2   Multiple Input Multiple Output Stochastic Cost Frontier

The maximum likelihood estimates for the second translog cost frontier are provided in the table below along with levels of significance and standard errors. As in the first model, the parameter γ is indeed significantly different from zero at the highest level of significance. With a value of approximately .84, this implies that the majority of the variation in the residual is accounted for by cost inefficiency. Time is also allowed to have an impact on observed inefficiencies, and the model reveals that on average, technological change impacted on observed efficiencies by approximately 1.13 percent per annum. The mean inefficiency in the multiple input multiple output model is indeed larger than that observed in the single input single output model. With a mean efficiency of 0.51, the model

Table 5.3: Maximum Likelihood Estimates of the Multiple Input Multiple Output Translog Cost Frontier

Variable	Parameter	Estimate	Std. Error	Pr(>|z|)	
(Intercept)	α_0	9.5449	1.6781	0.0000	***
log(loans)	α_1	-0.8524	0.3680	0.0205	*
log(invest)	α_2	0.1137	0.2725	0.6766	
log(plab/psav)	α_3	0.4064	0.5498	0.4598	
log(pcap/psav)	α_4	1.3925	0.4854	0.0041	**
I(0.5 * log(loans)^2)	β_{11}	0.2001	0.0605	0.0009	***
I(log(loans) * log(invest))	β_{12}	-0.1051	0.0397	0.0082	**
I(log(loans) * log(plab/psav))	β_{13}	-0.0548	0.0559	0.3276	
I(log(loans) * log(pcap/psav))	β_{14}	-0.1027	0.0525	0.0504	.
I(0.5 * log(invest)^2)	β_{22}	0.1266	0.0305	0.0000	***
I(log(invest) * log(plab/psav))	β_{23}	-0.0168	0.0312	0.5903	
I(log(invest) * log(pcap/psav))	β_{24}	0.0481	0.0297	0.1050	
I(0.5 * log(plab/psav)^2)	β_{33}	0.1509	0.0675	0.0254	*
I(log(plab/psav) * log(pcap/psav))	β_{34}	0.0118	0.0422	0.7809	
I(0.5 * log(pcap/psav)^2)	β_{44}	-0.1228	0.0307	0.0001	***
sigmaSq	σ^2	0.0659	0.0091	0.0000	***
gamma	γ	0.8412	0.0441	0.0000	***
mu	μ	0.4707	0.1532	0.0021	**
time	t	0.0113	0.0047	0.0172	*

log likelihood value: 140.1964

mean efficiency: 0.5110882

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

In order to ensure that gamma is indeed significantly different from zero, the likelihood ratio test has once again been employed to test the null hypothesis that H0: $\gamma = 0$ and H1: $\gamma \neq 0$. The results obtained reject the null at the highest level of significance and confirm that the multiple input multiple output translog cost frontier is indeed the better fit when compared to the OLS model (Coelli 1995).

Table 5.4: Likelihood Ratio Test of the Multiple Input Multiple Output Translog Cost Frontier

	#Df	LogLik	Df	Chisq	Pr(>Chisq)	
Model 1: OLS (no inefficiency)						
Model 2: Error Components Frontier (ECF)						
1	19	153				
2	18	159.06	-1	12.126	0.0004973	***

5.3   Evaluation of Cost Efficiency

5.3.1   Single Input Single Output Stochastic Cost Frontier

The time varying efficiency estimates can be seen in the table below. The first model has produced inefficiency estimates that range from .1345 to .6095, with a mean of .3245. As can be seen below, as time has progressed, all credit unions investigated moved towards the frontier of efficiency. This indicates that through improvements in management, the computerisation of credit union operations, the adoption of electronic technologies and the hiring of qualified personnel, the levels of efficiency of the credit unions increased steadily over the 24 year period.

Table 5.5: Sample Cost Inefficiencies from the Single Input Single Output Translog Cost Frontier

	1990	1995	2000	2005	2010	2012
Mean	0.3920	0.3801	0.3505	0.3212	0.2924	0.2644
TECU	0.3580	0.3454	0.3140	0.2831	0.2528	0.2236
Eastern	0.3169	0.3044	0.2737	0.2437	0.2148	0.1872
Teachers	0.6095	0.5990	0.5722	0.5443	0.5155	0.4858
TTPS	0.2526	0.2408	0.2119	0.1845	0.1586	0.1345
RHAND	0.2853	0.2731	0.2431	0.2142	0.1866	0.1606
Palo Seco	0.6017	0.5911	0.5639	0.5358	0.5067	0.4768
Agricola	0.2999	0.2875	0.2572	0.2277	0.1995	0.1727
Mt. Pleasant	0.4119	0.3994	0.3679	0.3364	0.3051	0.2744
Maximum	0.6095	0.5990	0.5722	0.5443	0.5155	0.4858
Minimum	0.2526	0.2408	0.2119	0.1845	0.1586	0.1345
St. Dev	0.1312	0.1319	0.1331	0.1334	0.1328	0.1313

Figure 5.1 : Histogram of Sample Inefficiencies from the Single Input Single Output Translog Cost Frontier

efficiencies(translogHOM1)
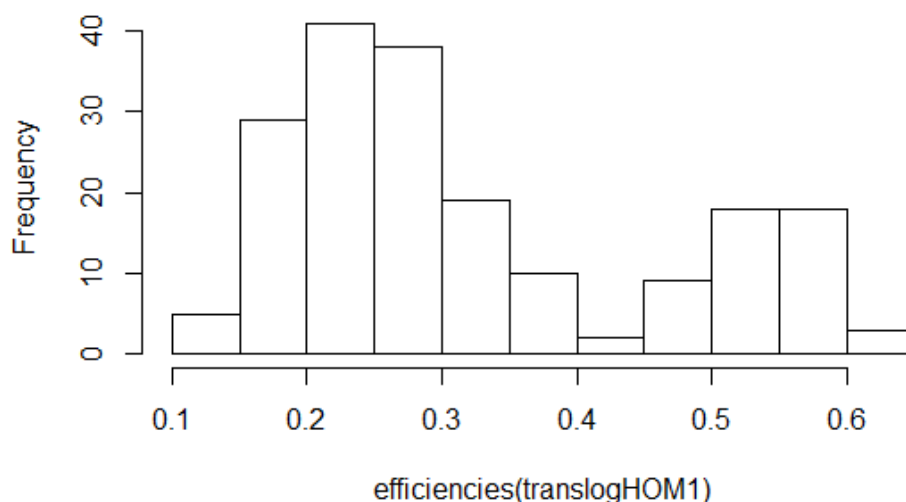
5.3.2 Multiple Input Multiple Output Stochastic Cost Frontier

When investments and the price of capital were taken into consideration, the estimated inefficiencies increased. Nevertheless, a similar trend has been observed over time, see table below. The second model has produced inefficiency estimates that range from widely from .271 to .974, with a mean of .5111, see table 5.6. Again, as time has elapsed, all credit unions investigated moved towards the frontier of efficiency. This indicates that through improvements in management, the computerisation of credit union operations, the adoption of electronic technologies and the hiring of qualified personnel, the levels of efficiency of the credit unions increased steadily over the 24 year period. The estimated inefficiencies can be visually inspected in figure 5.2.

Table 5.6: Sample Cost Inefficiencies from the Multiple Input Multiple Output Translog Cost Frontier

	1990	1995	2000	2005	2010	2012
Mean	0.5505	0.5438	0.5267	0.5095	0.4921	0.4746
TECU	0.4601	0.4520	0.4316	0.4110	0.3904	0.3696
Eastern	0.3612	0.3529	0.3321	0.3116	0.2911	0.2710
Teachers	0.6919	0.6861	0.6712	0.6559	0.6400	0.6236
TTPS	0.3956	0.3873	0.3666	0.3458	0.3251	0.3046
RHAND	0.4298	0.4216	0.4010	0.3802	0.3595	0.3387
Palo Seco	0.6097	0.6029	0.5854	0.5675	0.5491	0.5304
Agricola	0.9740	0.9734	0.9719	0.9703	0.9686	0.9668
Mt. Pleasant	0.4822	0.4742	0.4541	0.4337	0.4132	0.3925
Max	0.9740	0.9734	0.9719	0.9703	0.9686	0.9668
Minimum	0.3612	0.3529	0.3321	0.3116	0.2911	0.2710
St. Dev.	0.2036	0.2061	0.2125	0.2188	0.2251	0.2312

Figure 5.2 : Histogram of Sample Inefficiencies from the Multiple Input Multiple Output Translog Cost Frontier
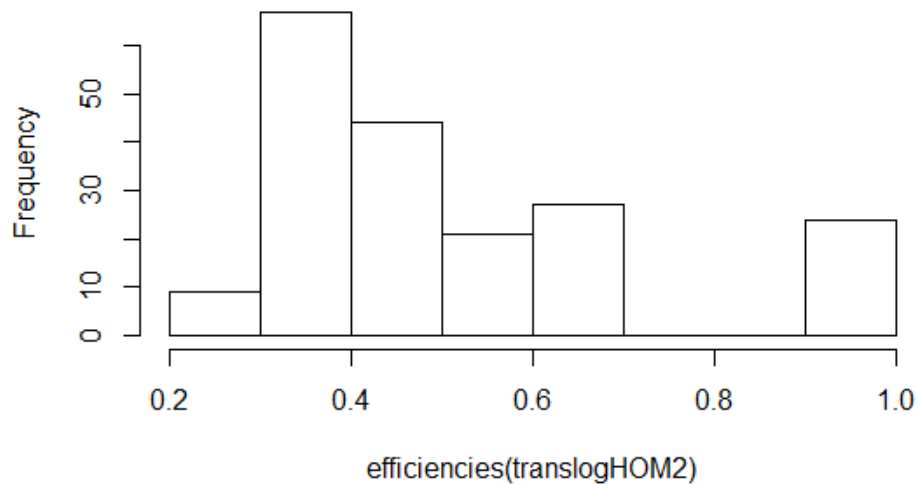
5.4 Skewness of the Residuals

In order to determine whether the Translog Cost Frontier was indeed the most ideal functional form to define the relationship between operating costs, institutional inputs and institutional outputs, we begin by visualising the distribution of the residuals of the estimated Cobb-Douglas and Translog Cost Frontiers with linear homogeneity in input prices imposed, see figures below. As seen below, the residuals of the restricted Cobb Douglas frontier are left skewed, while the residuals of the restricted Translog Cost Frontier are approximately symmetric.

Figure 5.3 : Histogram of the residuals of the Single Input Single Output Constrained Cobb-Douglas Cost Frontier.
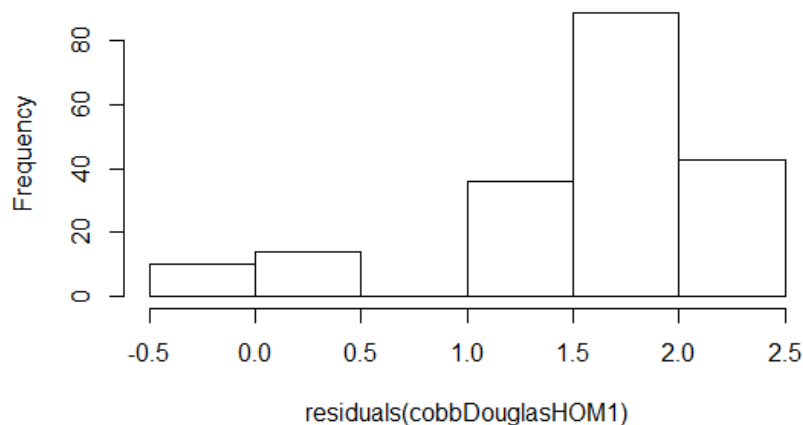
Figure 5.4: Histogram of the residuals of the Single Input Single Output Constrained Translog Cost Frontier.
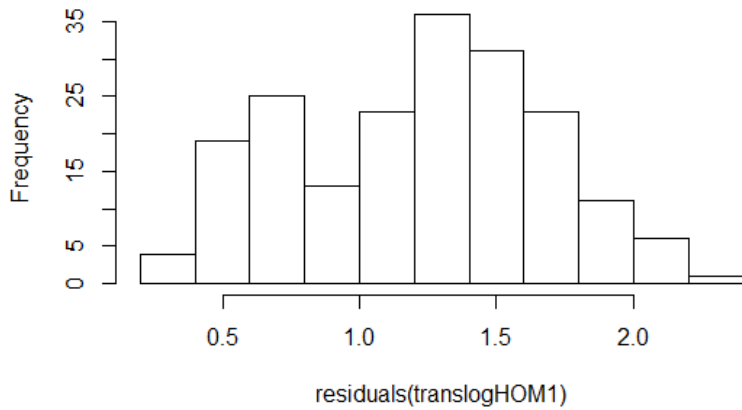
Conversely, with the multiple input multiple output specification, the residuals of both the linear homogeneity imposed Cobb Douglas and Translog Cost Frontiers are negatively skewed, see figures below.

Figure 5.5: Histogram of the residuals of the Multiple Input Multiple Output Constrained Cobb-Douglas Cost Frontier
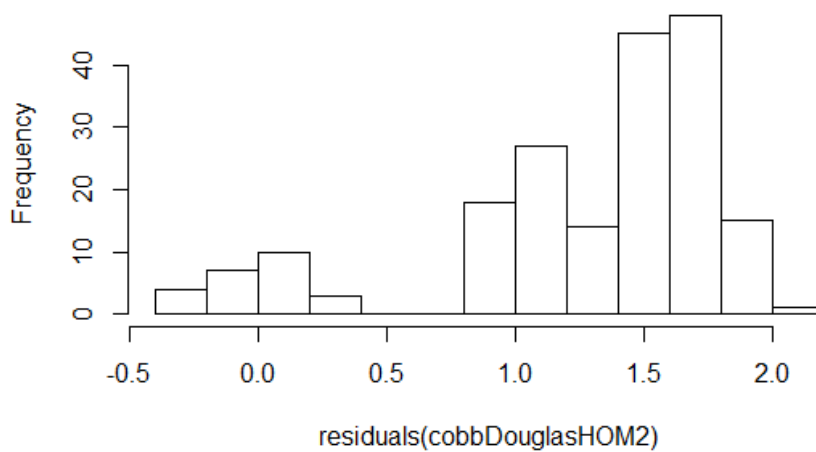
Figure 5.6 : Histogram of the residuals of the Multiple Input Multiple Output Constrained Translog Cost Frontier

residuals(translogHOM2)
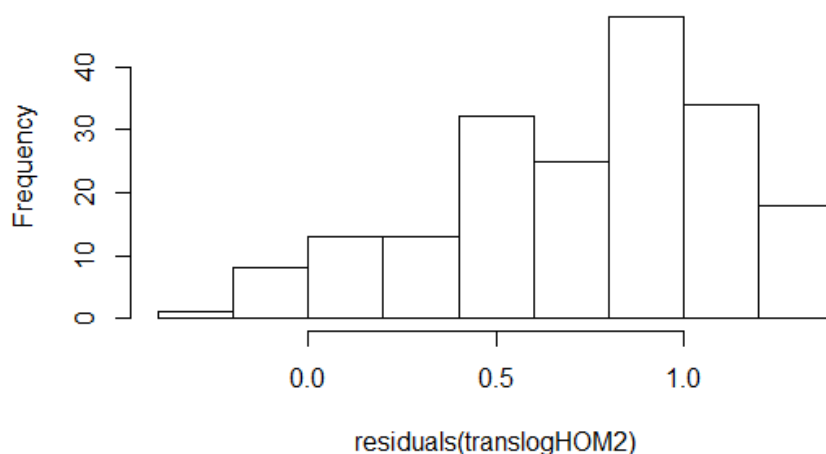
The visual inspection of skewness is confirmed through the calculation of skewness for the respective cost frontiers, seen in the table below.

Table 5.7: Skewness of the residuals of the estimated stochastic cost frontiers

Cost Frontier	Skewness
cobbDouglasHOM1	-1.4573219
translogHOM1	-0.3199598
cobbDouglasHOM2	-1.323234
translogHOM2	-0.6827188

The residuals of the restricted and unrestricted Cobb Douglas and Translog Cost Frontiers all have small yet negative skewness, which implies that the residuals are left-skewed, even though it is expected that residuals would be positively skewed. This may be due to a range of factors:

- The distribution of the efficiency component is negatively skewed or symmetric (misspecification of the distribution of the efficiency component)
- The distribution of the error component is negatively skewed, which neutralised the positively skewed distribution of the efficiency component (misspecification of the distribution of the statistical noise component)
- The credit union is perfectly cost efficient (there is only statistical noise)

Furthermore, the distribution of the real unknown residuals for the sample may indeed be positively skewed, however, OLS has provided negatively skewed residuals due to the following reasons:

- Institutional input prices or output quantities are not exogenously given (endogeneity bias)
- Inaccurate measurement of the explanatory variables (errors in variables bias)
- Critical explanatory variables (such as the cost of borrowed funds) may not have been incorporated in the specified model (omitted variable bias)
- The specified functional form (Such as the Translog or Cobb Douglas) is not a good approximation of the true but unknown functional form (misspecification of the functional form)

- The parameter estimates are not accurate

In order to compare the estimated translog functions against other possible functional forms, the likelihood ratio test is utilised. The table below shows the results of the likelihood test between the single input single output constrained translog cost frontier and the constrained Cobb Douglas frontier, the unrestricted translog function, and the corresponding OLS model respectfully. In all cases, the fit of the constrained Translog Cost Frontier has been found to be significantly better than the fit of the other forms.

Table 5.8: Likelihood Ratio Tests of Constrained Translog Cost Frontier

	#Df	LogLik	Df	Chisq	Pr(>Chisq)	
		Model 1: cobbDouglasHOM1				
		Model 2: translogHOM1				
1	7	106.553				
2	10	11.834	3	189.44	0.00	***

		Model 1: translog1				
		Model 2: translogHOM1				
1	10	51.009				
2	10	11.834	0	78.35	0.00	***

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**						

Table 5.9: Likelihood Ratio Tests of Constrained Translog Cost Frontier

	#Df	LogLik	Df	Chisq	Pr(>Chisq)	
		Model 1: cobbDouglasHOM2				
		Model 2: translogHOM2				
1	9	115.07				
2	19	140.2	10	50.246	0.00	***
		Model 1: translog				
		Model 2: translogHOM2				
1	19	153				
2	18	159.06	-1	12.126	0.0004973	***

6 Conclusions

6.1 Conclusions

Against the backdrop of the rapid structural changes observed in the financial services sector over the last two decades, the investigation has aimed to evaluate the performance of the largest societies in the movement over the period 1990 to 2012. In line with traditional and contemporary literature, both financial ratio and parametric stochastic cost frontier analyses were performed. Both a single input single output and multiple input multiple output translog stochastic cost frontiers were estimated to measure the efficiencies observed within the largest credit unions in the movement. The investigation has revealed that level of inefficiency faced by credit unions within the sample has been on average fifty one percent higher than those on the frontier of full efficiency. However, a steady downward trend was observed in levels of inefficiency over the period under investigation. Though levels of inefficiency were high, it must not be forgotten that these financial intermediaries are indeed Co-operative Societies, driven by the motto "Not for Profit, Not for Charity, but for Service." These institutions have allowed large numbers of people to exercise ownership and control of important assets such as real estate, housing development, and stocks and shares on the stock exchange. This demonstrates not only democracy but democratic participation. These institutions have and continue to cater to the socioeconomic needs of their members, a task that is not always possible to achieve in a cost efficient manner. Nevertheless, through improvements in management, technical training provided by secondary bodies in the movement, the adoption of electronic technologies, and the employment of qualified personnel, the movement has been able to steadily drive operational costs towards the frontier of full efficiency.

6.2 Policy Implications

6.2.1 Regulatory reform and sustainable development

In the regulation and supervision of financial co-operatives, the nuances between commercial banks and credit unions must be considered carefully, both with respect to their capital structures as well as internal governance. In keeping with the regulator's need to cater to the public's interests, certain aspects of the extant legislation were indeed in need of sweeping reform. However, it is important that the implications of the proposed legislation be considered against the backdrop of the role that the movement has played, and continues to play, in the reduction of poverty, inequality and financial exclusion. In the context of our developing country, regulatory bodies should not view themselves as being charged solely with the responsibility to maintain a strong and stable financial system, but must also to be held accountable for the development of a financial system that allows resources to be allocated towards developmentally beneficial activity. If regulatory authorities are concerned fomenting financial stability and development, the regulatory environment must be such that it enables the sector can grow to a mature stage of development where it can effectively compete with other financial institutions. The regulation of the sector should be oriented in such a way that it does not hinder its capacity to continue to contribute to sustainable development, including the reduction of poverty and economic and social inequality.

6.2.2 Information Requirements

The availability of reliable, up to date, and comprehensive information on the financial status of financial co-operatives is a sine qua non both for the efforts of researchers and regulators. However, information made available from the Co-operative Development

Division revealed that on average, over the last 10 years, only 84 percent of Credit Unions complied with statutory reporting requirements. Furthermore, where data have been submitted with regularity to the division, the systems in place have not allowed for the processing and consolidation of the data into useful information on the movement. The situation is made worse since the extant legislation identifies no reporting requirement for the Co-operative Development Division itself, in the manner that other supervisory and regulatory authorities must account to the public and the government on the activities of other sectors of the financial system. These shortcomings have both constrained the effectiveness of the current regulatory body and contributed to the marked discrepancies in aggregate information reported by the Central Bank, the Co-operative Development Division and other publications on the movement.

Consequently, a dearth of reliable aggregate information exists for the sector which both limits the possibility of empirical research and encumbers the division in effectively carrying out its mandate. The evidence demonstrates that greater emphasis should be directed towards the development of the capacity of the extant regulatory body. The institutionalization of systems that allow for the regular submission of audited financial statements would both ameliorate the state of ambiguity on the operations and performance of the sector and empower regulatory authorities recommend corrective and preventative measures where needed. Furthermore, the financial statements of each society should conform to established and internationally recognised reporting standards and also be consistently adhered to across the sector. This consistency should also apply to the measurement of items within the financial statements, since the investigation revealed that financial statement information has been inconsistently measured between and within Credit Unions, even where statements have faced external auditors.

Moreover, the institutionalisation of systems for the submission of information beyond that made available via audited financial statements at semi-annual or quarterly intervals would further empower regulatory authorities to recommend preventative and corrective measures. This in conjunction with the provision of powers to enforce compliance with these requirements would strengthen the capacity of regulatory authorities to ensure societies are in compliance with legal requirements and prudential criteria. This supplemental information could also feed into established macro-economic financial system databases and allow for a more complete portrait of the role of the sector in the overall economy.

6.2.3   Financial Management

The extant legislation has also displayed deficiencies with respect to suitable prudential criteria. Though the act covers the areas of capital adequacy as captured by the maintenance of a reserve fund, and borrowing limits to be set annual at annual general meetings, the act was deficient in the identification of suitable criteria in critical areas such as liquidity, asset quality and financial structure. The White Paper on Financial Sector reform identified the need for the development and implementation of relevant prudential criteria. The prudential framework that has been crafted by the Central Bank has been aligned with the PEARLS system of financial ratios, which through the continuous and determined efforts of the League, have been widely implemented throughout the movement.

Nevertheless, the system has not been met with great favour from a number of credit unions due to the belief some standards of excellence outlined in the framework may not be well suited for credit unions in the developing context. However, it is my view that the PEARLS

system reflects the standard of excellence of a credit union that is at a mature stage of development, and as such is reflective of its need to compete with other dominant financial intermediaries. Though this paper has analysed the largest credit unions in the movement, the societies under investigation were at different stages of development exhibiting not only markedly different organisational and financial attributes but also membership base of different orientations. Since credit unions are multiple interest operations, that have to find equilibrium between the interests of borrowers and savers, if the membership of a society is dominated by a particular type of orientation, the financial structure is likely to display certain characteristics.

The analysis of the financial performance of the sector using the PEARLS ratios revealed that saver-dominated societies were at a disadvantage in attaining the standards of excellence set with respect to effective financial structure. Nevertheless, these institutions were capable of satisfying the criteria in other areas with no less proficiency. Though the framework may not provide a benchmark to adequately compare credit unions within the movement, it is vital that societies in the movement continue to utilise the PEARLS framework since it provides crucial guidance to those managing the credit union and signals where trends in particular items may be contribute to or be at the detriment of the overall financial condition of the society. Though the Central Bank has outlined specific prudential regulations that must be satisfied by actively operating Credit Unions, those credit unions that seek to achieve the standards of excellence set will ensure that the societies are of safe and sound standing. The utilisation of the framework in conjunction with improved internal control mechanisms as well as the maintenance of well documented systems and procedures would not only strengthen quality of management of the society, but also contribute to greater levels of efficiency in the credit union, since it provides a tool through which progress towards particular financial goals can be monitored.

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Appendices

Appendix 1 – Contextualised PEARLS Ratios

The table below summarises the results of the sample of Credit Unions in the context of the four broad phases in the country's economic cycle over the last 23 years. The value of 1 indicates where a Credit Union has achieved the Standard of Excellence set by WOCCU during a particular period. The value of 0 indicates where a Credit Union has failed to achieve the prudential criteria.

Protection

Category	Protection			
Ratio	6. Solvency (Net Value of Assets/Total Shares & Deposits)			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	≥ 111%			
Sector	1	1	1	1
TECU	1	1	1	1
Eastern	0	0	1	1
TTPSCU	0	1	1	1
Teachers	1	1	1	1
Rhand	0	1	1	0
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Effective Financial Structure

Ratio	1. Net Loans / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	70-80%			
Sector	0	0	0	0
TECU	0	0	0	0
Eastern	1	1	1	1
TTPSCU	0	1	1	1
Teachers	0	0	0	0
Rhand	1	0	0	0
Palo Seco	0	1	0	0

Mt. Pleasant	0	0	0	0
Agricola	0	0	1	1
Sample Average	0	0	0	0
Very Large	0	0	0	0
Large	1	0	0	0

Ratio	2. Liquid Investments / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	≤ 16%			
Sector				
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Ratio	3. Financial Investments / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	≤ 2%			
Sector	1	1	1	1
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Ratio	5. Savings Deposits / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	70-80%			
Sector	1	1	0	0
TECU	0	0	0	0
Eastern	0	0	0	0
TTPSCU	1	1	1	0
Teachers	1	0	0	1
Rhand	0	0	0	0
Palo Seco	1	1	1	0
Mt. Pleasant	0	0	0	0
Agricola	0	0	1	0
Sample Average	1	1	1	0
Very Large	1	1	1	0
Large	1	1	1	0

Ratio	7. Member Share Capital / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	≤ 20%			
Sector	1	1	1	1
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Ratio	8. Institutional Capital / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth	Economic Decline

		(2004 - 2008)	(2009 - 2012)
Standard of Excellence	≥ 10%		
Sector	0	0	0	0
TECU	0	0	0	0
Eastern	0	0	0	0
TTPSCU	0	0	0	0
Teachers	0	0	0	0
Rhand	0	0	0	0
Palo Seco	0	0	0	0
Mt. Pleasant	0	0	0	0
Agricola	0	0	0	0
Sample Average	0	0	0	0
Very Large	0	0	0	0
Large	0	0	0	0

Asset Quality

Ratio	1. Total Loan Delinquency / Gross Loan Portfolio			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	≤ 5%			
Sector				
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	0
Teachers	1	1	0	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	0
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Ratio	2. Non-earning Assets / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	≤ 5%			
Sector	1	1	1	1

	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Ratio	8. Gross Margin / Average Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	ˆE9=10%			
Sector	1	1	1	1
TECU	1	1	1	0
Eastern	0	0	0	0
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	0	0	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	0	1	1	0
Large	1	1	1	1

Ratio	9. Operating Expenses / Average Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	ˆE9=10%			
Sector				
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1

Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Ratio	12. Net Income / Average Assets (ROA)			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	>1%			
Sector	0	0	0	0
TECU	0	0	0	0
Eastern	0	0	0	0
TTPSCU	0	0	0	0
Teachers	0	0	0	0
Rhand	0	0	0	0
Palo Seco	0	0	0	0
Mt. Pleasant	0	0	0	0
Agricola	0	0	0	0
Sample Average	0	0	0	0
Very Large	0	0	0	0
Large	0	0	0	0

Liquidity

Ratio	1. Liquid Assets - ST Payables / Total Deposits			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	15-20%			
Sector				
TECU	1	0	0	0
Eastern	1	0	0	0
TTPSCU	1	0	0	0
Teachers	1	1	1	0
Rhand	1	0	0	0
Palo Seco	1	0	0	0
Mt. Pleasant	1	0	0	0
Agricola	1	0	0	0
Sample Average	1	1	1	0
Very Large	1	0	0	0
Large	1	0	0	0

Ratio	2. Liquidity Reserves / Total Savings Deposits

Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	10%			
Sector	0	0	0	0
TECU	0	0	0	0
Eastern	0	0	0	0
TTPSCU	0	0	0	0
Teachers	0	0	0	0
Rhand	0	0	0	0
Palo Seco	0	0	0	0
Mt. Pleasant	0	0	0	0
Agricola	0	0	0	0
Sample Average	0	0	0	0
Very Large	0	0	0	0
Large	0	0	0	0

Ratio	3. Non-earning Liquid Assets / Total Assets			
Period	Structural Adjustment (1990 - 1994)	Economic Stabilisation (1995 - 2003)	Rapid Growth (2004 - 2008)	Economic Decline (2009 - 2012)
Standard of Excellence	< 1%			
Sector	1	1	1	1
TECU	1	1	1	1
Eastern	1	1	1	1
TTPSCU	1	1	1	1
Teachers	1	1	1	1
Rhand	1	1	1	1
Palo Seco	1	1	1	1
Mt. Pleasant	1	1	1	1
Agricola	1	1	1	1
Sample Average	1	1	1	1
Very Large	1	1	1	1
Large	1	1	1	1

Appendix 2 – Panel Data Set of Credit Unions

CU CODE	YEAR	loans	invest	cost	psav	pcap	plab
1	1	63577704	15662758	2571541	6.50	1.71	24716
1	2	57779593	46794873	3032516	6.50	1.70	25176
1	3	60816220	55456219	2905621	6.50	1.48	24492
1	4	69283447	127696477	3329827	7.00	1.72	24995
1	5	74232521	158470071	2504089	7.00	0.99	27316
1	6	63278088	180508582	2571433	7.50	0.98	28654

1	7	57444573	188938666	2731689	7.50	0.91	30078
1	8	57749871	166266446	2904145	8.00	0.94	33118
1	9	58934404	146152396	3145109	8.00	1.01	35483
1	10	65313528	158623812	3245007	8.00	1.05	35744
1	11	73652779	171548183	3371652	8.00	1.11	34583
1	12	78296692	153566875	3773285	8.50	1.12	40052
1	13	94897114	177350601	4148470	8.50	0.89	44893
1	14	106691898	272974871	4718514	7.50	0.74	48352
1	15	141095439	317639608	8667870	8.50	1.34	40592
1	16	199882927	392453675	11754105	8.50	1.46	44033
1	17	297766380	413754170	11754589	8.50	1.07	46336
1	18	408095741	409122670	14636319	6.50	1.18	47789
1	19	494701108	471012295	19893222	7.50	1.47	51767
1	20	556519667	481477085	21281606	6.50	1.67	62172
1	21	556639649	461854305	24308043	5.00	1.82	19309
1	22	541989616	641867557	28770449	3.00	1.21	96889
1	23	511741415	537116624	36948492	2.75	1.80	94817
1	24	532859624	647906854	44466194	2.75	2.03	109266
2	1	116058469	6881020	9519948	8.79	3.45	43220
2	2	124839900	9630743	9627269	10.18	3.22	39043
2	3	142340790	11711169	11587114	10.75	3.31	44400
2	4	156757752	14559583	13097667	12.20	3.60	42578
2	5	166265194.7	15710601.21	14314545.89	12.05	3.85	44554
2	6	176849666.7	16992009.92	15669276.17	11.89	4.09	46812
2	7	188344753.9	18383662.24	17140558.13	11.75	4.33	49306
2	8	200628652	19870811.92	18712801.77	11.61	4.55	52002
2	9	213608330.6	21442196.24	20374099.9	11.48	4.77	54876
2	10	227210406	23088931	22115060	11.37	4.96	57907
2	11	252658514	30616206	22957289	11.52	4.58	63177
2	12	264816426	37884764	25694142	12.05	4.35	79718
2	13	284018524	49560735	27925567	12.18	4.62	77554
2	14	299861712	73042567	31878595	12.63	4.82	62089
2	15	336002206	135337481	40095218	11.91	4.40	90449
2	16	388183075	164554302	36914123	11.41	3.84	70189
2	17	493758263	165498041	42159981	10.32	3.75	74425
2	18	637994310	162475720	55577264.5	10.85	4.21	90954
2	19	782230357	159453399	67878332	11.19	4.40	106214
2	20	937724609	135430978	77535570	11.07	4.61	106719
2	21	1011423807	144280421	84514405	11.85	4.64	114049
2	22	1020494805	209215933	103209319	12.39	5.92	111076
2	23	982742369	314737025	98100548	12.95	5.22	108469
2	24	1007347486	370765739	102244355	11.93	4.66	126917
4	1	46587000	10418345.89	853178.198	6.75	1.17	21619
4	2	51262000	13245527.11	939546.6892	6.75	1.16	22993
4	3	55937000	16528041.89	1131516.007	6.75	1.28	25951

4	4	62570432	20443397	1376973	6.75	1.36	29929
4	5	71592562	22430450	1575735	6.75	1.41	29872
4	6	77216908	28864019	1243425	6.75	0.78	32837
4	7	83500970	35201006	1937644	6.75	1.41	34464
4	8	86173154	41260363	2366380	6.75	1.52	43179
4	9	92022029	51329580	2361252	6.75	1.47	39279
4	10	98823876	57658634	2504883	6.81	1.44	41336
4	11	107155075	65847106	2827006	7.34	1.48	46922
4	12	112749961	76852295	2920083	9.13	1.44	46317
4	13	120039813	78815029	3319694	7.06	1.66	43064
4	14	127705620	93592881	3713343	7.00	1.80	41622
4	15	136094755	110047454	4169686	6.98	1.87	44153
4	16	145906279	130609715	4387465	7.14	1.73	40263
4	17	155853561	156714139	4681184	7.15	1.58	47338
4	18	166235857	160773494	4984731	7.31	1.48	50512
4	19	174880095	182602865	5532370	7.40	1.44	60843
4	20	185218818	210023342	6712107	7.47	1.43	86014
4	21	203799508	224807023	6784445	7.50	1.41	72193
4	22	223848700	249569828	7963682	7.50	1.49	79426
4	23	260483902	255803420	9725083	7.50	1.48	112108
4	24	298742082	272021662	11517625	7.50	1.75	99041
5	1	54451158	7804462	1400169	0.97	1.83	8261
5	2	58195645	8186476	2028654	0.95	2.56	10791
5	3	65718437	7569209	2735636	2.54	3.19	13652
5	4	73781854	7200048	3633367	2.71	3.55	21609
5	5	81717443	7826470	4641146	1.41	4.15	26064
5	6	83144155	9559947	6048379	2.99	5.39	27993
5	7	82838630	13826615	6010730	3.01	5.09	27503
5	8	82443323	15719762	6002192	2.86	4.82	27284
5	9	90098727	12452126	5838932	3.32	4.34	25205
5	10	96388468	16570099	5993071	3.85	4.12	41933
5	11	102082764	19635912	7883712	3.31	5.20	41044
5	12	108803410	22328997	8215009	1.65	5.11	45878
5	13	119511159	28705250	7900866	3.06	4.21	46330
5	14	131243476	25713403	8274819	4.30	3.75	55103
5	15	147895696	28784206	11016251	2.58	4.73	61321
5	16	175959454	33304711	9745644	2.82	3.10	68285
5	17	215485587	26578790	11003037	3.18	2.91	78584
5	18	238052120	33703343	12792781	4.05	3.13	86969
5	19	260078604	41187910	13772182	5.06	2.82	99756
5	20	300570795	24084734	15468311	3.32	2.65	82499
5	21	318668958	22842455	18375407	5.00	3.16	66825
5	22	337619588	23475965	17904564	3.83	2.45	83565
5	23	357092603	33773675	19532684	2.45	2.63	90459
5	24	376455262	29033704	20290101	2.08	2.58	92159

6	1	86128006	3417241	4101986	5.76	2.42	27230
6	2	90646230	5996846	4128912	8.00	2.39	26741
6	3	89526523	11009217	3899935	6.48	2.28	24653
6	4	91915883	12979850	4222070	8.02	2.36	26113
6	5	94405972	15495157	4656535	7.89	2.50	28427
6	6	92488998	18368182	5436338	7.54	3.15	29877
6	7	87845455	25828845	5633734	6.89	3.31	29308
6	8	85037934	31567185	5554306	7.04	3.10	30406
6	9	90066324	30767492	5860047	8.12	3.38	29633
6	10	96195997	29074393	6726260	7.15	3.99	30646
6	11	101958588	28629241	8041820	5.92	4.47	38359
6	12	113823868	23288671	8733293	6.55	4.95	36715
6	13	117459632	26975517	8991840	4.18	4.72	40130
6	14	124523524	41713399	9978552	5.75	4.55	48909
6	15	140128164	59010837	11172156	7.32	4.75	49265
6	16	149916095	78537485	12051585	7.00	4.39	53981
6	17	166270965	83288501	13040637	6.92	4.29	56869
6	18	186445910	81579639	14925572	6.48	4.76	62670
6	19	203799542	98445521	13618714	6.52	3.81	64206
6	20	221547669	102908927	16507969	6.79	4.04	88224
6	21	220195593	134493994	15517685	6.59	3.79	80302
6	22	242550058	119706613	15924096	5.61	3.39	90496
6	23	268631869	110655892	17619803	2.68	3.33	106086
6	24	292148221	121434202	19541117	2.34	3.23	124807
9	1	20954178	2849465	390352	5.67	0.97	12598
9	2	22216869	2678269	305471	6.10	0.55	12680
9	3	23217331	4573528	441633	5.67	0.80	16127
9	4	25672093	3674360	508643	7.64	1.02	16246
9	5	27929883	4291425	888783	6.54	1.72	27098
9	6	29868185	4433079	1083546	7.23	2.00	33117
9	7	29517838	5741927	970739	7.11	1.86	28456
9	8	30946132	5385510	1126624	8.00	1.99	36288
9	9	32906630	6000300	1063548	8.00	1.66	36588
9	10	36893841	6459214	1099518	8.64	1.70	35430
9	11	40333552	6575081	1255468	8.61	1.77	41097
9	12	42488192	7599315	1416372	8.68	1.44	56096
9	13	45374945	9610267	1480926	8.52	1.54	55452
9	14	47103351	15006740	1812806	8.83	2.03	58493
9	15	49838708	22336983	1898193	8.55	1.79	60224
9	16	57005142	27375504	2155683	8.09	1.55	67607
9	17	68632087	30972671	2218635	8.21	1.33	64386
9	18	81596617	42868214	2751372	7.69	1.42	59335
9	19	97800859	47988098	3468771	7.26	1.58	60508
9	20	115806931	52504456	4132219	6.51	1.66	83469
9	21	128574763	61338722	4508830	5.79	1.48	73135

9	22	136747595	73456471	4504153	5.35	1.11	76104
9	23	146548452	89092036	11377812	5.01	4.21	74557
9	24	155135714	103478446	6359953	4.53	1.22	102742
10	1	24430381	2644314	1505198	5.76	83.86	14537
10	2	26009304	3419100	1388585	6.90	75.35	13501
10	3	28810226	3379147	1399797	8.74	72.98	16368
10	4	33368456	2978142	1627774	8.61	81.86	15954
10	5	36758808	1716239	1983293	8.71	44.99	15770
10	6	38692232	3595918	2320508	5.91	51.44	15866
10	7	40160373	4634194	2465301	9.96	55.49	16778
10	8	42588221	4826478	2604727	7.30	60.39	16744
10	9	46910479	4715686	2726586	7.60	61.43	17746
10	10	49919227	5231303	2312865	9.40	40.54	23500
10	11	54014204	6196701	3182386	7.23	64.01	24741
10	12	57114123	7084568	3941430	10.54	86.10	25219
10	13	62369965	6519829	4037341	9.63	84.33	29254
10	14	69003441	5762982	4036595	7.48	68.78	33531
10	15	74331895	8975176	4627604	7.28	76.92	40174
10	16	85316435	15698030	4701787	6.62	41.59	39103
10	17	96571315	10792286	4757386	8.40	31.48	44615
10	18	105201846	12210540	5758177	7.71	26.78	63487
10	19	117175606	15434033	6769444	7.44	24.29	69271
10	20	132293199	18827600	7736464	7.64	27.82	70142
10	21	140534394	19178972	10834454	6.74	60.12	79863
10	22	172073461	18359322	9390546	6.56	46.32	92072
10	23	186137478	20900778	13114743	6.84	66.61	125780
10	24	208029011	17023737	11768838	8.32	51.87	104575
11	1	11593177	632378	787857	12.56	2.81	29394
11	2	10736874	950416	929460	12.22	3.74	31289
11	3	10452218	900589	957569	12.11	3.65	31416
11	4	10683257	985693	952973	12.07	3.84	28315
11	5	10206282	1074435	761090	12.84	2.66	26532
11	6	9448817	1387693	802276	12.57	2.91	27967
11	7	9604858	853479	889962	12.18	2.96	29085
11	8	9737669	1020008	1146082	10.04	3.73	37455
11	9	9408777	1199135	1337866	10.41	4.16	43723
11	10	11169032	1033425	1306090	11.03	3.85	42685
11	11	11615369	570247	1592852	12.13	4.45	48994
11	12	11447521	525954	1600419	13.60	4.23	49227
11	13	11089376	8244826	1882205	8.88	4.33	57894
11	14	12342769	9291246	2031076	9.40	4.23	62474
11	15	16169011	8188059	1995517	9.50	3.20	61380
11	16	18567264	8863479	2290802	10.71	3.21	66548
11	17	19565169	9567144	1731900	10.59	2.27	50312
11	18	22286001	9253952	1799761	10.31	2.17	52283

11	19	29024723	10733101	2780341	9.52	2.74	80769
11	20	35774353	2457217	3427689	13.54	2.93	99574
11	21	40880591	2620058	3251307	12.68	2.46	94450
11	22	44949969	12811277	3818037	10.46	2.61	110914
11	23	50120782	13198921	5013586	10.30	3.15	145645
11	24	61070061	15876144	5600989	9.35	3.06	162709

Appendix 3 - Translog Cost Frontier Program for the Cooperative Credit Union Movement of Trinidad and Tobago

#View descriptive statistics for the sample of credit unins

View(allcus)

summary(allcus)

 # Structure panel data set for cost efficiency frontier estimation

library("plm")

allcusPANEL <- plm.data(allcus, c("CUCODE", "YEAR"))

#Load Stochastic Frontier Analysis Package

require(frontier)

#-----Stochastic Cost Frontier 1 - Single Output, Single Input-----#

#Estimate the homogeneity constrained SISO cobb douglas cost frontier using the sfa() command

institutional input - plab/pcap

institutional output - loans

cobbDouglasHOM1 <- sfa(log(cost/pcap) ~ log(loans) + log(plab/pcap) ,

data = allcusPANEL, ineffDecrease = FALSE, timeEffect = TRUE, truncNorm = TRUE)

cobbDouglasHOM1

summary(cobbDouglasHOM1)

#Estimate the homogeneity constrained SISO translog cost frontier using the sfa() command

 # institutional input - plab/psav

 # institutional output - loans

```
translogHOM1 <- sfa( log(cost/psav) ~ log(loans) + log(plab/psav) +

        + I( 0.5 * log(loans)^2 ) + I( log(loans) * log(plab/psav) ) +

        + I( 0.5 * log(plab/psav)^2 ), data = allcusPANEL, ineffDecrease = FALSE,
timeEffect = TRUE, truncNorm = TRUE)

translogHOM1

summary(translogHOM1)
```

#Estimate the unconstrained SISO translog cost frontier using the sfa() command

 # institutional input - plab/psav

 # institutional output - loans

```
translog1 <- sfa( log(cost) ~ log(loans) + log(plab) +

        + I( 0.5 * log(loans)^2 ) + I( log(loans) * log(plab) ) +

        + I( 0.5 * log(plab)^2 ), data = allcusPANEL, ineffDecrease = FALSE, timeEffect =
TRUE, truncNorm = TRUE)

translog1

summary(translog1)
```

#Compare the skewness of residuals between SISO Cobb Douglas and Translog Functional Forms

```
library("moments")

skewness(residuals(cobbDouglasHOM1))

skewness(residuals(translogHOM1))

hist(residuals(cobbDouglasHOM1))

hist(residuals(translogHOM1))
```

#Use the likelihood ratio test to compare the homogeneous cobbDouglas with the translog cost function

lrtest(cobbDouglasHOM1, translogHOM1)

#Use likelihood ratio test to compare the homogeiety imposed with the unconstrained translog cost function

lrtest(translog1, translogHOM1)

#Use the likelihood ratio test to verify if the homogenous translog cost function is better than the OLS model

lrtest(translogHOM1)

#Estimate and plot Efficiencies of the respective efficiency frontiers

efficiencies(cobbDouglasHOM1)

efficiencies(translogHOM1)

hist(efficiencies(cobbDouglasHOM1))

hist(efficiencies(translogHOM1))

#-----Stochastic Cost Frontier 2 - Multiple Outputs, Multiple Inputs-----#

#Estimate the homogeneity constrained MIMO cobb douglas cost frontier using the sfa() command

cobbDouglasHOM2 <- sfa(log(cost/psav) ~ log(loans) + log(invest) + log(plab/psav) + log(pcap/psav),

        data = allcusPANEL, ineffDecrease = FALSE, timeEffect = TRUE, truncNorm = TRUE)

cobbDouglasHOM2

summary(cobbDouglasHOM2)

 # Estimate homogeniety constrained MIMO translog cost frontier using the sfa() command

 # institutional inputs - plab/psav pcap/psav

 # institutional outputs - loans and invest

```
translogHOM2 <- sfa( log(cost/psav) ~ log(loans) + log(invest) + log(plab/psav) +
log(pcap/psav) +

              + I( 0.5 * log(loans)^2 ) + I( log(loans) * log(invest) ) +

              + I( log(loans) * log(plab/psav) ) + I( log(loans) * log(pcap/psav) ) +

              + I( 0.5 * log(invest)^2 ) + I( log(invest) * log(plab/psav) ) +

              + I( log(invest) * log(pcap/psav) ) + I( 0.5 * log(plab/psav)^2 ) +

              + I( log(plab/psav) * log(pcap/psav) ) + I( 0.5 * log(pcap/psav)^2 )

          , data = allcusPANEL, ineffDecrease = FALSE, timeEffect = TRUE, truncNorm =
TRUE)

translogHOM2

summary(translogHOM2)
```

Estimate unconstrained MIMO translog cost frontier using the sfa() command

institutional inputs - plab pcap

institutional outputs - loans and invest

```
translog2 <- sfa( log(cost) ~ log(loans) + log(invest) + log(plab) + log(pcap) +

              + I( 0.5 * log(loans)^2 ) + I( log(loans) * log(invest) ) +

              + I( log(loans) * log(plab) ) + I( log(loans) * log(pcap) ) +

              + I( 0.5 * log(invest)^2 ) + I( log(invest) * log(plab) ) +

              + I( log(invest) * log(pcap) ) + I( 0.5 * log(plab)^2 ) +

              + I( log(plab) * log(pcap) ) + I( 0.5 * log(pcap)^2 )

          , data = allcusPANEL, ineffDecrease = FALSE, timeEffect = TRUE, truncNorm =
TRUE)

translog2

summary(translog2)
```

#Compare the skewness of residuals between Cobb Douglas and Translog Functional Forms

```
library("moments")#Compare the skewness of residuals between Cobb Douglas and Translog
Functional Forms

library("moments")
```

skewness(residuals(cobbDouglasHOM2))

skewness(residuals(translogHOM2))

hist(residuals(cobbDouglasHOM2))

hist(residuals(translogHOM2))

#Use the likelihood ratio test to compare the homogeneous cobbDouglas with the translog cost function

lrtest(cobbDouglasHOM2, translogHOM2)

#Use likelihood ratio test to compare the homogeiety imposed with the unconstrained translog cost function

lrtest(translog2, translogHOM2)

#Use the likelihood ratio test to verify if the homogenous translog cost function is better than the OLS model

lrtest(translogHOM2)

#Estimate and plot Efficiencies of the respective efficiency frontiers

efficiencies(cobbDouglasHOM2)

efficiencies(translogHOM2)

hist(efficiencies(cobbDouglasHOM2))

hist(efficiencies(translogHOM2))

Appendix 4 – Estimated Stochastic Cost Frontiers

Single Input Single Output Translog Cost Frontier

```
## Error Components Frontier (see Battese & Coelli 1992)
## Inefficiency increases the endogenous variable (as in a cost function)
## The dependent variable is logged
## Iterative ML estimation terminated after 14 iterations:
## cannot find a parameter vector that results in a log-likelihood value
## larger than the log-likelihood value obtained in the previous step
##
## final maximum likelihood estimates
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)            0.79577   1.16536    0.68  0.49470
## log(loans)            -1.17840   0.39109   -3.01  0.00259 **
## log(plab/psav)         2.70865   0.73976    3.66  0.00025 ***
## I(0.5 * log(loans)^2)  0.23078   0.04652    4.96  7.0e-07 ***
## I(log(loans) * log(plab/psav)) -0.25826  0.06707  -3.85  0.00012 ***
## I(0.5 * log(plab/psav)^2)  0.31144  0.10744   2.90  0.00375 **
## sigmaSq                0.23077   0.07922    2.91  0.00358 **
## gamma                  0.82304   0.03490   23.58  < 2e-16 ***
## mu                     0.87163   0.33981    2.57  0.01032 *
## time                   0.01716   0.00363    4.72  2.3e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## log likelihood value: 11.83
##
## panel data
## number of cross-sections = 8
## number of time periods = 24
## total number of observations = 192
## thus there are 0 observations not in the panel
##
## mean efficiency of each year
##     24     23     22     21     20     19     18     17     16     15
## 0.2589 0.2644 0.2700 0.2755 0.2811 0.2868 0.2924 0.2981 0.3039 0.3096
##     14     13     12     11     10      9      8      7      6      5
## 0.3154 0.3212 0.3270 0.3329 0.3387 0.3446 0.3505 0.3564 0.3623 0.3682
##      4      3      2      1
## 0.3742 0.3801 0.3860 0.3920
##
## mean efficiency: 0.3246
```

Multiple Input Multiple Output Translog Cost Frontier

```
## Error Components Frontier (see Battese & Coelli 1992)
## Inefficiency increases the endogenous variable (as in a cost function)
## The dependent variable is logged
```

```
## Iterative ML estimation terminated after 24 iterations:
## cannot find a parameter vector that results in a log-likelihood value
## larger than the log-likelihood value obtained in the previous step
##
## final maximum likelihood estimates
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    9.54489   1.67814    5.69  1.3e-08
## log(loans)                    -0.85241   0.36801   -2.32  0.02054
## log(invest)                    0.11365   0.27248    0.42  0.67661
## log(plab/psav)                 0.40641   0.54979    0.74  0.45978
## log(pcap/psav)                 1.39252   0.48542    2.87  0.00412
## I(0.5 * log(loans)^2)          0.20009   0.06046    3.31  0.00094
## I(log(loans) * log(invest))   -0.10515   0.03975   -2.65  0.00816
## I(log(loans) * log(plab/psav))  -0.05476   0.05593   -0.98  0.32760
## I(log(loans) * log(pcap/psav))  -0.10272   0.05251   -1.96  0.05044
## I(0.5 * log(invest)^2)         0.12656   0.03046    4.15  3.3e-05
## I(log(invest) * log(plab/psav))  -0.01682   0.03125   -0.54  0.59028
## I(log(invest) * log(pcap/psav))   0.04812   0.02968    1.62  0.10497
## I(0.5 * log(plab/psav)^2)      0.15089   0.06753    2.23  0.02544
## I(log(plab/psav) * log(pcap/psav)) 0.01175   0.04225    0.28  0.78092
## I(0.5 * log(pcap/psav)^2)     -0.12282   0.03071   -4.00  6.4e-05
## sigmaSq                        0.06586   0.00909    7.24  4.5e-13
## gamma                          0.84123   0.04410   19.08  < 2e-16
## mu                             0.47074   0.15317    3.07  0.00212
## time                           0.01129   0.00474    2.38  0.01718
##
## (Intercept)                    ***
## log(loans)                     *
## log(invest)
## log(plab/psav)
## log(pcap/psav)                 **
## I(0.5 * log(loans)^2)          ***
## I(log(loans) * log(invest))    **
## I(log(loans) * log(plab/psav))
## I(log(loans) * log(pcap/psav))   .
## I(0.5 * log(invest)^2)         ***
## I(log(invest) * log(plab/psav))
## I(log(invest) * log(pcap/psav))
## I(0.5 * log(plab/psav)^2)      *
## I(log(plab/psav) * log(pcap/psav))
## I(0.5 * log(pcap/psav)^2)      ***
## sigmaSq                        ***
## gamma                          ***
## mu                             **
## time                           *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## log likelihood value: 140.2
##
## panel data
## number of cross-sections = 8
## number of time periods = 24
## total number of observations = 192
## thus there are 0 observations not in the panel
##
## mean efficiency of each year
##     24     23     22     21     20     19     18     17     16     15
## 0.4711 0.4746 0.4781 0.4816 0.4851 0.4886 0.4921 0.4956 0.4991 0.5026
##     14     13     12     11     10      9      8      7      6      5
## 0.5060 0.5095 0.5130 0.5164 0.5199 0.5233 0.5267 0.5302 0.5336 0.5370
##      4      3      2      1
## 0.5404 0.5438 0.5472 0.5505
##
## mean efficiency: 0.5111
```