FINANCIAL STRUCTURE, ASSET STRUCTURE, BOARD DEMOGRAPHICS AND OPERATING EFFICIENCY OF HOUSING CO-OPERATIVE SOCIETIES IN NAIROBI CITY COUNTY, KENYA

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A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN BUSINESS ADMINISTRATION, SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

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DEDICATION

This thesis is dedicated to my parents the late James Kimanzi Simba and Sera Muthili Kimanzi for guidance during my formative years.

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LIST OF ABBREVIATIONS AND ACRONYMS

AS	-	Asset Structure
BD	-	Board Demographics
CEO	-	Chief Executive Officer
CRS	-	Constant Returns to Scale
CRS_TE	-	Constant Returns to Scale Technical Efficiency
CV	-	Coefficient of Variation
DEA	-	Data Envelopment Analysis
DMU	-	Decision Making Unit(s)
DRS	-	Decreasing Returns to Scale
FS	-	Financial Structure
GoK	-	Government of Kenya
HCS	-	Housing Co-operative Society
IOF	-	Investor-Owned Firm
IRS	-	Increasing Returns to Scale
NIRS	-	Non-Increasing Returns to Scale
OE	-	Operating Efficiency
PTE	-	Pure Technical Efficiency
SE	-	Scale Efficiency
STATA	-	Statistical data
TE	-	Technical Efficiency
VRS	-	Variable Returns to Scale
VRS_TE	-	Variable Returns to Scale Technical Efficiency
WOCCU	-	World Council of Credit Unions

ABSTRACT

Empirical evidence on co-operatives' house financing is scanty and does not provide a clear link between financial structure and operating efficiency. The purpose of this study was to establish the effect of asset structure and board demographics on the relationship between financial structure and operating efficiency. The specific objectives using housing cooperatives in Nairobi County, Kenya, determined the relationship between financial structure and operating efficiency, established the intervening effect of asset structure on financial structure in estimating operating efficiency, assessed board demographics moderating effect on the relationship between financial structure and operating efficiency, and finally examined the significance of the combined effect of financial structure, asset structure, and board demographics on operating efficiency. The pecking order theory was the anchoring theory of the study while the study design was descriptive cross-sectional research design. The key respondents for primary data were chief executive officers/administrators and the board members. The data covered a period of five years from 2012 to 2016 where 173 housing co-operatives were targeted. Data was analyzed for 87 housing cooperatives which constituted a 50.3% of the target population. A two-stage model, the data envelopment analysis and regression analysis was applied in the analysis. The average operating efficiency score was at 67.76 % for all housing co-operatives. Thus, the DEA results for DMUs indicated that most of the housing co-operatives were operating at wrong scale of operation and suffered from poor management. Finally the regression results showed that financial structure had significant effect in predicting operating efficiency. On further analysis the asset structure transmitted changes on financial structure in predicting operating efficiency while changes in the magnitude of board demographics greatly influence the strength of the relationship between financial structure and operating efficiency. Besides, the findings show that financial structure, asset structure, and board demographics jointly contributed significantly to changes in operating efficiency. The findings of this study present DEA as an alternative approach of measuring operating efficiency of housing cooperatives, and introduces application of Shannon-wiener's index, a biological and ecological monitoring index in construction of board demographics indices. The findings will help policymakers to devise ways of optimizing resources and recommend areas of improvement to attain operating efficiency. Therefore the study recommends cessation of the registration of housing co-operatives and growing organically or merger of small co-operatives to reap benefits of economies of scale. Lastly, co-operatives' members should consider electing board members of different level of education since it could reduce shortcomings of groupthink hence increased efficiency. DEA technique is sensitive to data noise and measurement errors. Therefore, other studies should apply stochastic frontier analysis as an alternative to data envelopment analysis in estimating efficiency.

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

The fundamental concern of corporate finance managers is selecting a financial structure that maximises the performance of a firm. However, financial constraints and diversity in board members of co-operatives influence the mix of finances (Bretos & Marcuello, 2017; Chaddad, Cook & Heckelei, 2005). Nevertheless, the optimal mix of debt and equity finances could lessen financial frictions arising from asymmetric information (Jensen & Meckling, 1976) through mitigation of agency costs. There is abundance of empirical literature on co-operatives access to financing and financing strategies (Li, Jacobs, & Artz, 2015), but the competitiveness of co-operatives is dependent on how resources are allocated and managed by owner-user firms.

Several studies have linked efficient operation of financial intermediaries to an optimal mix of factors of production for instance labour and capital (Apergis & Rezitis, 2004). Though the financing of co-operatives has been extensively discussed theoretically and empirically (Al-Najjar & Hussainey, 2011; Hailu, Jeffrey, & Goddard, 2007; Wang 2016), the empirical literature on financing of housing co-operatives is scanty. This makes financing of co-operatives largely remain a central question in corporate finance. Kassim, Ishak, and Manaf (2013) observed that past empirical studies provide a relatively little consensus on the link between financial structure, ownership structure, board members' knowledge and experience, and operating efficiency.

As noted by Marr and Tubaro (2011), operating efficiency provides information about the optimal use of resources, and failure to measure and monitor performance could lead to a crisis in an organization. The performance of managers should be regularly evaluated to ascertain their effectiveness. Additionally, Darmadi (2011) views are that an array of factors, including attributes of managers, firm-industry classification, principal-agent relationship, information asymmetry and ownership structure contribute to efficiency. While Bereźnicka (2013) notes that the board members' attributes and choice of asset structure have an influence on the choice of finances.

Yu and Nilsson (2019) have argued that research gaps regarding the efficient and inefficient functioning of co-operatives in a competitive global market still exist in the finance literature. According to Soboh, Lansink, and Dijk (2012) co-operatives in contrast to investor-owned firms are technically and economically inefficient. Some of the characteristics of co-operatives for example owner-user principle and ownership structure influence the choices of investment, financing and operations because co-operatives are not only driven by the motive of profit maximization, but also social goals. This makes the co-operatives less competitive in the financial market thus highly vulnerable to government policy changes and regulation.

Sacchetti and Tortia (2016) noted that the internal governance and practices in co-operatives reflect the essential economic objective of promoting the welfare of members. Nonetheless, Cornforth (2004) maintains that co-operatives have weak governance structures which arise from the principal-agent problem. Other challenges they face are free riders, portfolio problem and financial control of members (Royer, 1999; Wanyama, Develtere, & Pollet, 2009). Soboh et al. (2012) however disagree with the notion that co-operatives are weak performers and as an alternative proposed different approaches of measuring performance.

Co-operative researchers have used a variety of theories among them governance theory and property rights theory (Yu & Nilsson, 2019). They argue that property rights bridges the differences between agency and transaction costs by requiring residual control rights to match residual rights to income in conceptualising ownership. Though the broader aspects of co-operatives are both social and economic benefits, the presumption of the theories in this study is members pursue individual benefits. As a result, pecking order theory, agency theory and theory of social capital are underpinning theories that explore the financing mix and operating efficiency of housing co-operatives.

The anchoring theory was the pecking order theory. The theory proposes that the order of financing of the firm's activities should begin with internal sources, then debt finance and finally equity financing (Jensen & Meckling 1976; Myers & Majluf, 1984). However, according to Leary and Roberts (2010), this theory is hypothetical and has not gained consensus among researchers. Although many studies have expounded on the issues co-operatives face when acquiring financial capital especially the presumption that members seek only individual benefit; this inhibits co-operatives from pursuing economic objectives (Yu & Nilsson, 2019). Co-operatives are funded by receivers of services and not by passive outside investors (Li et al., 2015); this has implications on financial decisions. This limits the quality of monitoring of management activities hence increased agency problem as explained in the agency theory.

The agency costs associated with sourcing of finances influence the financial structure of a firm. The members who contribute a large amount of share capital in a co-operative setup do not have more control over other members (Wang, 2016). This is for the reason that the democratic member control principle states that members have the same voting rights irrespective of the amount of equity contribution. This is likely to slow down and limit the decision-making process of co-operatives when financing needs arise. Further, the members' passive residual rights act as a barrier to the advancement of best management practices. The commissioner of co-operatives through the Kenyan co-operative societies Act of 2008 is empowered to authorize all loans applications by the co-operatives (Government of Kenya [GoK], 2004). Moreover, the theory of social capital explains the means through which an individual (s) network with each other in societies contributes to their welfare and that of others in the community. The theory embraces the notion that members in a community have a strong bond between them and see themselves as equals (as family members, close friends, or neighbours).

The focus of this study was housing co-operatives in Nairobi City County. The co-operative board members provide strategic direction and work collaboratively by applying different approaches to realize firms' goals. For instance, they connect with the community guided by the democratic principles, a characteristic that differentiates co-operatives from other types of private enterprise (International Labour Organization [ILO], 2010). While business corporations aim to maximize shareholders wealth, co-operatives are membership-based organisations committed to certain values and principles, at least in theory (Borda-Rodriguez, Johnson, Shaw, & Vicari, 2016). This could jeopardise the social and economic interest of members. Empirical literature does not provide a clear link between financial structure, asset structure, board demographics and operating efficiency of housing co-operatives.

1.1.1 Financial Structure

Financial structure constitutes the sources of finance employed by an entity. Firms could be all equity or debt-financed or a mix of the main strands of sources of finance used to fund firm's operations (Vo & Nguyen, 2014). The terms financial structure and capital structure are not clearly distinguished in finance literature but are used as a synonym (Ross, 1977). However, in the context of the financial sector, the inclusion of short-term finances in the finance

structure is what distinguishes financial structure from the capital structure. The elements of capital structure incorporate only share capital and long-term loans as sources of finance, thus capital structure sought by investor-owned firms may not be equally optimal in the case of co-operatives. The financing of co-operatives emphasise on equity management including equity accumulation and equity redemption without share price consideration (Wang, 2016). Irrespective, co-operatives face comparable market forces and market tests as investor-owned firms. This makes co-operatives' capital needs no different from those of their non-co-operative counterparts, despite different objectives (Li et al. 2015), and therefore not immune from market dynamics. Conversely, Baxamusa, Sunilmohanty, and Rao (2015) pronounced that co-operatives' ownership structure, agency costs, information asymmetry and multiple objectives hampers the firms from accessing loan facilities.

The users of services from the co-operatives contribute to the financing of the firm's activities through members' deposits and share capital (GoK, 2004). Other sources of co-operatives' finance comprise retained margins, subordinated member loans, and short- and long-term finances (Wang, 2016; Baarda, 2006). The Kenya co-operative societies Act of 2008 is silent on compliance with prudential guidelines. Nevertheless, housing co-operatives follow these guidelines to safeguard the co-operatives' assets. This ensures that the minimum share capital and the institutional capital rules are not violated since they safeguard members from operational risk and capital inadequacy (Robb, Smith, & Webb, 2010; World Council of Credit Unions [WOCCU], 2003).

The core capital, which comprises share capital and reserves, represents shareholders' funds for a co-operative society. The co-operative societies Act requires co-operatives to set aside 20% of their earnings as statutory reserves (GoK, 2004). These include general and revenue reserves, collectively termed as institutional capital. The institutional capital acts as a contingency reserve since it caters for asset losses arising from adverse economic cycles in an economy. The stringent co-operatives' bylaws and regulatory requirements limit board members from borrowing. Despite the financial capability of co-operatives, the commissioner of co-operatives (GoK, 2004) must approve all loans applications

1.1.2 Asset Structure

Asset structure encompasses different categories of assets employed by an entity. Kehinde and Mosaku (2006), and Sibilkov (2009) defined asset structure as a sum of the percentage proportion of non-current assets and current assets to total assets in a firm. While Vo and Nguyen (2014) describe asset tangibility as long-lived assets of a firm. The long- lived assets are used to generate income of an entity, while asset liquidity - cash and cash equivalent, debtors and prepayments support day-to-day operational activities. Therefore, the production capacity a firm aims to achieve determines the amount of assets required.

Tangible assets comprise non-current assets for instance land, buildings, machinery and equipment. Campello and Giambona (2013) describe tangible assets as elements of a balance sheet that comprise total tangible assets stated at book value. While asset liquidity according to Gopalan, Kadan, and Pevzner (2012) is a measure of the weight of the sum of liquidity scores assigned to each asset class. Both tangible assets and asset liquidity facilitate corporate borrowing. Most lending institutions evaluate the ability to pay based on the quality and value of assets used as security and the firm's cash flows (Harris & Raviv, 1991). This makes the firms have the capability to sustain high debt levels which places them at an advantageous position to negotiate better credit terms.

Firms with collateralizable and high valued assets have high chances of negotiating affordable loans this could lead to an increased debt portfolio in a firm (Bereźnicka, 2013). Contrary to this proposition, profitable firms that have fewer fixed assets experience low debt ratio (Heyman, Deloof, & Ooghe, 2008; Sibilkov, 2009). Nevertheless, agency costs tend to increase because of disproportionate change in the composition of the assets when substituted for existing debts instruments (Jensen & Meckling, 1976). This argument by Jensen and Meckling nonetheless failed to factor the influence of diversity of board members in the selection of assets because risk-averse managers lean towards low-risk finances.

1.1.3 Board Demographics

Board demographics is diversity in boards which are characteristics of board members for example board diversity, board competence, board composition and board independence (Darmadi, 2011; Gunderson, Gloy, & Rodgers, 2009; Hillman, 2015). As enunciated by Nekhili and Gatfaoui (2013), board attributes comprise the level of education, business expertise, nationality, foreign experience, and connections to the external sources. Jackson & Alvarez (1992) were of the view that diversity is an individual's uniqueness that manifests in different setups and forms. The index of diversity is dependent on the opportunities accorded to dimensions of race and ethnicity, gender and marital status, social and economic status, age, and religious belief (Ararat, Aksu, & Cetin, 2015; Lau & Murnighan, 1998).

Diversity means equal opportunity accorded to all categories of persons with different attributes (Ararat et al., 2015). Concerning board members, their diversity contributes to fresh and different perspectives on solving business problems. Dezso and Ross (2012) perceived the potential benefits arising from the diversity of management as better decision-making, reduced groupthink, creativity, and innovative decision-making. The board members' herding behaviour is reduced when their attributes are different (Ararat et al., Erhardt, Werbel, & Shrader, 2003). According to Hillman (2015) and Sener and Karaye (2014), female directors persist when providing solutions to problems, are ethical, and meditate over decisions. This notwithstanding, the implementation of gender diversity policy is a challenge due to citizens' cultural beliefs (Ramly, Chan, Mustapha, & Sapiei, 2015) in many countries.

Competence describes the ability to perform a task successfully to its conclusion (Boyatzis, 2008). Aspects that describe competence consist of reason and attribute, one's self-perception and social role, skills and level of knowledge. According to Woodruffe (1993), competence is an important characteristic of an individual and its attributes are behaviour, skills, and knowledge - leading to the effective performance of a position. Milliken, Bartel, and Kurtzberg (2003) defined board competence as the cognitive characteristics of an individual, which include board experience, professional background, tenure, education background, and industry experience. Besides, Darmadi (2011) maintains that board competencies are non-observable attributes but influence the way organizations handle issues related to their operations.

The efficacy of the board is measured by its ability to provide resources, monitor, advice, and contract the management (Chancharat, Krishnamurti, & Tian, 2012). Board members spend most of their time at advisory and strategic levels. Nekhili and Gatfaoui (2013) indicated that members of the board contribute to the strategic financing decisions of a firm. However, different board attributes have a bearing on the choices of the source of finance. Briggeman, Jacobs, Kenkel, and Mckee (2016) perceive that debt-holders influence the governance of organisations, while Ararat et al. (2015), Mande, Park, and Son (2012), opined that competence and diversity influence the choices of factors of production hence operating efficiency.

1.1.4 Operating Efficiency

Operating efficiency is the ability of an entity to deliver products or services to its customers in the most cost-effective manner (Kuosmanen & Johnson, 2017). Efficiency determines whether the resources utilized achieved maximum outcome (Mozaffari, Gerami, & Jablonsky, 2014). Operating efficiency is achieved when the production of output per unit is more than a given level of input. A decision-making unit has the option of increasing operating efficiency by increasing the output or decreasing input prices, and increasing the scale of the production process to reduce the average cost per unit. To achieve efficiency Coelli, Rao, O'Donnell, and Battese, (2005) pointed out that firms should have the capacity to produce maximum outputs from a minimum level of inputs.

The link between operating efficiency and financial structure as advanced by Alsas and Florysiak (2011) holds that the firm's management should utilise the capital invested to acquire the assets for a firm and leverage technology as a core process of realizing productivity. An appropriate management team will identify the perfect financial structure which translates to operating efficiency and in turn leading to competitive prices of commodities. In this study, operating efficiency is measured by technical efficiency. Farrell (1957) in his pioneering research measured the operating efficiency of firms in terms of production frontier and non-parametric framework. Since then, non-parametric tools such as DEA are widely used in appraising the performance of profit and non-profit making organisations (Othman, Mansor, & Kari, 2014). DEA is a linear programming methodology for evaluating proportional changes in inputs and on outputs with a view of determining efficiency or inefficiency of decision-making units.

Data envelopment analysis is a managerial and performance measurement tool that incorporates several predictors and criterion variables when assessing the operating efficiency of a firm (Charnes, Cooper, & Rhodes, 1978). According to the existing literature on banking, the production and intermediation approaches guide in the specifications and selection of inputs and outputs of decision-making units (Morita, Hirokawa, & Zhu, 2005). In the production approach, banks are relatively service entities that use the deposits and loans at their disposal to provide services to the customers (Berger & Humphrey, 1997). In this approach, outputs are deposits and loans, and inputs defined as employees and capital expenditures. However, the intermediation approach categorises firms as financial intermediaries which assign deposits to borrowers. This approach considers inputs as labour costs, capital expenditure and interest charged on savings and outputs as loans and investments (Marwa & Aziakpono, 2016).

Conditional to the orientation approach suitable to the management, the stakeholders have a different understanding of the inputs and outputs when estimating the operating efficiency. Favero and Papi (1995) submitted that there is no single answer to the identification of inputs and outputs considering that each approach has a reasonable argument for its choice. Two approaches of orientation are outlined in DEA literature. The orientations applied in literature are input-oriented and output-oriented approaches. The input-oriented approach focus on minimization of inputs and the output-oriented one is about maximising outputs. One may apply a combination of both approaches (Othman et al., 2014). This hint at a combination of expert knowledge and accepted practices in the choice of the inputs and outputs. The selection of the type of orientation depends on the level of control exercised by a firm's management on inputs and outputs. Given the preceding empirical theory, the managers of housing co-operatives have better control over the inputs than outputs, thus input-oriented approach was appropriate for this study.

Even though housing co-operatives are not profit-making organisations, it is imperative to be profitable to contribute to the accomplishment of the goals of the firm. The turnover and profits are part of the criteria for evaluating efficiency, besides other non-financial aspects (Othman et al., 2014). The commonly used inputs for decision-making units are earnings per share, equity, labour costs, and return on assets whereas outputs are revenues and profit (Zhu, 2003).

The intermediation approach was adopted in the selection of housing co-operative societies' inputs and output variables. The inputs for labour cost, operating expenses, and cost of investment (sales) were selected based on existing cost structure while the output was total revenue. In line with this approach, housing co-operatives as financial institutions provide financial intermediation services of transforming members' deposit to real estate (land) for sale. Though the turnover of housing co-operatives differs from that of other financial institutions in that interest on loans and deposits for the co-operatives' members are not determined by market forces between buyers and suppliers. This study considered the total revenue as the appropriate output of measuring the performance of housing co-operative societies since efficient housing co-operatives will attract a big number of members.

In assessing efficiency, most studies use technical efficiency to measure operating efficiency (Berger & Humphrey, 1997). The technical efficiency is a global measure of firms' performance in different sectors of the economy (Banker, Charnes, & Cooper, 1984). To evaluate the reasons and causes of inefficiency for DMUs, the technical efficiency scores are decomposed to obtain scores for pure technical efficiency, scale efficiency and returns to scale for each decision-making units. The returns to scale highlights inefficiencies arising from the wrong scale of operations due to incorrect size of operations and poor management practices.

1.1.5 Housing Co-operative Societies

Housing co-operatives are legal associations of persons formed by members through self-help and collective efforts to provide solutions to housing problems (Birchall, 2003). They are owner-user controlled entities formed to address common socio-economic objectives of members through the provision of affordable housing (Ganapati, 2010). The membership and capital invested define the size of a housing co-operative. Housing co-operatives stimulate capital formation through members' contributions. Accordingly, the capital base is dependent on the social-economic class and number of members.

Housing co-operatives as financial intermediaries contribute to the growth of the economy of a country by directing resources to productive units. The first co-operative began as a consumer self-help group where the urban workers organized themselves under the Rochdale principle in 1844 in Rochdale, England (Sazama, 2000). The principle is anchored on the democratic

control of the capital of one member one vote. However, it was not until 1918 when the first affordable housing co-operative was organized under this principle was developed in New York, United States (Sazama, 2000). In the early 20th century, working-class organizations from Germany and Scandinavian countries sponsored most of the housing co-operatives in Europe since the co-operative model provides several exceptional attributes that are rarely found in other forms of economic units. (Wanjare, 2008, Mann, 1995).

In Africa, housing co-operatives are recent in origin (Bah, Faye, & Geh, 2018). In the less developed countries, colonists and then the national government as a way to modernise traditional economies (Birchall, 2003) supported co-operatives. African housing finance system is quite diverse where both public and private entities are involved in offering different finance products to respond to the unmet housing finance needs (Bah et al., 2018). The Africans found themselves with a common housing need thus leading to formation of housing co-operatives to secure affordable housing (Birchall, 2013). Even though the concept of affordable housing has varied over the years, its objective has remained enshrined on low- and moderate-income families. Despite the growth of housing co-operatives, many of the laws governing co-operative societies in developing countries are skewed towards agricultural, marketing, producer, and consumer co-operatives, with very little legal framework supporting housing co-operatives (Wanyama et al., 2009).

In Kenya, the housing co-operative movement is relatively young because the concept of housing co-operatives was first introduced in Kenya in the early 1980s (Bah et al., 2018). The co-operative societies Act in Kenya does not provide an adequate legal framework on housing co-operatives (GoK, 2004). The Act does not address the essential aspects relating to the purchase of land or borrowing of construction funds by members of housing co-operatives. The membership comprises employee from the private and public sector, investment groups, small businesses, individuals from religious groups and ethnic affiliation. The membership, therefore, is primarily individuals with a common affiliation (Oyebanji, Zhang, Baitu, & Rollnick, 2010). In Kenya the co-operative societies Act places a constraint on the application of good business models (GoK, 2004). The co-operatives do not have a free hand to borrow and this limits them from engaging in economic incentives that would improve the quality of the members' lives.

Nairobi City County is a financial centre for Kenya and East African countries. As of December 31, 2016, housing co-operatives registered by the Nairobi City County were 708 (GoK, 2016), the city has the highest number of co-operatives in Kenya. Statistics from the Kenya National Bureau of Statistics [KNBS] (GoK, 2015) have shown a trend of increase in registration of housing co-operatives over the years, especially after 2010. This, however, has not translated to improved access to affordable housing. The trend of the performance of co-operatives in Kenya since 1998 and earlier is also unclear, and the reasons for the increase in dormant housing co-operatives remain unknown. Some researchers have indicated that the poor performance of co-operatives has been because of lack of short and long-term financing, unavailability of land, and the lack of technical expertise and administrative skills (Wanyama et al., 2009). Additionally, the governance structure of housing co-operatives in Kenya is unknown and the empirical evidence is scanty and varying across geographical areas (Oyebanji et al., 2010).

1.2. Research Problem

The co-operatives sub-sector plays a critical role in the growth of an economy of a country, and their impact cannot be underestimated (Marwa & Aziakpono, 2016). Besides contributing to sound financial sector, co-operatives are essential in stabilizing an economy (Sufian, 2011). As a result, it is important to monitor and regulate the sector's operations to minimize the economic downturn. However, the growth of the sub-sector has experienced an unprecedented level of competition leading to the instability of many microfinance (Marr & Turbora, 2011). Consequently, knowledge about factors affecting operating efficiency of financial intermediaries is important to owners, managers, regulators, and the public at large in making socio-economic decisions. However, housing co-operatives differ across the world in their operations and management (Ganapati, 2010) in that the factors have curvi-linear relationship on operating efficiency across countries.

In spite of a long history of housing co-operatives, there is relatively little empirical evidence on affordable housing finance in many countries (Bah et al., 2018). Most empirical literature on co-operatives focuses on developed economies and predominantly credit unions,

agricultural co-operatives, and microfinance institutions (Berger & Humphrey, 1997; Marwa & Aziakpono, 2016). Cornforth (2004) asserted that the governance of co-operatives is relatively under-theorised in contrast to public companies. Nilsson (2001) observes that, no known documented study that explains the pecking order theory and agency theory in the context of housing co-operatives. This is especially so when co-operatives' philosophy leverages higher costs and corporate governance problems. Mwangi (2014) found that management competence insignificantly affects the efficiency of Saccos, whereas Darmadi (2011) established that the dominance of female directors contributed to a decrease in firms' accounting return. The contrasting views of Darmadi, and Ekadah and Mboya (2011) on the percentage of women board members and correlation to return on assets were limited only to the attribute of the gender of the directors in the board.

According to Hailu et al. (2007) other than board demographics and asset structure, the choice of financing of inputs is a key factor that influences operating efficiency. Veenstra, Koolma, and Allers, (2016) indicated that weak governance structure, lack of market control, real owners, adverse selection, and choice of financing contribute to inefficiencies of housing corporations. Nevertheless, Bereźnicka (2013) noted that an inverse relationship subsisted between the cost of debt and agency costs whilst Sibilkov (2009) affirmed that a positive association existed between asset liquidity and the level of debt. But Li et al. (2015) findings reported contrary results from that of Sibilkov that information asymmetry had a greater effect on the choices of finance and cost of inputs.

Conventionally, ratios have been the only tool for measuring efficiency of organisations. Nonetheless, recent researchers have focused on other performance measurements such as DEA that accommodates multiple inputs and outputs. A study by Veenstra et al. (2016) used approaches of DEA and stochastic frontier analysis. Darmadi, (2011) used cross-sectional regression analysis for the entire population while Marwa and Aziakpono (2016) used DEA with bootstrap approach on savings and credit co-operative societies. These studies limited their analysis to the calculation of efficiency scores without decomposing the technical efficiency scores, a reason this study used variable returns to scale methodology.

This current study built on a two-stage methodology using DEA and regression analysis. The first stage used data envelopment analysis to calculate constant returns to scale technical efficiency scores and under variable returns to scale with a view of establishing the causes and

sources of inefficiencies of housing co-operatives. Finally, the second model tested for correlation by regressing the variables on technical efficiency scores. The study, therefore, sought to answer the resulting research question: "what was the effect of asset structure and board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County, Kenya?"

1.3. Research Objectives

The general objective of this study was to determine the effect of asset structure and board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County, Kenya. The specific research objectives are as stated below:

(i) Determine the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County, Kenya.

(ii) Establish the mediating effect of asset structure on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County, Kenya.

(iii) Assess the moderating effect of board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County, Kenya.

(iv) Examine the combined effect of financial structure, asset structure, and board demographics on operating efficiency of housing co-operative societies in Nairobi City County, Kenya.

1.4. Value of the Study

Housing co-operatives contribute to the social-economic growth of a country. The members actively participate in the affairs of the co-operative to ensure efficient operation. It was the expectation of this researcher that the results of this study would add value in the following ways:

Add to the existing body of knowledge on financing decisions, operating efficiency, asset structure and board demographics for housing co-operative societies. It brings a new dimension on how board demographics and asset structure impact the relationship between financial structure and operating efficiency, and in so doing make an immense contribution to the

existing body of knowledge. This is because there is quantifiable information related to agency and pecking order theories that it was hoped would build up the empirical literature on housing co-operative societies. Provide guidance on the optimal financing mix for housing co-operatives, the nature and composition of assets, and the application of Shannon index of diversity in determining the diversity in dominance and rareness of board members. It would also guide on the level of expertise required from management committees to achieve operating efficiency.

Empirical studies reviewed revealed a combination of accounting ratios and other performance measurements in evaluating efficiency. This study introduced DEA methodology combined with a linear regression model as a performance optimization tool for assessing the relative operating efficiency and the influential effect of the variables across housing co-operative societies in Kenya.The application of DEA methodology sets a new agenda for future research to adopt the same as a practical tool for evaluating operating efficiency. It would also help managers in identifying areas where the methodology is inappropriate and ineffective.

The growth and sustainability of housing co-operatives are dependent on improved performance. Their operating efficiency directly enhances the public perception that would make members contribute to the economic and social development of a country. However, ineffective co-operatives should be monitored and sanctions put on management to guarantee the safety of members' funds. The findings of this study could guide the policymakers in formulating recommendations desirable for financial and asset structure for housing co-operatives.

Guide in building the internal capacity of board members to design public policies that promote the efficient use of assets and debt instruments for housing co-operatives. The Shannon index of diversity calculated in the study could guide co-operatives in building capacities in placing importance on the attributes that require enrichment among board members. Aid the government in formulating policies that could strengthen the existing regulatory framework on corporate governance and borrowing limits for housing co-operatives. This will also contribute to the development and practice of finance and the furtherance of academic research in housing co-operatives, as well as provide an impetus to finance practitioners in providing empirical support for the significance of contextual factors in the correlation between financial structure and operating efficiency. Lastly, the limitations arising from the study could become possible areas for further research.

1.5. Organization of the Thesis

This thesis comprises six chapters, namely introduction; literature review; research methodology; descriptive data analysis and presentation; hypotheses testing and discussion of findings; and summary of findings, conclusion and recommendations. Each chapter is discussed below.

Chapter 1 introduces the conceptual arguments of the main constructs of the study. These constructs include financial structure, asset structure, board demographics, and operating efficiency. In the chapter, the context of the study is discussed. Finally, the research problem, general research objective, and specific research objectives are outlined in the chapter. The chapter also covers the value of the study thus giving a justification for the research.

Chapter 2 covers an analysis of theories and empirical review that underpin the variables of the study. The pecking order theory was the anchoring theory of the study. Others were the agency theory and theory of social capital. These theories underpinned the empirical arguments on the effect of asset structure and attributes of board demographics on the financial structure and operating efficiency. The chapter also includes a review of empirical literature in which the relationship between the variables of the study is described. The chapter completes with a conceptual framework that examined the relationships of the variables and the null hypotheses tested.

Chapter 3 presents the study methodology where research philosophy and study design, target population and sample size are discussed. Other aspects described are methods used in collecting data, operational definition of the variables, editing and coding of data, and lastly, techniques for data analysis, model formulation, diagnostic tests and hypotheses testing.

Chapter 4 presents descriptive data analysis, and presentation. The areas covered here include response rate, descriptive statistics for housing co-operative demographics, financial structure, asset structure, board demographics, and operating efficiency and the calculated technical efficiency scores. The chapter content also includes results of diagnostic tests for normality and linearity tests, multicollinearity and heteroscedasticity tests, correlation analysis and Hausman test for model specification, and finally the chapter summary.

Chapter 5 contains the tests of null hypotheses and discussion of findings. Also contains tests for significant association of financial structure and technical efficiency; the mediation of asset structure on the financial structure in predicting operating efficiency; the moderating effect of board demographics on the association between independent variable and operating efficiency; and the significant combined effect of financial structure, asset structure and board demographics on operating efficiency. The chapter concludes with a summary of the findings of the study.

Chapter 6 comprises a summary of the study findings, the conclusion and implications, and recommendations. Again, the chapter points out the contributions of the study to theory, managerial practices and policy. Finally, limitations and suggests of areas of further research are also covered in the chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a discussion of theories underpinning the variables of the study, the literature review on the variables of the study and their relationship. Further, the chapter summarises the empirical literature and research gaps emanating from empirical studies reviewed. Finally, it presents the conceptual model and the null hypotheses of the variables of the study.

2.2 Theoretical Foundation of the Study

Three theories, namely the pecking order theory, the agency theory and theory of social capital underpinned the relationship among the variables of the study.

2.2.1 Pecking Order Theory

The pecking order theory as proposed by Myers and Majluf (1984) was the anchoring theory in this study. It states that in the absence of internal funds, a firm has a preference to raise external funds from debt instruments and finally equity finance. The pecking order theory hypothesizes that managers have skewed information about firms' prospects relative to investors thus making the interest of insiders, equity-holders, and debt-holders uncorrelated (Chen & Chen, 2011). The absence of information symmetry among managers and investors, however, would influence the hierarchy of financing (Chay, Park, Kim, & Suh, 2015; Myers & Majluf, 1984). A firm that is less prone to asymmetric information problems is likely to use less debt financing since floatation costs are not high in the equity market. This theory does not consider the value of assets in choosing the source of finance. As a result, the notion that firms endowed with non-current assets opt for internal capital to debt financing could be misleading in the framework of the pecking order theory. The use of assets as collateral for the loan drives the cost of retaining the debt to a minimal level.

Further, the attitude of board members toward risk is also crucial in determining the hierarchy of financing. Risk-averse managers would prefer equity to debt financing despite implications of floatation costs. The financial distress costs and monitoring costs discourage uptake of finances from interest-bearing liabilities. Rajan and Zingales (1995) report that a liquid firm uses less debt finance and the effect of liquidity position on secured loans is negative and curvilinear on unsecured debts. Nevertheless, the low level of asset liquidity does not make management get attracted to debt finance which ultimately reduces the probability of costly defaults when gearing level is low.

The pecking order theory predicts that information asymmetry determines the hierarchy of the financing preference of firms. Lenders will not be able to differentiate good firms from poor quality ones thus pooling all the firms as bad borrowers (Akerlof, 1970). This implies that when lenders increase the interest rate to caution high-risk borrowers, the lower risk borrowers would drop out of the market and eventually the market is dominated by fewer credit borrowers who will be willing to pay high-interest rates. According to Halov and Heider (2011), firms prefer equity finance to loan capital when the information between the management and outsiders is asymmetrical. This makes the investors uncertain about future investments of the firm thus causing the risk and adverse selection costs of debt to increase. Halov and Heider noted that the observed pattern of debt financing is weakest in small and young firms therefore in line with pecking order theory.

Leary and Roberts (2010) reckoned that the pecking order theory does not describe firms' actual financing behaviour in terms of gearing level. Further, the theory does not suggest any remedy in case a firm is highly geared, as well as the board attributes when determining the financial structure. Baarda (2006) opined that managers must balance between current monetary returns to members and members' co-operatives equity structure to maintain the autonomy and independence of members. Despite empirical evidence on investor-owned firms, financial structure theories are limited in co-operatives and if any focuses on firms in developed economies. Transaction costs associated with obtaining new external financing are higher than the costs of obtaining internal financing. Therefore the hierarchy of financing is based on theory of pecking order theory is considered in the context of many choices of financing. Successful firms do not need to depend so much on external finance; Myers (1977) argues that firms with growth potential will tend to have less capital structure.

2.2.2 Agency Theory

The agency theory assumes that owners face agency conflict when owners are different from those in control of the enterprise. As the firm grows in size, the owners have a general tendency to disconnect themselves from the firm's management. As a result, they have to incur agency costs to safeguard their interests. The theory originated with Jensen and Meckling (1976) as a dominant theory for corporations and governance arrangements since the interests of the owners of an entity and that of the managers are asunder. This makes owners face agency problems arising from agents' choices of personal interests over that of owners. The theory observes corporate governance arrangements as a way to ensure that managers serve equity owners' interest.

The agency problems in co-operatives can be resolved by developing a system in firms that encourage workers to define goals that maximize their welfare and induce managers to pursue broad goals (Surroca, García-Cestona, & Santamaria, 2006). Nevertheless, when compared to equity capital-controlled firms, agency problems become more complex and harder to resolve in a co-operative framework. With multiple objectives of co-operatives, the choice of finance especially debt instruments forces the managers to reduce agency costs by minimizing perquisites and prudently appraising projects to minimise hostile takeover and bankruptcy costs (Grossman & Hart, 1982).

The regulator determines and approves the co-operatives' debt finance. This influences the restriction and composition of finances that funds the activities of the firm. However, when a high proportion of fixed assets is present in the asset structure, a firm may be motivated to borrow more funds thus leading to high debt portfolio (Rajan & Zingales, 1995). This could induce financial distress costs when debts covenant is breached. Based on agency costs, there is an expected positive correlation between gearing and tangible assets, as well as capital structure (Al-Najjar & Hussainey, 2011). A high presence of fixed assets in the firm's financial structure is likely to lower agency costs between shareholders and debt holders due to assets pledged as collateral and thus decreased financial distress costs.

The financial structure theories are grounded in the assumptions of managers having superior information over investors (Heyman et al., 2008) implying that differences between the interests of the managers, shareholders, and the debt-holders are uncorrelated. This makes the

owners and lenders incur agency costs in monitoring the functions of the management thus reducing agency problems emanating from interested parties involved. All the same, the ownership and multiple objectives of co-operatives may take a cautious approach in the application of agency theory, as it is unlikely to correct the imbalance between social and economic objectives.

The members who are owner-users may not significantly influence themselves in making decisions that benefit all members. The management, therefore, will engage in self-satisfying activities over that of the members. Jensen and Meckling (1976) noted that when managers entrench themselves through sub-optimal investment decisions, they end up strategically increasing their voting power. As a result, the transaction costs for monitoring corporate managers will increase. This, however, does not seem to apply to co-operatives. The ownership structure contributes to the bond of association which forms the basis of providing surveillance by electing board members who will protect members' interest. Nevertheless, as membership increases, the board of association weakens and bureaucratic decision-making creeps, thus affecting performance. This forces a firm to invest in corporate governance mechanism to reduce high operating costs. Since the firm is guided by laid down principles and systems, the agency costs are lowered. Though this is uncommon in housing co-operatives, the effect of agency costs upon the election of board members and appointment of auditors needs to be tested empirically across these co-operatives.

Co-operatives serve members' interests and their shares are unlisted on the securities market. This reduces market surveillance and external pressure on managers to perform (O'Sullivan & Diacon, 2003). This patronage of co-operatives is limited to members who double as customers and decision-makers. Lack of separation of ownership and control as pointed out by Power et al (2012) creates an incentive problem and increases agency costs. Co-operatives' ownership structure makes the board members use less monitoring information devices when mitigating agency costs due to the increased bond of association.

Grossman and Hart (1982) maintained that monitoring costs are higher for firms with low assets tangibility. This needs to be tested in housing co-operatives because social benefits could override operating costs, with profit maximization remaining a subsidiary objective. Nonetheless, common property incentive problems contribute to the disparity between

members' equity contribution and the benefit they receive. The result of this will usually be free rider tendencies arising from collective ownership of equity. Share ownership could contribute to low commitments among members hence leading to inefficiencies and weak membership commitment.

2.2.3 Theory of Social Capital

The theory of social capital is about social network where the whole notion is about social relationships. The co-operatives' ownership structure encourages broad-based participation in the management of co-operative organisations. The social capital theory is traced from Lin (1982 as cited in Lin, 2008), a sociologist (Siisiainen, 2003). Social capital is one of the most influential theoretical concepts in contemporary sociology. The concept explains how individuals use their relationships with other actors in societies to benefit themselves and members of the community.

The resources in one's social network are for the benefit of individuals and group members. The social capital theory examines the mechanism and processes of resources in social networks (voluntary associations) as an investment (Son & Lin, 2008). According to Siisiainen (2003), the laws governing the exchange of economic capital also apply to human social relations in all their numerous forms. Thus, social capital can generate profits and extend benefits in the social world, which can be convertible into physical assets or other forms of capital (Westlund & Bolton, 2003).

The Link between the theory of social capital and factors of production (labour and capital) directly enhances factor productivity and capital accumulation. Quibria (2003) claims economic and social empowerment of group membership contributes to social capital. The board members elected have different attributes that would reduce limitations relating to groupthink. Therefore, an increase in a social network will reduce the average unit cost similar to an increase in physical capital would reduce the average cost of production (Sabatini, 2009). Therefore, the social relationship is an economic resource as it fosters broad participation of people belonging to the local communities in the democratic development of their areas (Bretos & Marcuello, 2017).

The fundamentals of social capital are to offer access to more information, increase social cohesion, decrease opportunistic behaviour, reduce transaction costs, and improve efficiency (Bhandari & Yasunobu, 2009). The theory of social capital therefore enables co-operatives to minimise operating expenses and reduce agency costs because of bond of association. This leads to profitability since the interests of members is realigned towards giving co-operatives a strong democratic character. In this context, individuals view networks as a principle of social equals and not instruments or competitors in co-operative forms of organisations. When social capital is incorporated, members will patronage, govern, and finance the co-operative because there is trust between them and the board of directors (Yu & Nilsson, 2019). Additionally, co-operatives will access borrowed capital from lenders because of the social capital built by members through the board of directors.

Housing co-operatives are membership economic entities with equal shares and are democratically controlled. Accordingly, there will be trust in the board of directors in the governance of co-operatives, which is democratic and power, and decision-making is in the hands of board members (Cornforth, 2004; Lang & Roessl, 2013). Nevertheless, ICA (2003 as cited in Lees & Volker, 1996) recommended that co-operatives should revitalize members' participation through affirmative action by setting aside positions for women board members. This study applied the theory of social capital to explore how social network contributes to the management of transaction costs and raising of equity and borrowed finances across housing co-operatives.

2.3 Empirical Literature Review

This section presents an overview of the empirical literature on the study variables namely: financial structure, asset structure, board demographics, and operating efficiency of housing co-operative societies. The discussion focuses on empirical studies undertaken both in developed and emerging economies.

2.3.1 Financial Structure and Operating Efficiency

The level of operating efficiency depends on how firms employ factors of production, for instance, labour and capital resources to produce output(s). Efficiency measures how optimally a firm allocates inputs for instance capital, staff costs and other operating expenses to earn

maximum output. Firms with an ideal financial structure and optimal size could have high levels of performance arising from economies of scale. Hailu et al. (2007) did a study focusing on capital structure, firm size and operating efficiency of co-operatives in Canada. The data was from an unbalanced sample of 42 co-operatives from 115 different co-operatives in Canada from 1984-2001. The study applied unrelated stochastic frontier model examining cost structure and cost-efficiency. The findings indicated a significant cost inefficiency in all co-operatives, though those that had financial structure sufficiency in equity capital exhibited variations in the cost efficiency and showed improved co-operative efficiency. The sampled co-operatives were from agriculture and petroleum sectors; this would pose difficulties in generalising the findings because the decision variables are heterogeneous in terms of technology and processes of their operations.

A study by Othman et al. (2014) assessed productivity and efficiency of co-operatives in Malaysia. The study looked at 56 co-operative groups out of 70 where the analysis used a two-stage model, the DEA and Tobit regression model for one (2011) year. The inputs of the study were members, turnover, and profit as output. The findings of Othman et al.'s study indicated that an increase in turnover and profit of co-operatives contributed to an increase in co-operative efficiency scores. However, referring to co-operative groups under the study only 19.6% were operating at efficient and less than 2% of big co-operatives were in the successful category. The use of profit and turnover as outputs amounted to a similar item because profit is a function of turnover and operating expenses, hence only profit or turnover as output and not using both at the same time. Bearing in mind the notion that members are owners, the study should have used equity capital as a proxy for members to represent owners' investment as input in the co-operatives. Besides, the orientation approach used did not stipulate the procedures used in the selection of inputs and outputs variables of the study. Further, the efficiency scores were non-metric and the researchers did not standardize the predictor variables to the scale of efficiency scores when running the regression model. The present study standardized the variables to the same scales, and applied intermediation and input-oriented approach in the selection of DEA variables to calculate operating efficiency.

Rajan and Zingales (1995) analysed public firms in the G-7 countries on how they are financed. The study used international data and the findings revealed that firms that used retained

earnings and less debt were more profitable compared to all debt-financed ones. Given that the study focused on firms from different economies, the results could not be generalized. Further examination on foreign evidence, the theoretical foundations of the observed associations of the findings are largely unclear in light of the fundamental principles of the theory of pecking order. The underlying principle of pecking order theory is utilization of retained earnings first, followed by debt, and then other sources of finances. Robb et al. (2010) contradicted these findings with the argument that a big proportion of debt finance in the capital structure contributed to the growth of co-operatives. Ishengoma (2012) established that microfinance co-operatives linked to formal financial institutions that charge high-interest rate and have low equity ratio made co-operatives bear the incidence of agency costs not directly related to the operations.

The increase in debt uptake could reduce efficiency and increase transaction costs then ultimately reduction in profit opportunities. This limited co-operatives' ability from the timely response to the market demands. The discussed studies provide contradicting findings on the mix of finance and fail to consider the board of directors' attributes in influencing co-operatives' financing decisions. Without competent management, the overall performance is bound to decline regardless of the nature of the financial structure. In this respect, it could be appropriate to consider other factors including the asset structure and cost of inputs when assessing the overall operating performance of a firm.

The data envelopment analysis application has been used in several studies to investigate the cost and profit efficiency of deposit-taking institutions (Berger & Humphrey, 1997). Though, studies examining the efficiency of housing co-operatives are relatively few in developing countries. A study by Veenstra et al. (2016) determined the effect of scale and mergers on the efficiency of Dutch housing corporations where DEA and stochastic frontier analysis were used on a panel data of twelve years from 2001 to 2012. The findings disclosed that housing corporations generally operated under diseconomies of scale and the reasons for high technical efficiency were not attributable to the merger of housing corporations. Considerations in this study infer that factors affecting technical efficiency would vary across DMUs depending on the scale of operations and poor management practices. Nonetheless, study findings neither provided the returns to scale nor the non-increasing returns to scale that could help identify the peer housing corporations.

A study by Lang and Welzel (1996) who analyzed financial data of 757 German co-operative banks from 1989 to1992. The findings indicate that low capitalized banks benefited from higher total factor productivity (TFP) growth to highly capitalized banks, in that big German banking sector did not indicate any evidence of economies of scale. They found that merging small inefficient banks did not reap any benefits of economies of scale or eliminated inefficiencies of smaller banks due to failure to respond to input prices and external environmental variables which are not diversifiable through merger.

Mullins (2006) researched on local accountability, scale and efficiency for growing non-profit housing segment in English social housing market. The findings indicate that the size of the social housing contributed to overall scale efficiency. On the other hand, Lupton and Kent-Smith (2012) found no relationship between operating costs and scale efficiency (SE) of English social housing market. However, customarily the size of the firm should affect the average unit cost and consequently improve overall profitability. The parameters used in these units of analysis reveal that the studies contradict the principles of cost behaviour, where total variable costs decline with an increase in the size of a firm. In this respect, the decomposition of technical efficiency into pure technical efficiency and scale efficiency could easily have ascertained inefficiency attributed to poor management and the wrong scale of firms' operations. The studies focused on the size of the firms without integrating proxies of calculating operating efficiencies (SE) such as sales, owners' equity, cash flows, and the number of employees in the model that is likely to vary with the size of the firm.

2.3.2 Financial Structure, Asset Structure and Operating Efficiency

The financial base of an entity influences the nature of the assets and debt uptake of a firm. Bereźnicka (2013) undertook a study focusing on private firms across nine European Union (EU) countries from 2000-2010. In the study, correlation analysis established the relationship between the variables: the capital structure and the assets structure ratios. The findings of Bereźnicka's study revealed a negative significant link between the non-current asset and the firm's debt ratios when capital structure mediated asset structure. The study used asset structure as a composite, without incorporating constituents' elements. This made it difficult to identify the influential effect of individual components of asset structure on the debt uptake. Also, the firm size had a relatively weak impact on the way the asset structure correlated with the capital structure. Considering the firms' liability structure and the firm asset choices, the

tangible assets, in particular, the plant and equipment, support the borrowing ability of the firm because they have greater liquidation and collateralizable value. The debt ratio, therefore, is higher when tangible assets represent a larger proportion of the firm's values since a larger amount of tangible assets increases the appetite for loans. Bereźnicka's study excluded several industries from the analysis, this could bias the results due to the selective application of ratios presented for the industries studied.

A study by Williamson (1988) established a positive connection between gearing and asset liquidity. Firms with high asset liquidity have borrowing power and can attract long-term finances. Since asset liquidity forms a strong base for negotiating loans at competitive interest rates, a firm is likely to reduce its operating expenses. However, results from a study by Sibilkov (2009) contradicted Williamson findings in that, firms with liquid assets issued less unsecured debt.

Given that liquid firms can attract cheap collateralised long-term debts, firms are poised to increase the gearing level. This could threaten the going concern of the firm. This relationship could only hold when the proceeds of the liquidated assets are not more than the value of debt. According to Li et al. (2015), co-operatives have lower debt to asset ratios than comparable investor-owned firms since they (co-operatives) rely more on shareholders' funds, which may impose restrictions on the amount of money to borrow. Nonetheless, Li et al. did not find evidence of co-operatives facing financial constraints. In analyzing Japanese banks, Fukuyama (1996) indicates that overall technical inefficiency declined with growth in the asset base of credit co-operatives, which point toward the nature of the assets held by the firm. Thus a big proportion of assets held as non-productive by the firm would be operating at the wrong scale and eventually overall inefficiency.

Pasiouras, Sifodaskalakis, and Zopounidis (2011)'s study on Greek co-operative banks throughout 2000-2005 used two-stage DEA in estimating technical, allocative and cost-efficiencies of co-operatives. The findings indicate that cost inefficiency affected allocation inefficiency more than technical inefficiency. To evaluate the allocation efficiency, one should have looked at the ability of the management in resources allocation through integrating the variable returns to scale in the model in order to determine pure technical efficiency and scale efficiency. However, the way firms utilize resources enables lenders to evaluate creditworthiness and the associated firm's risks.

Voulgaris, Asteriou, and Agiomirgianakis (2002) found that utilizing the asset, profit, and total assets affected the financial structure of the firm. In measuring asset liquidity, the study by Schlingemann, Stulz and Walkling (2002) found that liquid assets increased the chances of financial distress costs and investors are likely to access detailed information about the firms with high liquid assets. When there is the use of debt, they should furnish the lenders with all fundamental information that support the ability to repay the loan. However, the findings of Rajan and Zingales (1995) provided contrary results on asset liquidity and performance. A firm with high asset liquidity is likely to negotiate better interest rates and ultimately reduce operating costs.

2.3.3 Financial Structure, Board Demographics and Operating Efficiency

Most studies on board demographics and its effect on firms' performance are recent. Post and Byron (2015) performed a meta-analysis of women board members on operating performance. The study used descriptive statistics to survey the discrepancies in firms' regulatory, social and cultural setting across 140 firms. Post and Byron determined that female board members positively correlated to accounting returns. Still, the correlation was higher in countries with stronger shareholder protections and greater gender parity. The study relied on unique country variables, specifically focusing on gender and not on other attributes of female directors. A mere gender classification without pairing other attributes of women directors, for instance, their competence and experience could not provide concise feedback about their effectiveness on efficiency. This current study aimed at finding out the moderating effect of attributes of board demographics such as board competency and board diversity on the association between financial structure and operating efficiency.

In evaluating board diversity attributes and management control of the board, Coffey and Wang (1998) state that key performance indicators of a good manager are; qualities of expertise and skills, personalities, education, age and learning styles. The study was descriptive and failed to define aspects of managerial background. Gunderson et al. (2009) examined the impact of characteristics of the board of directors on farm credit associations' performance in the United State America, using a sample of 86 farm credit associations during 2007. A regression analysis was applied explaining the hypothesized association between board characteristics and return on assets and operating efficiency of the firms. The results

established that board size and board compensation contributed to operating efficiency and non-interest operating expenses of the associations. This is contrary to what this study was focusing on about moderation effects of attributes of board members in influencing the effect of financial structure on operating efficiency.

A study by Erhardt et al. (2003) focused on how the directors' diversity affects the operating performance of firms. The findings show existence of an unrelated association of female board members and profitability of firms. The results contradict the results of Post and Byron (2015) though they seem to agree with that of Ararat et al. (2015). They found a non-linear positive association existing between demographic attributes and different financial performance indicators of firms. The heterogeneity of the firms could have contributed to the non-linear relationship of the variable of the study, an aspect addressed by this current study since all the firms are from the same sub-sector and are homogenous.

Gender is among the most researched demographic diversity attributes (Terjesen, Sealy, & Singh, 2009). A study by Ekadah and Mboya (2011) analyzed how board members' gender diversity affected the performance of banks in Kenya from 1998-2009 using stepwise regression analysis the findings disclosed that board members of commercial banks in Kenya were male-controlled that a board comprising eight board members had only one female director. Consequently, the findings revealed that board diversity did not affect the performance of commercial banks in Kenya. Ekadah and Mboya's findings contradicted Erhardt et al. (2003) determination that a female director has a positive correlation on accounting returns. The study focused on one board attribute that was gender diversity and based on a nominal scale, this could have been analysed together with other board attributes and at a higher scale of measurement to avoid effects of confounding variables in the study.

In the examination of the effect of gender diversity and board monitoring on banks' efficiency. Ramly et al. (2015) used a broad panel of ASEAN-5 (comprising Malaysia, Singapore, Indonesia, Thailand, and the Philippines) listed commercial banks from 1999-2012. The study determined the relationship between gender distribution and bank efficiency by using efficiency scores for cost and profit elements in the second stage. The findings showed that gender diversity of bank board members had a significant and negative influence on cost and profit efficiency. These results differ from those of Ekadah and Mboya (2011). The findings

infer that women as directors of the board failed to mitigate the perceived negative effect of gender diversity on bank efficiency. Therefore, considering other board diversity aspects for instance age and ethnicity, the results would be different. A study by Brammer, Millington, & Pavelin (2007) on ethnic and gender diversity of board of United Kingdom firms found that both ethnic and gender diversity were restricted and less pronounced among executive positions.

The election of managers with necessary management skills could enable co-operatives to achieve their multiple objectives. A study by Mwangi (2014) on how members' income and their conduct could influence the savings and credit co-operatives characteristics in predicting efficiency of Saccos in Kenya from 2009 to 2013. The researcher applied a two-stage model in the study that was DEA and multiple regression analysis. Where the regression model predicted the efficiency score generated from the DEA methodology. The findings showed an insignificant relationship between managers' competence and the efficiency of Saccos. The study did not provide individual inefficiency scores for each Sacco and therefore it was impossible to ascertain the causes of the inefficiency for each Sacco, and could not give a complete picture of returns to scale for the DMUs in the dataset. Using regression analysis, Bhagat, Bolton, and Subramanian (2012) determined the outcome of managers' characteristics and financial structure. The results of the study indicated that managers' ability and equity ownership caused a decline in long-term debt. On the contrary, Vo and Nguyen (2014) established that a high proportion of debt financing compels managers to minimize perquisites, and make prudent financing decisions to avoid losing autonomy.

Board competence is critical to the success of any organisation. Darmadi (2013) examined the effect of the academic level of entrenched board members on the financial performance on 160 firms quoted at the Indonesia securities market. The study used Tobin's Q, returns on assets in measuring profitability. The results established that the CEOs with qualifications of degrees from prestigious universities performed significantly better than those who had such qualifications from other universities. The study should have considered other characteristics of board members for example board experience and managerial skills together with academic qualifications that are important for management functions.

2.3.4 Financial Structure, Asset structure, Board Demographics and Operating Efficiency

Several studies on a combination of these variables are contained in the empirical literature but different contexts. Wang (2016) examined the optimal financial structure of co-operatives incorporating stochastic interest rates. The results showed that changes in business risk were sensitive to optimal equity-to-asset ratio but less sensitive to the changes in the interest rate risk. This places firms with high-quality assets at a better negotiating position when borrowing funds for operating activities (Bereźnicka, 2013). As stated by Robb et al. (2010), for co-operatives to remain efficient they must have the ability to raise enough equity capital to meet their long-term investment needs. Since an increase in debt uptake would contribute to costs related to financial distress thus leading to inadequate liquidity, which will affect financing decisions.

Technical efficiency measures the overall efficiency of a decision-making unit. Worthington (1999) examined the technical efficiency of Australian credit unions. He found out that those credit unions with a high level of asset and using bank loans were relatively efficient. The study did not explain the nature of the asset base - whether it was about asset tangibility and asset liquidity, or otherwise. Further, the study did not define or indicate the magnitude of the differences in findings among the credit unions. No co-operatives were identified as part of peers from the sampled credit unions to be used as reference DMUs for inefficient housing co-operatives.

Co-operative members supply inputs to obtain the maximum amount of outputs. A study by Li et al. (2015) revealed that co-operatives relying heavily on equity financing and loans contributed to mixed results in the short-run due to the financial constraints of the co-operatives. However, a study by Berger, Ofek, and Yermack (1997) found out that managers doubling as a chief executive officer (CEO) and board member took less debt to avoid financial distress. Gearing levels decrease when CEOs encounter pressure from either ownership or compensation incentives to perform. The managers are therefore cautious about the sources of finances for the firm's operations. Brown, Brown, & O'Connor (1999) assessed the effectiveness of individual credit unions in the Australian state of Victoria from 1992-1995 and revealed an unexplained behaviour where members were exiting from some of the efficient small credit unions. The study considered operating costs as inputs and accounting ratios as output without considering specific costs and performance measurements.

Productivity is a function of factors of production as well as a variation in the magnitude of the enterprise. Piesse and Townsend (1995) measured the productivity of 57 building societies in the United Kingdom using data envelopment analysis using accounting data. Even after decomposing total efficiency, the findings indicated no evidence of optimal operation size for building societies. Kipesha (2012) looked at the efficiency scores of 35 microfinance institutions and co-operatives using the production approach. The results showed that microfinance institutions in East Africa, especially Kenya and Rwanda had higher average efficiency scores. The results of the study did not have peer co-operatives to benchmark with the inefficient decision-making units to ascertain the nature of scale inefficiencies. The studies used different aspects of the key variables but none had incorporated the concept of returns to scale in data envelopment analysis.

2.4 Summary of Empirical Literature and Knowledge Gaps

This section provides a summary of the empirical studies reviewed on financial structure, asset structure, board demographics and operating efficiency. The reviews did not find any literature on the mediation of asset structure and moderation of board demographics in predicting financial structure on operating efficiency. Further, the empirical literature on board demographics focuses on individual attributes of board members on performance and not on operating efficiency. This study uses both the composite and individual components of asset structure and board demographics to ascertain the relationship of financial structure and operating efficiency. Most empirical studies focus on the direct relationship of individual attributes of board demographics, without making reference to all board attributes which comprise board competence and board diversity and their influence on financing factors of production and ultimately the cost of inputs and operating efficiency (Kassim et al., 2013; Mande et al., 2012).

Table 2.1 presents a summary of empirical literature, the focus of the study, the research methodology, findings of research and knowledge gaps and lastly the focus of the current study.

Table 2.1: Summary of Empirical Literature and Research Gaps

Researcher(s)	Focus of Study	Research Methodology	Research Findings	Research Gaps	The Focus of Current Study
Marwa and Aziakpono (2016).	Assessed the efficiency and sustainability of Tanzanian saving and credit co-operatives.	The study used DEA with a bootstrap approach to predict the efficiency of Saccos on a cross-section of societies for one-year (2011).	The findings indicate that most Saccos were operating at low efficiency-profitability level, and small Saccos were found to be the best performing firms.	The study was limited to a cluster of Saccos and focused only on one year audited financial statements, 2011, thus unable to make a comparative yearly analysis.	This study was on housing co-operatives, where audited financial statements for 5 years (2012 to 2016) were used in the analysis, and the unbalanced panel data used pooled OLS in estimating the model.
Veenstra et al. (2016).	Determined how scale and mergers affected the efficiency of Dutch housing corporations.	DEA and SFA methodology was applied in the analysis of panel data for 2001-2012.	The results of the study show that housing corporations were operating under diseconomies of scale, and the merger of housing corporations did not affect technical efficiency.	The methodology of the study did not define the approach used to identify inputs and outputs. And the two approaches only compared the methods without improving the robustness of the results reported.	The study used a two-stage model, the DEA and regression models to estimate efficiency. This study applied the intermediation approach in the selection of inputs and outputs cross-section of firms over a five-year period where all observations for the 5 years were used in the study.

Researcher(s)	Focus of Study	Research Methodology	Research Findings	Research Gaps	The Focus of Current Study
Post and Byron (2015).	Examined the influence of women board members on regulatory and socio-cultural contexts across the performance of firms.	A meta-analysis of 140 firms was used in the study.	The presence of female board members had a positive correlation to accounting returns. Besides, it was more pronounced in countries with stronger shareholder protections and greater gender parity.	The study relied on unique country variables with a specific focus on only one category of gender.	This study introduced various attributes of board members as moderator variables. Also, the firms were from one geographical region thus reducing any economic disparity that could affect the generalisation of the results.
Ramly et. al. (2015).	Examined the effect of gender diversity and board monitoring on banks' efficiency.	The study used a broad panel of listed commercial banks from 1999 to 2012. The DEA was used to determine the cost and profit efficiency.	The findings indicate that gender diversity in boards of banks has a significant negative effect on cost and profit efficiency.	The study broadly looked at gender with no specific focus of other attributes of board members, such as board competency and board diversity which are key attributes of successful management functions.	This study focused on board diversity and board competence as attributes of board demographics where Shannon index of diversity was used to compute indices for each attribute.

Researcher(s)	Focus of Study	Research Methodology	Research Findings	Research Gaps	The Focus of Current Study
Mwangi, (2014).	Examined the efficiency of deposit-taking SACCOs in Kenya.	Two-stage model: The DEA and multiple regression analysis average data from 2009 to 2013.	The findings indicate an insignificant relationship between management competence and efficiency of SACCOs.	The findings provided only the mean efficiency score for the SACCOs. The study did not establish the causes of inefficiencies	This study decomposed crs-te scores into PTE and SE with a view of identifying causes of inefficiencies of DMUs.
Othman et al. (2014).	The study was on the productivity and efficiency of co-operative groups in Malaysia.	A two-stage model, the DEA and Tobit regression was used on data for one year, that is 2011, focusing on a sample of 56 co-operative groups out of a population of 70 co-operative groups.	The findings indicated a positive correlation between turnover and profit on efficiency scores of co-operative groups where a small group was efficient.	The study did not use equity capital as a proxy for members/owners' investment as input in the co-operatives but instead used members as input.	This study used share capital and members' deposits as an element of financial structure in the second model, where they were regressed on operating efficiency.
Bereźnicka (2013).	The study did a comparative analysis of the structure and capital structure of private firms across 9 European Union countries.	Pearson's correlation coefficient between the capital structure ratios and the assets structure ratios were used in ascertaining the relationship over a 10-year, period; from 2000-2010.	The findings indicate that capital structure was a mediator of asset structure and that the relationship between asset tangibility and the level of debt was negative and statistically significant.	The study focused on a very small sample and the composite capital structure, and many firms were left out from the analysis because of non-availability of data.	This study used a large sample comprising 87 DMUs The components of asset structure mediated individual components of financial structure to establish the hypothesised relationship by regressing the efficiency scores on the components of the main variables of the study.

Researcher(s)	Focus of Study	Research Methodology	Research Findings	Research Gaps	The Focus of Current Study
Ekadah and Mboya (2011).	Analyzed the effect of board gender diversity on the performance of commercial banks in Kenya.	The financial data from 1998-2009 were analyzed using stepwise regression.	Findings indicate that gender diversity did not have any effect on the performance of banks in Kenya.	The study focused on gender diversity without factoring other attributes of board members such as the board members qualifications and experience, which are key in determining the quality of management.	This study focused on board demographics by computing Shannon diversity indices for different attributes board diversity which were not limited to gender diversity.
Darmadi (2011).	Examined the association between the board members diversity and financial performance.	Data were obtained from a cross-section of firms. Regression analysis was done for 169 firms in Indonesia.	The findings indicate a significant and negative relationship between gender diversity and financial performance of firms.	The study findings could not be generalised to other firms outside Indonesia because of economic disparity of firms in other countries such as Kenya.	This context of the study was on housing co-operatives Nairobi County. Where the units of analysis were firms from the same geographical and carrying out similar activities of providing affordable house, therefore the firms were homogenous, and results can be generalised.
Gunderson et al. (2009).	Determined the impact of board of director characteristics on farm credit associations' performance in the United State of America	Regression analysis was performed on data collected from 86 farm credit associations during the year, 2007.	The result of the model finds that board size and board compensation contributed to both operating efficiency and non-interest operating expenses of the associations.	The data was for one single year, could not provide a trend of performance, and focused on broad board characteristics.	This study focused on the moderation effect of the board demographics attributes on the relationship between financial structure and operating efficiency on housing co-operatives.

Researcher(s)	Focus of Study	Research Methodology	Research Findings	Research Gaps	The Focus of Current Study
Worthington (1999).	Measured the technical efficiency of a sample of 233credit unions in Australia.	Technical efficiency was determined using both non-parametric and parametric techniques.	The study established that credit unions, which had large assets base and used bank loans were relatively more efficient than those had a large asset base and did not use bank loans.	The study failed to clarify the nature of data distribution and used two different techniques to estimate technical efficiency, where asset base and composition of debt finance were used.	This study presented descriptive statistics and diagnostic tests to help establish data distribution. The study also focused on the mediating effect of the elements of asset structure on financial structure and operating efficiency using DEA and regression model.
Piesse and Townsend (1995).	Focused on measuring the productive efficiency of building societies in the UK.	DEA was used to determine the optimal operation size for building societies after decomposing total efficiency on a survey of 57 UK building societies, where accounting data was used in the analysis.	The results found no optimal operation size that would influence total efficiency for building societies.	The study did not use the log for asset and log for total revenue as proxies of the size of the building societies.	This study used the number of members of co-operatives as a proxy for size housing co-operative. DEA' s estimated technical efficiency scores and was decomposed to find the causes and sources of inefficiencies.

Source: Author (2019)

2.5 The Conceptual Framework and Research Hypotheses

The conceptual model depicts the relationship among the variables of the study and then research hypotheses derived from the study variables. The anchoring theory in this study was the pecking order theory, which reiterates that the source of financing is dependent on the cost of raising finance. Still, the choice of financial structure is anchored on asset structure and board demographics, and not only on mere hierarchal financing. Other factors found to influence the main variables of the study were information asymmetry and ownership structure. The conceptual model shows the relationship between the variables and the corresponding null hypotheses.

2.5.1 Conceptual Model

Figure 2.1 illustrates the relationship between financial structure, asset structure, board demographics and operating efficiency. The variables of the study were generated from the theoretical and empirical literature of co-operatives and investor-owned firms from developing and developed economies. The independent and dependent variables were financial structure and operating efficiency, respectively. Several studies have revealed a linear relationship between financial structure and operating efficiency. Nonetheless, this study introduces components of asset base and attributes of board members to establish the link and effect on the relationship of the main variables. Despite many studies adopting the use of capital structure, this study purposively used financial structure to incorporate non-interest-bearing liabilities (current liabilities) in the components of finance. This was so considering that non-interest-bearing liabilities are the main source of financing for micro and small enterprises.

The empirical literature on finance cites that several factors influence the effect of financial structure on performance. These factors include factors of production that guide in the choice of selection of inputs and outputs. In addition, information asymmetry and bond of association (Li et al., 2015) although not specified in the model helped in explaining elements of the theories that underpinned the variables of the study.

Pertaining to board demographics, the study assumed that board demographics did have insignificant moderating effect financial structure in estimating operating efficiency. A study by Gunderson et al. (2009) found a non-significant effect on diversity and competence in explaining the choice of financing policy. To supplement board demographics, the attributes for board diversity and board competence were incorporated in the regression model to establish their effect on financial structure and operating efficiency of housing co-operatives

(Ararat et al., 2015; Gunderson et al., 2009). Finally, this study also hypothesised that the mediating effect of asset structure in the relationship between financial structure and operating efficiency was not significant (Bereźnicka, 2013; Sibilkov, 2009; Veenstra et al., 2016).

Figure 2.1 depicts, through arrows, the research questions, which this study addressed. The operating efficiency was presented across three spectrums as technical efficiency, pure technical efficiency and scale efficiency. The inputs selected were labour costs, operating expenses, and the book value of the cost of investment (cost of sales), and the output was defined as total revenue. The crs-te was the standard measure for operating efficiency. Technical efficiency was disintegrated into pure technical efficiency and scale efficiency. Finally, the scale efficiency was determined by obtaining a ratio of crs_te to vrs_te.

Figure 2.1: Conceptual framework

Source: Author (2019)

2.6 Null Hypotheses

The study hypothesized that a non-significant existed between financial structure and operating efficiency. Additionally, the hypothesized effect of asset structure on financial structure, and the moderation effect of board demographics was insignificant on the relationship between financial structure and operating efficiency. In addition, the hypothesized combined effect of financial structure, asset structure, and board demographics was also not significant on operating efficiency. The process involved the testing of four null research hypotheses derived from research objectives. The following are the null hypotheses:

H_{01} The relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County is not significant.

H_{02} The mediating effect of asset structure on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County is not significant.

H_{03} The moderating effect of board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County is not significant.

H_{04} The combined effect of financial structure, asset structure, and board demographics on operating efficiency of housing co-operative societies in Nairobi City County is not significant.

2.7 Chapter Summary

The chapter discussed the theoretical foundation of the study namely; the pecking order theory, the agency theory, and the theory of social capital. The chapter similarly presents empirical literature about the variables and knowledge gaps emanating from the literature review. Other information provided in the chapter is literature on the interrelationships amongst variables of the study and the conceptual model. Finally, the chapter presents four null hypotheses derived from the research objectives. The assumptions made for the null hypotheses included the scale of measurement, random sampling, and normality of data distribution, linearity, and adequacy of sample size.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter presents the research methodology for this study. This consists of research philosophy, research design, the population and sample of the study, the data collection methods and collection instruments. The chapter also outlines the operational definition of the variables, editing and coding of data, the data analysis methods and models formulation, diagnostic tests, hypotheses testing and a table comprising a summary of research objectives, hypotheses and data analysis technique.

3.2 Research Philosophy

Philosophy is a way of thinking to resolve the dilemmas people face. Research philosophy is an underlying assumption upon which research and development in the field of inquiry is based (Saunders, Lewis, & Thornhill, 2009). The three main research philosophies that underpin research in social sciences are positivism, phenomenology, pragmatism, or mixed methods approach (Johnson, Onwuegbuzie, & Turner, 2007), with the widely used ones being phenomenology and positivism.

A Phenomenology is a philosophical approach for studying human experiences. This approach is based on the idea that human experiences is determined by the context of where people live, therefore inherently subjective (Zikmund, 2003). Researchers using phenomenology as a philosophy focus on the individual relationship with the physical environment, objects, people, and the situations that influence a person's behaviour. In this approach, one assumes that knowledge comes from an individual's experience and avoids generalization based on an existing theory (Saunders et al., 2009). Therefore, the focus is on experiences and relies on case scenarios characterized by open and unstructured interviews/questions. The research respondents should relate experiences of a phenomenon which could be achieved if the environment is conducive. The researcher should ensure that the respondents are comfortable telling their stories as part of the members of the group. This approach aims to get data analysed and conclusions drawn on the correlations between the study variables based on empirical evidence to assist in interpreting experiences (Zikmund, 2003).

Positivism philosophy is a research orientation that assumes that useful research is anchored on theory, hypotheses, and quantitative data on real facts (Saunders et al., 2009). Positivism seeks facts about social phenomena. It has little regard for the subjective status of individuals and presupposes that the social world subsists objectively and externally with knowledge being valid when based on observations of external reality. Positivism paradigm guided this study because the study orientation included the operationalization of variables and tests of hypotheses based on existing theories (Zikmund, 2003). The study also considered a quantitative approach to testing the phenomena of asset structure and board demographics through several hypotheses when predicting the relationship between financial structure and operating efficiency.

3.3 Research Design

A research design is a plan providing a framework of carrying out research. It is a structure and strategy for obtaining answers to research questions. According to Zikmund (2003), a research design outline the procedures for the collection and analysis of research data. Research designs commonly used are exploratory, causal and descriptive.

The exploratory research has the object of clarifying ambiguous situations and the discovery of potential business opportunities or new ideas about a phenomenon (Zikmund, 2003). This, however, does not provide conclusive evidence on any specific phenomenon being investigated. Nevertheless, it is a first step towards conducting research that would provide more evidence about the phenomenon. This research design is often a guide in refining subsequent research efforts. Causal research seeks to identify the cause-and-effect association between variables to help the researcher make an educated prediction about a phenomenon being investigated. Exploratory and causal research design builds the foundation of descriptive research.

Descriptive research focuses on describing the characteristics of objects, people, organizations, and the environment (Zikmund, 2003). There are three methods mainly used in descriptive research, namely the survey studies-which describe the status quo of a phenomenon, correlational studies examine the correlation between variables, and developmental studies determine changes over time. Descriptive design is categorized by cross-sectional and

longitudinal studies. Cross-sectional studies involve selection of elements from the target population and measuring them only once at a given point in time, while longitudinal studies are concerned about questioning the respondents at multiple points in time to examine the continuity of responses and observe changes over a long period (Sekaran, 2010).

The descriptive cross-sectional study design was adopted because the overall objective of the study was to establish a significant association concerning variables of study units over five years. This enabled the researcher to conclude from the information gathered over a period across firms thus improve the accuracy and generalization of findings (Mugenda & Mugenda, 2003). A longitudinal study enables researchers to determine whether a correlation exists among variables over a long period of study. The research design guards against biasedness and allows researchers to analyse, interpret, and report findings without any manipulation (Nachmias & Nachmias, 2004). The descriptive cross-sectional survey establishes the nature of the relationship of the variables by dividing a sample into appropriate subgroups (Zikmund, 2003). Several studies for instance Bereźnicka (2013) and Irungu (2007) used the descriptive cross-sectional survey to test for the board effectiveness and performance across firms.

3.4 Population and Sample

The study population comprised housing co-operative societies registered by the commissioner of co-operatives before or during the year 2012 (GoK, 2016) in Nairobi City County. The sampling frame was drawn from the register of co-operatives at the state department of co-operatives (GoK, 2016). The unit of analysis was housing co-operatives and whose target population comprised 173 housing co-operative societies, which had operated for more than five years as at December 31, 2016 *(*see Appendix IX*).* The reason for the choice of five years was informed by few housing co-operatives that had operated for more than 10 years. Further, the choice of co-operatives in Nairobi City County was necessitated by high level of concentration and diversity of the Kenyan population. In addition, Nairobi City-County controlled for variations in local conditions such as local economic conditions and the annual rate of residential construction. Worthington (1999) and Li et al. (2015) indicated that residual differences in geographic and institutional characteristics are extremely sensitive when measuring efficiency. This study was restricted to analysing the common industry and common geographic area as it controlled for heterogeneous market and economic conditions (Worthington, 1999).

Multistage sampling technique determined the selection of the sample from the study population. This technique uses a combination of probability sampling techniques at several steps (Zikmund, 2003). Studies that have used a multistage sampling technique include that of Joy and Kolb (2009) on cultural differences in learning styles. This current study followed three stages in determining the sample size. The first stage involved drawing a sampling frame from a list of registered housing co-operative societies as of December 31, 2016. The second stage was the selection of the housing co-operatives registered before or during the year 2012. The third and final stage used convenient sampling to select all active housing co-operatives that had filed audited financial statement in the past five years as of December 31, 2016. From this, a sample of 173 housing co-operative societies was selected. This formed the reference point for both secondary and primary sources. The audited financial statements for the years 2012- 2016 were used to construct a dataset for 5 years. However, some active housing co-operatives did not file financial statements regularly; hence, the final sample for housing co-operatives that met the criteria was 87 comprising a 50.3% of the target population (see Appendix X).

3.5 Data and Data Collection Instruments

The data for the study were assembled from primary and secondary sources. The quantitative data was from the financial statements of the sample housing co-operatives. The primary data provided information relating to the attributes of board members who sat in respective boards to determine the dominance and evenness of the attributes.

The data collection form was used to record the data extracted from financial statements. The data collection form was a convenient tool because it helped the researcher in extracting data faster from financial statements and made it easier to edit and code the data for subsequent data processing and analysis (Saunders et al., 2009). Additionally, a research question guide recorded information from board members/CEOs on the board attributes not provided in the financial statements. The questions guide was revised after interviewing and calling 10 respondents. The financial statements provided information on financial and asset structure, in addition to some attributes of board demographics (age, gender, ethnicity, and board experience); while education background data was obtained through face-to-face interviews, telephone contacts, or emails sent to managers/office administrators and management committee members.

Research assistants were recruited from among the interns from Co-operative University attached at the county co-operatives' main registry. Their duties involved extracting preliminary information of all housing co-operatives from legal files. The preliminary information included the year of registration, physical address, and telephone contact of the head office, and for board members. The research assistants had accounting knowledge but were still trained on maintaining confidentiality and honesty in the course of gathering data to ensure compliance with ethical issues in research.

Data for this study were collected from March 01, 2018 to July 2018. The latest audited financial statements registered by the commissioner for co-operatives were for the year ended December 31, 2016. Some financial statements were missing at the County Co-operatives' Registry, resulting in the extension of the data collection to the Central Registry, at the State Department of Co-operatives, Ministry of Trade, Industry, and Co-operatives. Despite extending data collection to the head office, the data was readily available. Moreover, the collected data was found adequate and sufficient for the study. Data for studies by Marwa and Aziakpono (2016) and Mwangi (2014) was not entirely available thus used cross-sectional study. This study-pooled cross-section of the firms over a five-year period to record 435 observations.

3.6 Operationalization of the Study Variables

Operationalization involves breaking down of concepts into operational measurable terms (Sekaran, 2010). The actual measurement scales assess the variables of interest. The study context guided the conceptualization of operational terms. To this end financial structure as an independent variable was designated as the sum of the ratio of core capital (share capital and reserves) and liabilities, while the mediating variable was asset structure conceptualised as the summation of proportions of asset tangibility and asset liquidity to total assets. The other variable was board demographics comprising board diversity and board competence. A composite index was computed using simple arithmetic mean, where the attributes of board members were given equal weight and indices aggregated.

This study calculated the individual index for each attribute and composite index using the Shannon index of diversity. The index in commonly used in biological and ecological monitoring (Spellerberg & Fedor, 2003). This study applied the Shannon index of diversity in computing respective indices for various attributes of board members to ascertain the spread of their attributes across boards of housing co-operatives.

A diversity index measures species diversity in a specified population. The index provides important information about rareness and dominance of attributes in a given community. Several indices of diversity are largely used in literature among them; Blau index (Ararat et al., 2015; Lau & Murnighan, 1998), Shannon-wiener index (Spellerberg & Fedor, 2003), and Simpson index (Keylock, 2005). The Shannon-wiener index takes into account both abundance and evenness of species (attributes) present in a community (population). This is especially so when the variables are at interval or ratio scale, unlike Blau and Simpson indices that are based on an ordinal scale when interpreting results.

The 'Shannon index' is sometimes referred to as 'Shannon-Weaver' index or Shannon-Wiener' index. The index formed the basis for calculating board diversity and board competence indices. The index is computed as: where $H = \sum_{i=1}^{s} -(\mathrm{Pi} * \ln \mathrm{Pi})$. H is the Shannon diversity index; Pi is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N). Ln is the natural logarithm and Σ is the sum of the calculations and S is the number of species.

Finally, the dependent variable, which is the operating efficiency, was measured as an efficiency ratio, which is the ratio of the sum of the amounts of the weights of output and inputs for each DMU. To test the null hypotheses, an interval and a ratio scale of measurements made it possible to apply a wider number of analytical alternatives. The operationalization and scale of measurements of variables are shown in Table 3.1.

Table 3.1: Operationalization of Variables

Variable		Operational definition	Source	Hypothesis	Measurement scale
Financial Structure (FS): Core Capital: (Share Capital+ Reserves)	Indicator Share Capital (SC)	Share capital is the members' equity. Share capital / Core capital + Liabilities	Chay et al. (2015); Wang (2016); WOCCU (2003); Yu & Nilsson, 2019.	H_{0_1}	Ratio
	Institutional capital (IC)	Institutional capital is statutory reserves, general reserves and revenue reserves. Institutional capital / Core Capital + Liabilities.	Wang, (2016); Chay et al. (2015); WOCCU (2003) Yu & Nilsson (2019).		
Liabilities(L) (MD+NIBL+IBL)	Members deposits (MD)	Members' deposits include; members' savings and or deposits made by members. Members deposits / Core Capital + Liabilities	Chay et al. (2015); Wang (2016); WOCCU (2003) Yu & Nilsson (2019)	H_{0_1}	Ratio
	Non-interest-bearing Liabilities (NIBL)	Non-interest-bearing liabilities comprise accruals and trade payables. Non-interest-bearing liabilities / Core Capital + Liabilities			
	Interest-bearing liabilities (IBL)	These are loans and other debt instruments. Non-interest-bearing liabilities / Core Capital + Liabilities.			
Asset Structure (AS)	Asset liquidity (AL)	Cash and cash equivalent / Total assets	Gopalan et al. (2012); Harris Raviv (1991); Sibilkov (2009); WOCCU (2003)	H_{0_2}	Ratio
	Asset tangibility (AT)	NBV of non-current assets / Total assets	Bereźnicka (2013); Vo & Nguyen (2014); WOCCU (2003)	H_{0_2}	Ratio
Board Demographics (BD)	Board Diversity (BD): Gender	Female/Male board members expressed as a % age of total board members. $pi=\frac{\text{no.of members of each gender in the board}}{\text{total number of board members}}$ Then apply Shannon index formula to get a gender diversity index for all gender in the board of a DMU. $H=\sum_{i=1}^{s}-(\text{Pi}*\ln\text{Pi})$	Blau (1977 as cited in Ararat et al., 2015); Erhardt et al. (2003); Post and Byron (2015); Shannon index of diversity (Spellerberg, & Fedor, 2003).	H_{0_3}	Ratio

Variable		Operational definition	Source	Hypothesis	Measurement scale
	Ethnicity	A number of board members from one ethnic group expressed as a %age of total board members $\text{pi}=\frac{\text{No of ethnic groups in the board}}{\text{Total ethnic groupings in a DMU}}$ Then apply Shannon index formula to get Ethnic diversity index for all ethnic groups in the board of a DMU. $H=\sum_{i=1}^{s}-(\text{Pi}*\ln\text{Pi})$.	Blau (1977 as cited in Ararat et al., 2015); Erhardt et al. (2003); Gunderson et al. (2009); Post and Byron (2015); Shannon index of diversity (Spellerberg, &Fedor, 2003).	H_{0_3}	Ratio
	Age	% age of board members aged up to 35, % age of board members aged > 35 and not more than 60, and % age of board members aged over 60 years: Each expressed as a % age of total board members. $\text{pi}=\frac{\text{members under each age category}}{\text{Total members in all categories}}$ Then apply Shannon diversity index to obtain Age diversity index for all category in a board of a DMU. $H=\sum_{i=1}^{s}-(\text{Pi}*\ln\text{Pi})$.	Blau (1977 as cited in Ararat et al., 2015); Gunderson et al. (2009); Post & Byron (2015); Shannon index of diversity (Spellerberg, &Fedor, 2003).	H_{0_3}	Ratio
	Board Competence (BC): Education background	The level of education of each board member: Ordinary level (KCE/KCSE or Advanced level-KACE; College diploma/ Certificate or University Degree. $\text{Pi}=\frac{\text{No.of board members under each level of education}}{\text{Total number of members in the board}}$ Then apply the Shannon diversity index to obtain education diversity index. $H=\sum_{i=1}^{s}-(\text{Pi}*\ln\text{Pi})$.	Blau (1977 as cited in Ararat et al., 2015); Erhardt et al. (2003); Post and Byron (2015); Shannon index of diversity (Spellerberg, &Fedor, 2003).	H_{0_3}	Ratio

Variable		Operational definition	Source	Hypothesis	Measurement scale
	Board experience	The number of years each member has served as a board member in the housing co-operatives. $\text{Pi}=\frac{\text{No.of board members with certain no of years of experience}}{\text{Total number of members in the board}}$ Then apply the Shannon index to obtain the board experience diversity index. $H=\sum_{i=1}^{s}-(\text{Pi}*\ln\text{Pi})$	Blau (1977 as cited in Ararat et al., 2015); Gunderson et al. (2009); Post & Byron (2015); Shannon's index (Spellerberg, &Fedor, 2003).	H_{0_3}	Ratio
Operating Efficiency (OE)	Constant Returns to Scale Technical efficiency (crs_te) or TE.	Sum of the product of the weights of the amounts of output divided by the sum of the product of the weights of the amounts of inputs for each DMU under perfect market.	Marwa, and Aziakpono (2016); Mozaffari et al. (2014); Othman et al. (2014); Ruggiero (1998).	H_{0_4}	Ratio
	Variable Returns to Scale technical efficiency [vrs_te] i.e Pure Technical efficiency (PTE)	Sum of the product of the weights of the amounts of output divided by the sum of the product of the weights of the amounts of inputs for each DMU under imperfect market.			
	Scale efficiency (SE)	$\text{SE}=\frac{crs\_te}{vrs\_te}$			

Source: Author (2019)

3.7 Editing and coding

Editing and coding of data is the first step in the data processing. Information is mined from raw data leading to the analysis stage. Editing involves verification of data collection forms for any omissions, clarity and reliability in classification (Zikmund, 2003). The editing process rectifies interviewer errors and when answers are wrongly entered in the data collection form before the data is transferred to the computer. Coding follows editing and establishes meaningful categories in the form of assigning numbers or characters and symbols for groups of responses before the tabulation of data (Saunders et al., 2009). The coding process facilitated the analysis of data by the computer.

Editing and coding of the data for this study were done by scrutinizing the completed data collection form against the entries made in the excel spreadsheet. This ensured that the data gathered was accurate and consistent, and uniformly entered (Zikmund, 2003). A do-file or syntax file comprising all commands was prepared for all research objectives and operationalized study variables to aid in analysis in STATA statistical software.

3.8 Data Analysis

Data analysis is the application of reasoning to understand the data that has been gathered (Zikmund, 2003). It determines the consistent patterns and summarizes relevant details revealed in the investigation. The specific research objectives determine the research design and nature of the gathered data. Both descriptive and inferential statistics were used in the analysis of data. Descriptive statistics ascertains the variability of study variables by measures of central tendency and dispersions. The mean, standard deviation, coefficient of variation (CV), skewness (SK), and kurtosis (KU) display the attributes of the study variables. This determined the nature of inferential statistics used in the analysis. The Sturges' rule helped in the determination of construction of classes' width (Scott, 2009). The rule describes the classical formula for the construction of histogram or frequency curves. However, a few amendments on data distribution were made when preparing the frequency distribution tables.

The study followed a two-stage method (Simar and Wilson, 2015) in the conceptualization of variables used in the DEA technique. The model combines DEA and linear regression in the analysis. The first stage involved the application of DEA programmed in STATA, where constant returns to scale technical efficiency, pure technical efficiency, and scale efficiency were produced for each housing co-operative society. Subsequently, the returns to scale for each DMUs were determined to establish the causes of scale inefficiencies. The independent variables were regressed on constant returns to scale technical efficiency (crste) to establish the hypothesized relationships of study variables. Studies by Coelli et al. (2005), Mwangi (2014), and Simar and Wilson (2015) used a two-stage method on a cross-section of data but did not determine the nature of returns to scale. Other studies that have used the two-stage model include Othman et al. (2014) used DEA and Tobit regression while McDonald, (2009), used DEA and ordinary least square. Recent studies show that OLS regression is more appropriate compared to Tobit regression in estimating the hypothesized relationship in a two-stage model (Simar and Wilson, 2015; Hoff, 2007; McDonald, 2009).

The analysis resulted in descriptive statistics (mean, range, standard deviation, and coefficient of variance, skewness, and kurtosis) for each input and output variables. The second stage was undertaken according to Mwangi (2014), Ruggiero (1998), Simar and Wilson (2015), and Zhu (2003) by first obtaining the efficiency scores of each DMU using DEA technique. Further, the technical efficiency was decomposed to ascertain the returns to scale (Banker et al., 1984; Charnes et al., 1978). Moreover, the effect of predictors on technical efficiency scores was determined using simple linear regression, hierarchical regression and multiple regression.

3.8.1 Descriptive Statistics

Descriptive statistics summarise the characteristics of a dataset. It involves the use of measures of central tendency and dispersion such as mean, standard deviation, range, and coefficient of variation skewness and kurtosis. The range indicates the minimum and maximum number in a dataset and is a good basis for the interpretation of standard deviation while standard deviation is expressed as a per cent of the mean (Doane & Seward, 2016), and measures the dispersion of datasets from the mean. Nevertheless, when the scale of measurements and averages are extremely different in the dataset, the coefficient of variation serves as a better statistical measure of the dispersion of data points around the mean.

Measures of central tendency, namely the mean, standard deviations, range, coefficient of variation, skewness, and kurtosis were used to present the descriptive statistics. The Sturges' rule, which as put forth by Scott (2009) describes the classical formula for the construction of histogram and frequency curves, determined the width of the classes of the variables. The width of each class is denoted by h where h= $\frac{b-a}{k}$. The numbers of the class formed depend on the sample size *(n)* where a large sample creates more classes. The Sturges'rule proposes that the estimates for the number of classes are determined as k = 1 + $log_{2(n)}$, where the logarithm is taken to base 2. Using the rule, the choice of the class interval was calculated as k = *m* + 1 = 1 +$log_{2(n)}$. The number of classes' k equals m + 1 and the size sample is represented by n. In this study the sample was 87 housing co-operative societies, hence the number of classes, k was computed as 1+ log_2 (87). As a result, the class width based on the Sturges' rule was 7.426. This number ($2^{7.426}$ = 87) being the power that gives the total sample size. The study adopted a class width of seven with some modifications on some frequency distributions.

3.8.2 Data Envelopment Analysis

Traditionally, the measurement of firms' efficiency has always been through ratios analysis. However, scholars are now widely using stochastic frontier analysis and data envelopment analysis as approaches for measuring the efficiency of economic units (Kipesha, 2012) referred to as DMUs. The stochastic frontier analysis specifies the functional form that produces maximum output in respect to inputs as the cost and profit/production and environmental factors (Coelli et al., 2005). Although DEA is non-parametric mathematical programming, the approach does not assume any form of data distribution when assessing the relative operating efficiency of a set of comparable economic units. The use of observed data in DEA constructs the best practice production function with no possibility of making mistakes in specifying production function (Drake & Hall, 2003; Jemric & Vujcic, 2002).

Data envelopment analysis identifies the efficient units, which act as benchmarking firms for the inefficient units in the production set. As a managerial tool, it is widely used for measuring the performance of organisations' relative efficiency for the public and private sectors such as bank branches, universities, and public houses using pre-selected inputs and outputs (Dyson & Shale, 2010). The method overcomes the problems of firms with multiple inputs and outputs and even multiple performances. Cooper, Seiford, and Zhu (2004) and Zhu (2003) found the method ideal even when conventional cost and profit functions cannot be justified.

The origin of DEA is traced from the work of Farrell (1957) who advocated for identification of an empirical efficient frontier for decision-making units (Banker et al., 1984). The frontier formed by a set of real units based on observed best practice instead of formulating a theoretical frontier based on a production function (Dyson & Shale, 2010). DEA for application in the public sector and not-for-profit organizations where typical economic behavioural objectives of cost minimization and profit maximization are not relevant was developed by Charnes et al. (1978).

Data envelopment analysis is superior to accounting ratio since it integrates multiple inputs and output(s). It is a good managerial and performance measurement tool and it identifies the sources and levels of inefficiency for each input and output (Marwa & Aziakpono, 2016; Mozaffari et al., 2014). DEA methodology is different from stochastic frontier analysis because it does not consider the functional form of data used in the analysis (Ruggiero, 1998). It

optimizes performance and identifies how much improvement (resources) are required for each DMU, allowing for multiple inputs-outputs at the same time without any assumption on data distribution. Simar and Wilson (2015) assumed a similar distribution of efficiency scores based on inputs and outputs for all DMUs. Therefore makes homogeneity assumption on efficiency not possible to deal with in the very real instance when some observations are more uncertain than others. Simar and Wilson maintained that bootstrapping could capture the vagueness in DEA through the construction of confidence intervals.

The basis of selection of the variables of this study was by the intermediation approach combined with expert knowledge and accepted practices. This study defined the inputs to include labour costs, operating expenses, and cost of the investment; while output was total revenue. Fukuyama (1996) defined inputs for the efficiency of banks to be interest and non-interest expense and output as interest and non-interest income forming total revenue. Studies by Marwa and Aziakpono (2016) and Mozaffari et al. (2014) applied the intermediation approach in the selection of inputs and outputs.

The two approaches used by managers in the choice of the method of the orientation of inputs and outputs are input and output-oriented models. The input-oriented model focuses on minimizing the inputs while sustaining a given level of output; while the output-oriented model maximizes the outputs without needing more of any of the observed input values (Banker et al., 1984). The input-oriented approach was preferred because the management has control over the inputs (labour costs, operating expenses, and cost of investments) than output.

In determining efficiency measurements, Charnes et al. (1978) originally proposed constant returns to scale (crs) model as an efficiency measurement model of the DMUs by assuming that firms operated at optimal scale. However, in 1984, Banker et al. (1984) introduced the variable return to scale (vrs) efficiency measurement model that assumes that market dynamics and government regulations affect the optimal scale of operations for DMUs. The Banker et al. model for variable returns to scale technical efficiency (vrs_te) generated scores for constant returns to scale technical efficiency (crs_te) scores, vrs_te (pure technical efficiency) scores, and scale efficiency (SE) scores. The non-increasing returns to scale (nirs) were the point of reference for determining the nature of returns to scale (Banker et al., 1984). The results under

variable returns to scale technical efficiency (crs_te) revealed sources of inefficiency in form of increasing returns to scale (irs) and decreasing returns to scale (drs) or constant returns to scale across housing co-operatives. The variable returns to scale technical efficiency (vrs_te) presupposes that firms operate under imperfect competition. This analysis follows several studies (Banker et al., 1984; Charnes et al., 1985; Marwa & Aziakpono, 2016; Mozaffari et al., 2014; Ruggiero, 1998; Worthington, 1999) in determining the effect of independent variables on constant returns to scale technical efficiency.

3.8.2.1 Data Envelopment Analysis Model Formulation

The formulation of the DEA model is in line with linear programming techniques that envelop the observed inputs and outputs of DMUs. DEA methodology determined efficiency ratios for each housing co-operative society where the efficiency ratio (h_s) was computed using STATA software equipped with DEA. The following were the steps involved in developing the model:

Stage One:

Consider having a population of s co-operative societies, that is DMU1, DMU2, …, DMUs. Each DMUproduces m outputs while consuming n inputs. Rewriting the input matrix X = [xij, i = 1, 2, …, n, j= 1, 2, …, s] and an output matrix Y = [yij, i = 1, 2, …, m, j= 1, 2, …, s].The s-th line – i.e. Xs and Ys – of these matrixes thus shows quantified inputs/outputs of DMUs. The efficiency rate (ratio) of such a DMU was expressed as:

$$h_s = \frac{\sum_{i=1}^{m} u_i y_{is}}{\sum_{j=1}^{n} v_j x_{js}} \quad \text{.......... (1)}$$

Where: vj, j = 1, 2, …, n, are weights assigned to j-th input, ui, i = 1, 2, …, m, are weights assigned to i-th output. h_s is efficiency ratio; u_i is the output weight; y_{is} is the amount of the output (m) produced by a specific housing co-operative society (s); v_j is the input weight; x_{js} is the amount of input (n) used by a specific housing co-operative society (s); i runs from one (1) to m; j runs from one (1) to n.

In DEA models, the s DMUs are evaluated; where each DMU takes n different inputs to produce m different outputs. The essence of DEA models in measuring the efficiency of DMUs by maximising its efficiency rate, however, subject to the condition that the efficiency rate

(score) of any other units in the population must not be greater than 1. The models must include all characteristics considered, i.e. the weights of all inputs and outputs must be greater than zero. The efficiency maximising problem was defined as follows:

$$\text{Max } \frac{\sum_{i=1}^{m} u_i y_{is}}{\sum_{j=1}^{n} v_j x_{js}} \ldots\ldots(2)$$

Subject to

$$\frac{\sum_{i=1}^{m} u_i y_{is}}{\sum_{j=1}^{n} v_j x_{js}} \leq 1, k = 1,2 \ldots, n \ldots\ldots(3)$$

Where

ui ≥ ε i = 1, 2, ..., s and vj ≤ ε j = 1, 2, ..., m……(4)

The first inequality (equation 3) implies that the score of a DMU should not exceed unity (1) meaning a firm's efficiency cannot be more than 100%, and the second inequality (equation 4) indicates that the weights are non-negative and determined entirely from the output and input data of all DMUs in the dataset. The weights of the variables in DEA are optimized automatically thus presenting the firm in the best possible way (Coelli et al. (2005). The DEA does not work with negatives values for inputs and outputs, and the number of observation for all the firms should equal.

To solve the fractional programme (equation 2) in the above formula, the inequality was converted into a linear programming problem in STATA for an easier solution as shown below:

$$Max \sum_{i=1}^{m} u_i y_{is} \ldots\ldots (4)$$

Subject to: $\sum_{j=1}^{n} v_j x_{js} = 1$

$$\sum_{i=1}^{m} u_i y_{is} - \sum_{j=1}^{n} v_j x_{js} \leq 0 \ldots\ldots (5)$$

$$u_i \geq \varepsilon; \quad v_j \leq \varepsilon$$

The STATA software with an in-built software for DEA prepared the DEA commands based on the linear programming for respective inputs and output. In order to establish the causes of inefficiencies for each DMU, the DEA through variable returns to scale produced scores under constant returns scale technical efficiency (crs-te), variable returns to scale technical efficiency

(vrs-te) and scale efficiency scores, as well as returns to scale. The scale efficiency was computed using SE = crs_te/vrs_te (Banker et al., 1984). However, one could still calculate inefficiency (IE) using a formula: IE = (1- E)/E, where E is vrs_te (pure technical efficiency). The constant returns to scale (crs) assume that DMUs are operating at optimal scale in that a change in inputs proportionately leads to a similar change in output. This is only ideal in a perfect market, which is unusual in a real market set up, hence the reason for the application of variable returns to scale approach. The DEA produced results for the nature of returns to scale whether constant returns to scale (crs), increasing returns to scale (irs) or decreasing returns to scale (drs) (Othman et al., 2014). They formed the basis of analysis and interpretation of the causes and sources of inefficiencies of housing co-operatives.

3.8.3 Regression Analysis

The second stage involved regressing the technical efficiency scores on the independent variables. Regression analysis explores the linear relationships between the dependent variable and one or more independent variables. Before conducting a regression analysis, it was a pre-requisite to perform diagnostic tests. The tests established whether the dataset met the basic assumptions to use regression analysis model. The ordinary least square (OLS) regression model requires a few assumptions to work. The primary concern is the residuals (errors) of the model, which is the vertical distance of each data point from the regression line.

The assumptions for OLS regression are homoscedasticity; where the probability distribution of the errors has constant variance and error values are equal for any given value of the independent variable (Aczel & Sounderpandian, 2009). Several tests were done to determine the nature of data distribution. These included normality, linearity, multicollinearity, heteroscedasticity, and correlation analysis tests (Saunders et al., 2009). Further, the coefficient of determination (R^2) tested the robustness of the whole regression model whether the model was a good (best of fit) estimator of the dependent variable by checking to establish if F-statistics was statistically significant at 10%, 5%, or 1% level of significance.

3.8.3.1 Regression Model Formulation

Regression analysis established the effect of the independent variables on constant returns to scale technical efficiency (crs_te)/technical efficiency. The efficiency scores were regressed on ordinary least square model to establish the observed variation of efficiency score due to

financial structure, asset structure, board demographics, and on the combined variables. According to Ruggiero (1998) and Zhu (2003), the use of DEA and regression analysis would examine the effect of independent variables on efficiency scores. The mathematical models used in the data analysis and testing of the hypotheses are presented in the subsequent sections.

Research Objective One:

This determined the relationship between financial structure (FS) and operating efficiency (OE); where the crs-te was used as a proxy to measure operating efficiency (Y) for decision-making units.

$Y = \alpha_0 + \beta_1 X_1 + \varepsilon$……..…….. (i)

Operating efficiency (Y) = f (constant +FS + error term). Where $\beta_1 X_1$ in the regression model represents individual components of financial structure.

Research Objective Two:

The model established how asset structure mediated the relationship between financial structure (X_1) and operating efficiency (Y). This study followed the four-step analyses by (Preacher, Rucker, & Hayes, 2007 in determining the effect of the mediation of asset structure on financial structure. The element of asset structure was regressed using different regression models to establish the mediation of asset structure on financial structure components on operating efficiency. The significant effect of the coefficient was examined at each of the first three-step, and where some components were significant and others not, the significant effect of the model was then determined using a p-value of the F-statistics. The following regression models display the testing of mediation.

Model 2(a) using a simple linear regression equation, the model tested for a significant relationship between the financial structure (X_1) and operating efficiency (Y).

$Y = \alpha_0 + \beta_1 X_1 + \varepsilon$……..……. (i)

Model 2(b): The model tested for the significant effect of the independent variable(X_1) on the mediator (X_2) using a simple linear regression equation, that is whether the elements of the financial structure had a significant effect on asset structure.

$X_2 = \alpha_0 + \beta_1 X_1 + \varepsilon$…….... (ii)

Model 2(c): The model predicted Y(OE) by regressing X_1(FS) and X_2(AS) on the dependent variable (crs_technical efficiency) to establish the significance effect using a multiple linear regression model.

$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$…….……. (iii)

Model 2(d): The model tested for insignificance effect, a confirmation that mediation had occurred or not occurred. The process included the tests for a direct relationship between a dependent (Y) and the mediator (X_2) using simple linear regression analysis.

$Y = \alpha_0 + \beta_2 X_2 + \varepsilon$…….……... (iv)

Model 2(a) to 2(c) determined the existence of a significant effect on the models. If the relationships were significant, the analysis proceeded to Model 2(d). This step established the existence or nonexistence of mediation. Nevertheless, mediation exists when the effect on the independent variable is insignificant or a meaningful reduction in the effect of the relationship between the initial independent and the dependent variable existed in the presence of the mediator.

Research Objective Three:

The third objective determined the influence of board demographics (BD) in the moderation of financial structure (FS) and operating efficiency (Y). The analysis used the hierarchical regression analysis. The three regression analysis models tested for moderation. The Shannon diversity index formula computed indices for board members' attributes. The indices comprised attributes for board diversity and board competence.

Model 3(a) $Y = \alpha_0 + \beta_1 X_1 \beta_3 X_1 X_3 + \varepsilon$…….…….…. …….…….……... (i)

Model 3(b): $Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_3 + \varepsilon$……..... (ii)

Model 3(c) $Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_3 + \beta_3 X_1 X_3 + \varepsilon$…….……..…..……. (iii)

Results for (Model 3 (a) was for reference purposes intended to determine the effect of the inclusion of a moderator in the model. However, the results for Models 3(b) and 3(c) determined the moderating effect. Model 3(c) is the functional form of the regression that included the interaction term to determine the effect on change on the magnitude of the moderator on the strength of the relationship. The interaction term ($X_1 X_3$) was computed as a

product of the centered component (s) of the independent variable (FS) and the centered indices of the attributes of the board. The indices used were gender, age, ethnicity, and education level and board experience. These variables were centered to eliminate multicollinearity and obtain meaningful results. To obtain a centered variable, a mean of each variable was calculated and then subtracted from the initial value of a variable. The product of the centered variable and initial variable determined the interaction term, which was included in the model to determine the moderation effect. Nevertheless centering of variables does not change the substantive meaning of the model or the predictions but makes results more easily interpretable.

The board demographics indices were computed using the formula of the Shannon index of diversity (Spellerberg & Fedor, 2003). The formula for computing Shannon index of diversity is $H = \sum_{i=1}^{s} -(\text{Pi} * \ln\text{Pi})$; where H = Shannon index, Pi = the proportion (n/N) of individuals of one particular attribute found in a sample (n) divided by the total number of individuals with that attribute found in the sample (N). Ln is the natural logarithm and Σ is the sum of the calculations while S is the number of attributes in a population.

Research Objective Four:

The objective four examined the combined effect of financial structure (FS), asset structure (AS), and board demographics (BD) on operating efficiency(Y).

$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$…….……... (i)

Where:

Y is the dependent variable (operating efficiency).

$\times_1$ is the independent variable (financial structure).

$\times_2$ is the mediating variable (asset structure).

$\times_3$ is the moderating variable (board demographics).

α is the Greek alphabet, a constant in the regression model.

β is the beta that indicates the effect of an independent on the dependent variable.

ε is the error term.

3.8.4 Diagnostic Tests

Diagnostic tests give the statistical properties of the data in addition to determining the appropriate model for estimation. The diagnostic tests evaluated the nature of data distribution thus fundamental in the choice of the appropriate regression model for analysis, and confirm

the statistical adequacy of the model. Among the key tests carried out in the study included; normality test, linearity test, multicollinearity test, heteroscedasticity test and Hausman test for model specification.

A normal distribution is a probability function displaying distribution of values of a variable in that the data points have symmetric distribution. This infers that observations cluster around the central peak and the values far away from the mean taper off equally in both directions. A normality test checks whether the sample data is from a normally distributed population, which is a pre-condition for running an ordinary least squares regression. However, a deviation from normality does not necessarily affect hypothesis testing (Greene, 2012).

Normality condition assumes that the estimators are unbiased, efficient and consistent (Gujarati & Porter, 2009). The test of normality of data is by Kolmogorov-Smirnov tests and Shapiro-Wilk test (Saunders et al., 2009; Field, 2013). Others tests are Skewness, Kurtosis, P-P plots and histograms. The study tested for normality assumptions of the regression model is by graphing the standard errors (residuals) against the observed (fitted/predicted) values in a normal probability plot. The normal probability plots (P-P plots) compare the plotted data values with the diagonal to establish whether the observed values deviate reasonably from the predicted values (Doane & Seward, 2016). The data is normal when a plot creates a straight line or does not deviate far from the reference line. Conversely, data that is not normally distributed deviates from the line of best fit. Therefore, depending on how far the plots deviate from the reference line determines the type of regression model to use. The regression model could be ordinary least square regression, logistic regression, and etcetera. However, Greene (2012) states that the non-normality of the dataset does stop the use of linear regression analysis.

Linearity means that the independent variable (s) and the dependent variable have a straight-line relationship. The study carried out a linearity test for assumption of ordinary least squares regression by investigating the relationship between independent and dependent variables to ascertain whether there was any association between them and what nature of the relationship (Doane & Seward, 2016). Linearity was determined through a scatter plot of standardized residuals against standardized predicted values plotted on a graph, which is not a graph of the data but a graph of the residuals from the data.

Multicollinearity is a high degree of association among several predictor variables. One of the important assumptions of the multiple regression model is that independent variables are not multicollinear. Therefore, a test for multicollinearity is important because it identifies highly correlated independent variables. When multicollinearity is present, the standard errors may be inflated and an estimator with a large variance could lead to drawing incorrect conclusions when t-test is used. For that reason, results for variance inflation factor and tolerance method were analyzed to check for multicollinearity.

Variance inflation factor measures the impact of collinearity among the variables in a regression model. The rule of thumb indicates that a VIF should not be more than 10 and tolerance not less than 0.1. However, a VIF of greater than 10 or tolerance of less than 0.1 implies that the variables suffer from multicollinearity problem (Field, 2013). The presence of multicollinearity is mitigated by ignoring the variables causing multicollinearity or dropping one of the highly correlated variables from the regression model or through the transformation of the data.

Further, the correlation matrix determined the linear relationship of the independent variables. Correlation is a statistical technique that describes the direction and strength of the relationship between two or more variables. Pearson's product-moment correlation coefficient (r) measures the strength and direction of the linear relationship between two variables. The Pearson's correlation is appropriate when the variables of the study are at interval and ratio scale of measurements (Sekaran, 2010). The values range from +1 to -1. The value of zero indicates no relationship between the two variables and a value different from zero indicates existence of relationship which could be positive or negative, and a value of one indicates a perfect positive correlation (Cooper, Schindler & Sun, 2006). According to Cooper, Schindler and Sun, multicollinearity arises when the correlation coefficient of two or more independent variables is greater than 0.8 while Field (2013) recommends a value greater than 0.9 since it may not render ordinary least squares estimators inefficient.

Heteroscedasticity refers to unequal variances of the data points for the outcome variable and independent variables (Mohammed, 2018). As a result, when the dataset has unequal variances/residuals, heteroscedasticity is found to exist in the variables. The inverse of heteroscedasticity is homoscedasticity, which indicates that the variability of dependent

variables is equal across values of independent variables. However, the existence of heteroscedasticity in the dataset does not prejudice the use of ordinary least square regression coefficients in the interpretation of results (Saunders et al., 2009). The heteroscedasticity was tested using the Breusch-Pagan test (Breusch & Pagan, 1979). The mitigation of the presence of heteroscedasticity is through the inclusion of robust standard error in regression estimates.

Before carrying out regression estimation, it was important to determine the appropriate model for estimating the regression. The study used the Hausman test to test for model specification (Hausman, 1978). Hausman tests for econometric modelling are based on comparing more than one estimator of the parameters of the model. The estimators are characterized by the following underlying issues; first, under the null hypothesis of correct model specification, both estimators are treated as being consistent. Secondly, under the alternative hypothesis of model misspecification, the estimator is considered as inconsistent. The main thing is that when the model has been correctly specified the compared estimators will be near each other contrary to when misspecified.

The determination of the Hausman test is based on comparing the p- values obtained from the sampling distributions to the test statistic. The null hypothesis is rejected on condition that the Hausman statistic exceeds the p-value.

3.9 Hypotheses Testing

An hypothesis is a preposition that is empirically testable and is written in a manner that can be supported or rejected through an empirical test (Zikmund, 2003). The testing of hypotheses was at 10%, 5%, and 1% (α= 0.10, 0.05 & 0.01) level of significance. The regression analysis estimated that the effect of asset structure (AS) and board demographics (BD) in predicting financial structure on operating efficiency (OE). The specific tests for null hypothesis as outlined in chapter two, section 2.6 are presented. The model was tested for overall fit by using R^2 (R-Squared) to establish whether the combined effect was not significant as hypothesised in the null hypothesis.

3.10 Summary of Research Objectives, Hypotheses and Data Analysis Technique

Table 3.2 presents the summary of research objectives, hypothesised relationships, and subsequent interpretation.

Table 3.2: Summary of Research Objectives, Hypotheses, and Data Analysis Technique

Research Objective	Hypothesis	Data Analysis Technique	Interpretation
Objective 1: Determined the relationship between FS and OE of Housing co-operatives in Nairobi City County.	The relationship between financial structure and operating efficiency was not significant.	The Data Envelopment Analysis (DEA) generated TE, PTE and SE scores for each decision-making unit. The technical efficiency scores were regressed using regression analysis to determine the relationship.	Technical efficiency (TE) measured the total efficiency of DMUs. It ranges between 0 and 1, where a score of 0 is inefficient and a score of 1 is efficient. Coefficient of determination (R^2) Assessed how much of dependent variable variation was due to the influence of the independent variable.$R^2 \geq 0.7$, indicates the model had a very high explanatory power, and below 0.5, the model had a weak explanatory power. Beta β (coefficient) determined the contribution of each predictor variable to the significance of the model. Beta β (t-test) with $p < 0.10$, ($p < 0.05$) and 0.01 indicated that the relationship was significant at 10%, 5% and 1% levels of significance for individual variables, respectively. F-test evaluated the significant effect of the model.

Research Objective	Hypothesis	Data Analysis Technique	Interpretation
Objective 2: Established the effect of AS in mediating the relationship between FS and OE across housing co-operatives in Nairobi City County.	Determined whether the mediation of asset structure in the relationship between FS and OE was not significant.	Regress technical efficiency scores. using hierarchical multiple regression analysis to generate (R^2) and β.	Coefficient of determination (R^2) assessed how much variation of the dependent variable arose from changes in the predictor variable. $R^2 \geq 0.7$, indicates the model had a very high explanatory power, and below 0.5, the model had a weak explanatory power. Beta β (t-test) with $p < 0.10$, ($p < 0.05$) and 0.01 indicates that the relationship was significant at 10%, 5%, and 1% levels of significance for individual variables, respectively F-test to assess the overall significance of the model. Step 1-3 established the existence of a significant relationship amongst the variables. If one or more of these relationships were no significant, then mediation was not possible. However, if significant the analysis proceeded to step 4. Mediation was confirmed when the relationship between FS and OE was no longer significant in the presence of AS and or there was a meaningful effect betwee independent and dependent variables.
Objective 3: Assessed effect of board demographics in moderating the relationship between FS and OE of housing co-operatives in Nairobi City County.	The effect of board demographics in moderating the relationship between FS and OE were not significant.	DEA efficiency scores were regressed following the hierarchical multiple regression to generate R^2 and β.	Coefficient of determination (R^2) Assessed how much of dependent variable variation was due to the influence of the independent variable.$R^2 \geq 0.7$, indicates the model had a very high explanatory power, and below 0.5, the mode had a weak explanatory power. Beta β (t-test) with $p < 0.10$, ($p < 0.05$) and 0.01 indicated that the relationship was significant at 10%, 5% and 1% levels of significance for individual variables respectively. Beta β with $p < 0.05$) indicate that the relationship was significant.

Research Objective	Hypothesis	Data Analysis Technique	Interpretation
			F- Test assessed the overall significance of the model. If change $in\ R^2$ after the introduction of the interaction term, the values of R^2 change, F change as well as β, and were all significant, then board demographics moderated the relationship between FS and OE
Objective 4: Determined the combined effect of FS, AS and BD on the OE of housing co-operatives in Nairobi, City-County.	The combined effect of financial structure, asse structure, and board demographics on operating efficiency of housing co-operative societies in Nairobi City County was not significant.	Data Envelopment Analysis (DEA) efficiency scores were regressed through hierarchical multiple regression analysis to generates R^2 and β.	Coefficient of determination (R^2) Assessed changes on dependent variable arising from the effects of an independent variable. $R^2 \geq 0.7$, indicates the model has high explanatory power, and below 0.5, the model has a weak explanatory power. Beta β (t-test) with P < 0.10, (p < 0.05) and 0.01 indicated that the relationship was significant at 10%, 5% and 1% levels of significance for individual variables, respectively. F- Test assessed the overall significance of the model. The coefficient of determination, a positive β and p < 0.05) indicated a significant effect on OE If there was a change in R^2, p < 0.05, for combined (FS, AS and BD) on OE then the model had a significant effect.

CHAPTER FOUR

DESCRIPTIVE DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter presents the response rate and the descriptive statistics of the study variables. The variables included financial structure, asset structure, board demographics, and operating efficiency. The chapter also presents results from data envelopment analysis on crs-technical efficiency, pure technical efficiency, scale efficiency, and returns to scale of sampled housing co-operative societies. Finally, the chapter provides results for various diagnostic tests for instance normality test, linearity test, multicollinearity test, heteroscedasticity test, Hausman test and correlation analysis.

4.2 The Final Sample

The final sample was 173 housing co-operatives that had operated for at least five years in Nairobi City County as at December 31, 2016. The period of the study was the years 2012 to 2016. Data on financial structure, asset structure, board demographics (gender and ethnicity), inputs, and output - for the five-year period was obtained from housing co-operatives' financial statements. The sampled housing co-operatives societies' chief executive officers, office administrators, board members, and members provided information regarding age and the highest level of education.

The data was collected for a period of five months, that is from March 1, 2018, to July 2018 and the study sample comprised 124 housing co-operatives selected from a target population of 173. Data relating to 37 housing co-operatives could not be analysed because it was incomplete in reference to data for DEA. Therefore, the effective sample used for analysis was 87: which was equivalent to 50.3 % of the final sample. Although there is no consensus among scholars on what is considered an acceptable response rate, Saunder et al. (2009) reckoned that adequate responses could range from 30% to 50% depending on the nature of the variables of the study. A study Mwangi (2014) analysed 67% of the target populatio while Machuki, Aosa, Letting, & Nicholas's (2011) study had a response rate of 43.3%. Therefore, the analysis of this study was a representative of the population based on the review of previous studies on co-operative organisations.

4.2.1 Demographics of Housing Co-operatives

This study focused on the following characteristics of housing co-operatives: the number of members, the level of savings/deposits, share capital contribution, and the age of the co-operative as defined by its years of existence. This section presents the housing co-operatives' demographic characteristics based on the co-operatives' age and size.

4.2.1.1 Age of Housing Co-operative

The study focused on housing co-operatives that were in existence as from 2012. The co-operative's year of registration was the first criterion to determine its inclusion in the sample. Table 4.1 presents a frequency distribution of years of existence of 87 housing co-operatives.

Table 4.1: Number of Years of existence for Housing Co-operative

Years of existence	Frequency (N)	Per cent (%)	Cumulative (%)
5	26	29.89	29.89
6	22	25.29	55.17
7	14	16.09	71.26
8	2	2.30	73.56
9	1	1.15	74.71
10	4	4.60	79.31
11	1	1.15	80.46
14	1	1.15	81.61
15	1	1.15	82.76
17	1	1.15	83.91
19	1	1.15	85.06
21	4	4.60	89.66
23	1	1.15	90.80
24	2	2.30	93.10
28	1	1.15	94.25
32	1	1.15	95.40
33	1	1.15	96.55
35	1	1.15	97.70
43	1	1.15	98.85
60	1	1.15	100.00
Total	87	100	

The data in Table 4.1 indicates that 79.31 per cent of housing co-operatives had not operated

for more than 10 years while a small number encompassing 20.69 % (100 - 79.31%) were found to have functioned for more than 10 years. The results reveal that most of the housing cooperatives were registered after the enactment of the county's new constitution took place in 2010 that devolved supervision of co-operatives at county government level. Firms that have existed for many years have well-established capital base besides efficient systems. Ibua (2014) indicated that firms that have existed for a long period have learning curve experience benefits and superior performance. These findings are inconsistent with those from studies by Awino (2007) and Busienei (2013) in that the results reported that most of the co-operatives had operated for less than 10 years, an indication of firms' inferior management processes and operating systems.

4.2.1.2 Size of Housing Co-operative by Membership

The study used the proxy for the size of a housing co-operative as the number of members over the five-year period. Firms with up to 10 members were categorised as micro-enterprises while those with 11-50 as small firms, and those with 51-100 members as medium-sized firms and over 100 members as the large one (Kenya Industrial Research and Development Institute [KIRDI], 1997). This study adopted KIRDI's (1997) classification in defining the size of housing co-operatives by a number of members. The co-operative societies Act (amended), 2004 sets out the minimum number of individuals required to register a co-operative to 10 members (GoK, 2004), thus no firm fell under micro-finance enterprise. The number of members in a class interval was 50 members. Table 4.2 outlines the number of members from the sampled housing co-operatives per year from 2012-2016.

Table 4.2: Size of Housing Co-operative by Membership

	Year (Frequency)					
No. of Members	2012	2013	2014	2015	2016	Total
Up to 50	16(18.39%)	22(25.29%)	24(27.59%)	25(28.74%)	20(22.99%)	107(24.60%)
51 up to100	6(6.90%)	11(12.64%)	12(13.79%)	9(10.34%)	12(13.79%)	50(11.49%)
101 up to150	5(5.75%)	9(10.34%)	12(13.79%)	9(10.34%)	7(8.05%)	42(9.66%)
Above 150	60(68.97%)	45(51.72%)	39(44.83%)	44(50.57%)	48(55.17%)	236(54.25%)
Total	87	87	87	87	87	435

The results in Table 4.2 show that over the five-year period the membership of housing cooperatives have been consistent with observations of firms having a membership of above 150 at 68.97% (2012) and 54.25% (2016). Overall, the number of housing cooperatives' membership with over 150 members had declined over the five-year period probably because of a wide selection of co-operative to join due to arise in new registration of housing co-operatives across the city-county. Over the five-year period (total column), approximately 24.60 % of housing co-operatives were operating as micro housing co-operatives, 11.49 % as small-sized DMUs, and 63.91% (9.66% + 54.25%) had over 100 members inferring they were large housing co-operatives. The analysis indicate that 36.09% of the housing co-operatives were small scale co-operatives (upto 100 members) hence unlikely to raise adequate equity capital that would support delivery of affordable housing to members. Therefore, co-operatives should vigorously enlist members to build up membership.

Given the preceding section, the descriptive statistics for members of co-operative societies. N represents the number of housing cooperatives that reported summary statistics for membership in the financial statements years from 2012 to 2016 as presented in Table 4.3.

Table 4.3: Descriptive Statistics for Membership of Housing Co-operatives by year

Year	N	Mean (No. of Members)	Std. Dev. (No. of Members)	CV	Min. (No. of Members)	Max. (No. of Members)	Skewness	Kurtosis
2012	44	350.7727	1032.68	0.339672	13	6866	5.900219	37.7113
2013	64	396.875	936.7903	0.423654	13	6866	5.443875	36.98849
2014	72	378.2083	923.1672	0.409686	13	7060	5.638103	39.71459
2015	70	402.0714	913.7968	0.440001	12	6734	5.180227	34.57799
2016	65	446.7385	993.0623	0.449859	12	6805	4.634451	27.91226

The results in Table 4.3 report evenly distributed mean for members over the five-year period from 2012-2016. The standard deviation and coefficient of variation were approximately similar over the five years while dispersion between the years was low. This infers that membership did not vary greatly across the years, an indication of low-level registration of new members. The skewness and kurtosis show that membership of housing cooperatives did not approximate normality because the values were outside the recommended range for a normally distributed dataset. Further, the study reports that membership remained steady over the study period, for example, the dispersion and variation of members did not vary greatly between the years.

4.2.2 Descriptive Statistics for Financial Structure

The financial structure comprised core capital (share capital and reserves), and liabilities (short- and long-term obligations). The summary statistics include components of the financial structure that shows the distribution of various sources of financing across housing co-operatives. Data for 87 housing cooperatives recorded 435 observations which are presented in the frequency tables and descriptive statistics for the five-year period from 2012-2016.

4.2.2.1 Core Capital

The core capital also referred to as shareholders' funds comprised share capital and institutional capital (reserves). The capital is a permanent source of finance and is only refundable to members upon liquidation of a co-operative society. Table 4.4 presents the distribution of core capital for the sampled housing co-operatives for 435 observations from 2012 - 2016.

Table 4.4: Core Capital for Housing Co-operative Societies

Core Capital (Sh.)	Frequency (N)	Percentage (%)	Cumulative (%)
Up to 200,000	155	35.63	35.63
Above 200,000 up to 2,000,000	126	28.97	64.60
Above 2,000,000 up to 3,800,000	31	7.13	71.73
Above 3,800,000 up to 5,600,000	18	4.13	75.86
Over 5,600,000	105	24.14	100
Total	435	100%	

Table 4.4 shows the distribution of core capital over a five-year period (2012-2016). The majority of the co-operatives with a cumulative 75.86% had core capital not exceeding sh.5.6 million. This point out that share capital and reserves are nominal sources of finance for housing co-operatives. As a result, the co-operatives are unlikely to overcome asset losses arising from adverse economic cycles in an economy. Therefore, co-operatives should register more members to increase share capital and address the negative institutional capital probably arising from loses from operating activities.

4.2.2.2 Members' Deposits

Members' deposits/savings is an integral source of finance for housing co-operatives. It encompasses the amounts members deposit with housing co-operative as savings. The deposits are not permanent sources of finance since they are refundable when a member exits the co-operative. The results of members' deposits in the sampled housing co-operatives - over the five-year period (2012-2016) for 435 observations - are presented in Table 4.5.

Table 4.5: Members' Deposits in Housing Co-operative Societies

Members' Deposits (sh.)	Frequency (N)	Percentage (%)	Cumulative (%)
Up to 100,000	102	23.45	23.45
Above100,000 up to 4,000,000	133	30.57	54.02
Above 4,000,000 up to 7,900,000	41	9.43	63.45
Above 7,900,000 up to 11,800,000	24	5.52	68.97
Above 11,800,000 up to 15,700,000	32	7.36	76.33
Over 15,700,000	103	23.67	100
Total	435	100%	

The results in Table 4.5 show the distribution of members' deposits which disclosed that the majority of housing co-operatives, representing 54.02%, had deposits below sh.4 million. Only 23.67% of the housing co-operatives had deposits/savings beyond sh. 15.7 million, an indication of a few members or the amount contributed was minimal.

4.2.2.3 Interest-bearing Liabilities

These are liabilities comprising bank overdraft and bank loan. They are interesting earning obligations payable at a predetermined period. Table 4.6 shows the distribution of interest-bearing liabilities (bank overdraft and loans) across housing co-operatives from 2012 to 2016.

Table 4.6: Interest-bearing Liabilities for Housing Co-operative Societies

Interest Bearing Liabilities (sh.)	Frequency (N)	Percentage (%)
Up to 300,000	316	73.32
Above 300,000 up to 3,300,000	32	7.42
Above 3,300,000 up to 6,300,000	20	4.64
Above 6,300,000 up to 9,300,000	7	1.62
Above 9,300,000 up to12,300,000	7	1.62
Over 12,300,000	49	11.37
Total	435	100%

As displayed in Table 4.6, according to 73.32% of the total observations, the majority of the housing co-operatives did not take up any form of bank loans or bank overdraft over the five-year period. Only a small number - 56(12.99%) - of the 435 observations had taken loans above sh. 9.3 million over the five years. This signifies that the government approval process and the principle of autonomy and independence potentially influence the level of loans uptake.

4.2.2.4 Non-Interest-bearing Liabilities

They comprise accruals and payables arising from trade credit. They rarely attract interest, thus have low financial distress costs relative to interest-bearing liabilities. Table 4.7 presents an analysis of accrued expenses and trade payables across housing co-operatives over the five years.

Table 4.7: Non-Interest-bearing Liabilities for Housing Co-operative Societies

Non-Interest-Bearing Liabilities (Sh.)	Frequency (N)	Percentage (%)
Up to 100,000	102	23.45
Above100,000 up to1,000,000	100	22.99
Above1,000,000 up to1,900,000	41	9.43
Above1,900,000 up to 2,800,000	28	6.44
Above 2,800,000 up to 3,700,000	14	3.22
Over 3,700,000	150	34.48
Total	435	100%

The results shown in Table 4.7 reveal that 46.44 % of the observations over the five years had accrued expenses and trade payables not exceeding sh.1 million, and only a small number of housing co-operatives (34.48%) had financed their operations by more than sh. 3.7 million. This is an indication that a significant number of housing co-operatives did not finance their activities through non-interest-bearing liabilities, probably because of ownership and lack of credit worth - a characteristic of micro and small enterprises.

4.2.2.5 Components of Financial Structure

The financial structure encompasses core capital/shareholders' funds and liabilities; core capital comprises share capital and reserves/institutional capital. Four hundred and thirty-five observations from the financial structure of different housing co-operatives over the five-year period were recorded. Table 4.8 displays analysis based on measures of central tendency and dispersion.

Table 4.8: Components of Financial Structure

Domain	Component	N	Mean Sh.	Std. Dev. Sh.	CV	Min. Sh.	Max. Sh.	Skewness	Kurtosis
Financial Structure	Share Capital	435	8,792,854	34,173,684	3.9	2240	45,8971,697	10	122
	Institutional Capital	435	29,604,817	252,936,643	8.5	-81,328,176	3,167,441,449	9.3	94
	Member's Deposits	435	55,300,176	157,663,428	2.9	32,500	1,372,965,712	4.8	29
	Non-Interest-Bearing Liabilities	435	87,061,258	895,919,694	10	7,900	17,047,512,064	18	347
	Interest Bearing Liabilities	435	97,241,562	41,419,4471	4.3	108,061	4,282,967,179	8.9	89

The findings in Table 4.8 disclose that share capital had the minimum mean value and standard deviation relative to other components of financial structure. Referring to the coefficient of

variation (CV), share capital had high dispersion in comparison to members' deposits and non-interest-bearing liabilities. These findings suggest that funding of co-operatives through share capital differed greatly across housing co-operatives. Likewise, the skewness value for share capital was outside the recommended range of normally distributed dataset; usually between -0.5 and 0.5. Accordingly, the distribution was asymmetric alluding that the share capital had a flat peak (platykurtic distribution) and a lower and broader light tail compared to a normally distributed dataset. The kurtosis value for share capital indicates was not bell-shaped since it was outside the range of -3 and +3 thus insinuating it was not normally distributed.

The results for institutional capital reported a minimum negative figure that had very high variation from the mean as reported by the standard deviation. The coefficient of variation indicates a wide dispersion from the mean for institutional capital across housing co-operatives. Contrasting the two elements of core capital namely share capital and institutional capital the dispersion of financing of co-operatives was entirely unrelated across housing co-operatives for both components. The skewness also attests that the distribution was approximately asymmetric since the values for institutional capital were outside the range of -0.5 and 0.5. Resultantly, the institutional capital had a flat peak (platykurtic distribution), and a lower and broader light tail when collated to a normally distributed data. The kurtosis value for institutional capital was not proximate to -3 and +3, and consequently, the data was not from a normally distributed dataset. In inference to the financial structure distribution, the core capital was minimal and varied significantly across the housing co-operatives.

The evaluation of members' deposits as presented in Table 4.8 discloses that the deposits greatly varied across housing co-operatives. The variation and dispersion of the deposits were amidst the lowest, save for share capital. The findings imply that members' deposits were thinly dispersed across the housing co-operatives relative to finances from other sources. Besides the Skewness and Kurtosis, the values for members' deposits were outside the accepted range for a normally distributed dataset. This suggests that the deposits greatly varied across housing co-operatives, and could be indicative of the demographics of size, age, and membership affiliation being determinants of the financial structure of a housing co-operative society.

The analysis for non-interest-bearing liabilities (accrued expenses and trade payables) indicates that some co-operatives had very low amounts from non-interest-bearing liabilities as a source of finance. The standard deviation and coefficient of variation reported across the firms were relatively high in comparison to other sources, therefore extrapolating that non-interest-bearing liability as a source of finance was different across co-operatives and was employed by very few housing co-operatives. Further analysis shows a positively skewed distribution for non-interest-bearing liabilities outside the recommended range, thus reaffirming that the data was non-normal and differed widely. Moreover, the kurtosis value for non-interest-bearing liabilities was outside the range of 0 or -3 and +3 of the recommended peak of a normally distributed dataset, hence financing by non-interest bearing liabilities were different amongst housing co-operatives.

The last component in the financial structure was interest-bearing liabilities, which consists of bank loans and bank overdrafts. This indicates that some co-operatives had low amounts of interest-bearing liabilities in their financial structure. Equally, the standard deviation and coefficient of variation were far from the mean thus exhibiting a wide dispersion in the uptake of loans and bank overdrafts across the housing co-operatives. The asymmetry of the distribution of the interest-bearing liabilities was confirmed through skewness and kurtosis, with the values being outside the recommended range of a normally distributed dataset.

Judging on the wide disparity in the reported mean of the components across all the observations, this study opted to use a coefficient of variation to interpret the spread around the means for all the components of financial structure. Consequently, non-interest-bearing liabilities had the highest magnitude of spread from the mean, followed by institutional capital, then interest-bearing liabilities. The components that had the minimum spread were members' deposits then share capital. As pointed out earlier, the membership of housing co-operatives was not widely spread: the majority had members' above100 over the five-year period. In summary, the findings fail to specify a definite financing pattern across housing co-operatives in Nairobi City County, save for members' deposits and share capital that had the lowest dispersion.

The findings of financial structure support the principles in the theory of social capital (Lin, 1982). The members consider themselves as equal partners through the principle of democratic member control, which points out that members who contribute a large amount of share capital

do not have greater control than those who contribute less (Yu & Nilsson, 2019). Further, the results are in support of the principle of member economic participation and free riders that members' financial contributions receive limited compensation. Additionally, external debt capital would violate member control as explained in the principle of autonomy and independence. This further supports the pecking order theory's assertion that the preference to use low-risk funds infers that a firm's finance choices are intended to mitigate agency costs associated with adverse selection in the financial markets. Overall, housing co-operatives use less debt finance due to ownership structure and probably government surveillance, thus inhibiting them from exploring the best financing strategies.

4.2.3 Descriptive Statistics for Asset Structure

Asset structure consists of asset tangibility and asset liquidity. This study sought to determine the composition of assets held by housing co-operatives. Tables 4.9, 4.10, and 4.11 present the statistics of elements of asset structure from 2012-2016 for 435 observations of 87 housing co-operatives.

4.2.3.1 Asset Tangibility

This refers to non-current assets held by an entity over a long period to support operating activities. They comprise property, plant, and equipment (PPEs) - excluding land held for sale and development. The frequency distribution of assets tangibility for observations over a five-year period was as exhibited in Table 4.9.

Table 4.9: Asset Tangibility for Housing Co-operative Societies

Asset Tangibility (Sh.)	Frequency (N)	Percentage (%)	Cumulative (%)
Up to 500,000	180	41.38	41.38
Above 500,000 up to 3,000,000	68	15.63	57.01
Above 3,000,000 up to 5,500,000	23	5.29	62.3
Above 5,500,000 up to 8,000,000	23	5.29	67.59
Above 8,000,000 up to10,500,000	17	3.91	71.5
Above 10,500,000 up to13,000,000	7	1.61	73.10
Over 13,000,000	117	26.90	100
Total	435	100%	

As per the results in Table 4.9, 41.38% of the total observations over the five-year period across the 87 housing co-operatives reported held less than sh. 500,000 worth of asset tangibility. This shows that co-operatives financing has restrained them from acquiring assets that could stimulate growth. The analysis indicates that only a small number comprising 26.90% had non-current assets over sh.13 million. This thus means that a substantial number of housing co-operatives did not have adequate resources likely to sustain a progressive firm that intends to achieve members' social and economic needs.

4.2.3.2 Asset Liquidity

This refers to the current assets comprising trade receivables and prepayments, cash and cash equivalent and short-term investments. Table 4.10 presents the results for asset liquidity over a five-year period for all observations of 87 housing co-operative societies.

Table 4.10:Asset Liquidity for Housing Co-operative Societies

Asset Liquidity (Sh.)	Frequency (N)	Percentage (%)	Cumulative (%)
Up to 500,000	116	26.67	26.67
Above 500,000 up to 3,000,000	127	29.20	55.87
Above3,000,000 up to 5,500,000	41	9.43	65.3
Above 5,500,000 up to 8,000,000	31	7.13	72.43
Above 8,000,000 up to10,500,000	17	3.91	76.33
Above 10,500,000 up to13,000,000	13	2.99	79.32
Over 13,000,000	90	20.69	100
Total	435	100%	

The findings in Table 4.10 indicate that about 26.67% of all 435 observations for 87 housing co-operatives over a five-year period had asset liquidity not exceeding sh. 500,000. Nevertheless, several housing co-operatives comprising 20.69 % had asset liquidity above sh.13 million. These results suggest that a substantial number of housing co-operatives did not have feasible asset liquidity likely to spur the growth of the subsector. The problem could be worsened when the co-operatives fail to fulfil short-term obligations from members' withdrawal needs and other trading obligations.

4.2.3.3 Asset Structure

Asset structure encompasses tangibility and asset liquidity. This section presents observations of value of assets held over a five-year period by 87 housing co-operatives. The results of descriptive statistics for measures of central tendency and dispersion of two components of asset structure are shown in Table 4.11.

Table 4.11: Asset Structure

Component	N	Mean Sh.	Std. Dev. Sh.	CV.	Min. Sh.	Max. Sh.	Skewness	Kurtosis
Asset Tangibility	435	109,549,551	469,366,364	4.3	0	4,740,195,001	7.1	57
Asset Liquidity	435	30,400,501	105,081,449	3.5	7,121	1,201,614,592	6.5	56
Asset structure	435	114,560,760	467,361,154	4.08	205,000	5,150,230,016	7.664	67

As demonstrated in Table 4.11, that some housing co-operatives did not have asset tangibility. The reported standard deviation and coefficient of variation was far away from the mean thus indicative of a wide disparity in asset ownership across the housing co-operatives. The results disclose positive skewness of asset tangibility whose value is outside the range of -0.5 and 0.5, thus pointing to an approximated asymmetric distribution. Comparably, the kurtosis value for asset tangibility was also not within the range thus the data distribution was platykurtic, insinuating that the non-current assets held over the five-year period substantially differed across the housing co-operatives.

Asset liquidity incorporates trade receivables, prepayments, cash and cash equivalent, and short-term investments. The spread based on the standard deviation and coefficient of variation reported a wide variation from the mean. This signifies that asset liquidity scattered greatly across the housing co-operatives. Moreover, the test for the skewness of data reported a positively skewed distribution of asset liquidity but outside the recommended range of -0.5 and 0.5. Consequently, the distribution was asymmetric across housing co-operatives. Furthermore, the kurtosis value for asset liquidity was not within the accepted range of 0 or -3 or +3, an indication that the distribution of asset liquidity was platykurtic. Based on this, it can be inferred that the distribution of asset liquidity differed greatly across the housing co-operatives.

4.2.4 Descriptive Statistics for Board Members Demographics

The section presents the demographics of housing co-operatives' board members. Demographics are statistics describing the sampled population of the board of directors. This study described board demographics as board diversity and board competence and whose attributes were collected during the year ended December 31, 2016. The frequency tables specify the information gotten from summary statistics in the financial statements and respondents. Based on the summary statistics for 87 housing cooperatives the list of board members added up to 828 from which data for age, ethnic groups and education level, board competence and board experience were sought from these respondents.

4.2.4.1 Board Diversity

The study enlisted gender, age, and ethnicity as attributes of board diversity. Tables 4.12 and 4.13 present the results of each attribute of board diversity to validate the composition of attributes across board members of housing co-operatives.

4.2.4.1.1 Age of Board Members

The age diversity of board members was in three spectrums: those members who were not more than 35 years (youth), those above 35 but not more than 60 years (non-youth category), and those above 60 years (retired category). Table 4.12 presents the distribution of board members across the three spectrums for the sampled 87 housing co-operatives as of December 31, 2016.

Table 4.12: Board Members Age Composition

Age	Frequency (N)	Percentage (%)
Up to 35 years	41	4.95%
Above 35 years up to 60 years	664	80.2%
More than 60 years	32	3.86%
None Response	91	11.0%
Total	828	100%

Results in Table 4.12 indicate that 737 (828-91) revealed information about their age. The findings show that board members within the age spectrum of 35 to 60 years dominated most

of the boards whilst those in the 35 years and below age spectrum were poorly represented across housing co-operatives' boards. Based on this dominance age category, it can be construed that individuals who had worked for some years dominated the boards. However, one needs to establish the number of youth category in each membership affiliation to identify the reasons for the low representation across the boards of housing co-operatives.

4.2.4.1.2 Ethnic and Gender Composition of Board Members

The ethnic background information of board members was obtained from summary statistics in the financial statements, and from CEOs/board members/office administrators. The ethnic diversity is a representation of ethnic differences in a population. The ethnic affiliation of board members was disaggregated into gender; male or female. This established the dominance or evenness of gender distribution across board members' ethnic diversity. The results of the ethnic and gender distribution of board members were as presented in Table 4.13.

Table 4.13: Ethnic Composition of Board Members disaggregated by Gender

	Gender		
Ethnic	Female	Male	Total
Asian	4 (1.4%)	16 (2.9%)	20 (2.4%)
Embu	6 (2.1%)	16 (2.9%)	22 (2.7%)
Kalenjin	11 (3.9%)	29 (5.3%)	40 (4.8%)
Kamba	28 (9.8%)	64 (11.8%)	92 (11.1%)
Kikuyu	141 (49.5%)	206 (37.9%)	347 (41.9%)
Kisii	8 (9.1%)	31 (5.7%)	39 (4.7%)
Luhya	37 (13.0%)	61 (11.2%)	98 (11.8%)
Luo	26 (9.1%)	77 (14.2%)	103 (12.4%)
Maasai	5 (1.8%)	12 (2.2%)	17 (2.1%)
Meru	3 (1.1%)	2 (0.4%)	5 (0.6%)
Taita	2 (0.7%)	7 (1.3%)	9 (1.1%)
Teso	0 (0.0%)	1 (0.2%)	1 (0.1%)
Others	14 (4.9%)	21 (3.9%)	35 (4.2%)
Total	285 (100%)	543 (100%)	828 (100%)

The data in Table 4.13 shows the ethnic and gender distribution of board members across

different boards of housing co-operatives. Male board members were the dominant gender, as they constituted two-thirds representation in various boards of housing co-operatives. This implies that women should be encouraged to join and offer themselves for election as board members.

Across all the housing co-operatives in Nairobi City County, the findings indicate that the majority of the board members were from the Kikuyu ethnic group, followed by Luos, Luhyas, and Kambas in that order. In terms of gender, women from the Kikuyu ethnic group had the highest presentation followed by women from the Luhya ethnic group. Equally, men from the Kikuyu ethnic group dominated their male counterparts in the housing co-operatives boards, followed by men from the Luo ethnic group. However, the Kamba tribe was the fourth in terms of dominance despite their heritage neighbouring Nairobi in the same manner as the Kikuyu.

4.2.4.2 Board Competence

The board competence was conceptualised as board members' education and board experience. The level of schooling and qualifications is the most generally used standard of assessing competence, while the experience was conceptualised as the number of years of service of a member in the board of a housing co-operative society. Hitt et al. (2001) explained that an employee who has served for a long time in a given speciality would be more efficient than a non-experienced counterpart would. This study established the competence of board members according to the level of education and board experience. Tables 4.14 and 4.15 present the distribution of board members' highest level of education and board experience, respectively.

4.2.4.2.1 Board Members Highest Level of Education

In observing at the distribution of board members according to the highest level of education across the housing co-operatives, the members' highest level of education was categorised into the following four levels of certifications: primary education, secondary education, diploma/certificate, and degree. The results concerning this aspect are illustrated in Table 4.14.

Table 4.14: Board Members Highest Level of Education Distribution

Education level	Frequency (N)	Percentage (%)
Primary Education	4	0.48%
Secondary Education	107	12.9%
Diploma/certificate	130	15.7%
Degree	471	56.9%
None Response	116	14%
Total	828	100%

The findings in Table 4.14 disclose that most of the board members had a university degree, followed by diploma holders, and then the other levels. This infers that the engagement amongst the board members was high - an aspect that may slow the decision-making process. Ordinarily, individuals with the equivalent level of skills or knowledge may fail to reach consensus when making decisions because of strong positions the individuals may hold in the process.

4.2.4.2.2 Board Members Experience

The board members' experience was defined in terms of the years of service of a member in the board of a housing co-operative society. The elected board members serve for two terms, each term lasting three years though they are eligible for re-election for another term of three years. Nevertheless, some board members serve for more than two terms (GoK, 2016). Table 4.15 outlines the results of board members' experience across the housing co-operative societies.

Table 4.15: Board Member Level of Board Experience

Board Experience	Frequency (N)	Percentage (%)
Up to 3 Years	651	78.6%
More than 3 Years	177	21.4%
Total	828	100%

As per the results displayed in Table 4.15, most of the board members were serving their first term, while a small percentage was serving their second term. This is an indication that most of them had less than three years of board experience and thus lacked the relevant expertise to manage a housing co-operative society.

4.2.4.3 Board Demographics

Board demographics comprised board diversity and board competence. This study followed an approach used in aggregating gender inequality index for the United Nations Development Programme (Gaye, et al., 2010). The indices computed for board demographics attribute (Appendix VIII) for 87 housing co-operatives presents the equality and inequality of spread of attributes across the boards of directors repeatedly applied over the five-year period. Table 4.16 presents the diversity indices for board diversity and board competence, whilst Table 4.17 displays board demographics index.

Table 4.16: Descriptive statistics for board Diversity and Competence Indices

Attributes	N	Mean	Std. Dev.	Min	Max	C.V	Skewness	Kurtosis
Age Diversity Index	435	0.1619	0.2547	0.00002763	0.9743	1.573	1.281	3.45
Gender Diversity Index	435	0.5251	0.2051	0.000	0.693	0.3906	-1.653	4.647
Ethnic Diversity Index	435	0.8057	0.454	0.0001243	1.493	0.5635	-0.5945	2.157
Board Experience index	435	0.6338	0.2916	0.00002763	1.099	0.4601	-0.7552	3.233
Education level Index	435	0.4577	0.4183	0.00004145	1.168	0.914	0.1147	1.444

The findings in Table 4.16 point to a huge concentration in age distribution across boards based on the mean age diversity index, in reference to the minimum and maximum age diversity index. The majority of the board members tended to lean towards one age bracket. In comparison to the maximum age diversity, the mean age diversity index was very low. An index of 0.000 or close to zero is demonstrative of boards having members from only one age bracket. On the other hand, a very high index suggests a good representation by all categories of age brackets. Referring to the coefficient of variation, there was a wide dispersion in age diversity, as was in skewness and kurtosis. The values were positive, but the degree of the peak was not within the recommended range. This suggests an unequal representation in terms of youthful members, middle-age members, and senior citizens. Therefore, concluded that boards of housing co-operatives did not accord an equal opportunity to members of different age categories.

On the gender aspect, the results reflect an equitable distribution. The mean gender diversity index was skewed towards the highest score indicated by the maximum index. However, the standard deviation and coefficient of variation did not indicate a great variation in gender across the board members; thus, the gender diversity index was moderate. This skewness describes diversity further. The value for skewness was negative and outside the range of normally distributed data. Equally, the kurtosis showed that data for gender had high peak suggesting an uneven representation of board members by gender across the boards of housing co-operatives.

The board members' ethnic distribution was from a representation of 13 tribes. The ethnic diversity index computed showed that board members' composition was moderately diverse across the boards. However, some boards had the entire team from one tribe (min, index 0.000), which implies that co-operatives are community-based - this is in line with the theory of social capital. The standard deviation and coefficient of variation indicated a moderate spread across board members by ethnicity; an indication of low ethnic representation in some boards. The skewness and kurtosis reported a moderate ethnicity distribution that had negative skewness and mesokurtic hence suggesting a near-normal distribution. Therefore, ethnicity distribution was not highly different across the boards of housing co-operatives.

Board member experience refers to the number of terms a member had served in the board. The co-operative societies act (amended), 2004 requires that a third of board members retire but then be eligible for re-election for another term of 3 years (GoK, 2004). The mean for board experience indicates that board members' experience was not moderate across most boards. However, the standard deviation and coefficient of variation reported a low spread from the mean, implying that board members' experience was not highly different across boards. Further, a negative skewness and positive kurtosis were not far from the range for normal distribution. This suggests that the level of board experience among members was not highly different across the boards of housing co-operatives.

The board competence incorporated the skills and knowledge to do the work. This was conceptualised as the highest education background and board experience. The mean index of education diversity was low and indicated a low representation of board members by the

highest level of education across the boards. Some boards had members with the equivalent highest level of education denominating the board (Min, index 0.000), while others had equitable distribution in the level of education (Max, index 1.168). This means that members with different levels of education represented some boards. The dispersion from the mean shows that the highest level of education was not spread evenly. The mean was relatively low in reference to the minimum index of 0.000 and a maximum index of 1.168. The results of skewness and kurtosis disclose that the values were outside the recommended range, denoting that the highest level of education of board members was not even across the boards of the housing co-operatives.

The board demographic index was constructed using simple arithmetic mean (Mazziotta & Pareto, 2013), where the indices for gender, age, ethnicity (board diversity index), education, and experience (board competence index) were aggregated to calculate the mean for board demographics index using Shannon index – as equal weight of the $\sum_{i=1}^{s} H$ divided by two. The index indicates the overall representation of board members' attributes across the population. A high diversity index signifies less dominance representation of the attribute in that population and vice versa. Results in Table 4.17 presents a summary of the attributes of board members.

Table 4.17: Descriptive Statistics for Board Demographics Index

Attribute	N	Mean	Std. Dev.	Min	Max	C.V	Skewness	Kurtosis
Board Diversity	435	.4976	.1732	.00005526	.8777	.3481	-.4752	2.889
Board Competence	435	.5458	.2302	.00003454	1.069	.4218	.04638	2.92
Board Demographics	435	.5217	.1266	.225	.8774	.2428	-.06919	2.912

Table 4.17 indicates that standard deviation and coefficient of variation had a low spread from the mean, implying that there was no dominant attribute among the elements of board diversity for instance gender, age and ethnicity. Additionally, skewness and kurtosis were within the accepted range for normally distributed dataset - an indication of no dominance of any attribute over others. In case of competence diversity index, the dispersion from the mean was low, though slightly higher than that of board diversity index, suggesting that there was no dominant

attribute in respect to the level of education and board experience constituting attributes of competence diversity across board members. Consequently, the use of equal weights in constructing board demographics index was appropriate (Gaye, et al., 2010).

Results for board demographics as provided in Table 4.17 show that deviation and coefficient of variation had moderate dispersion away from the mean - an indication that those board demographic attributes were not significantly different across the board members of housing co-operatives. Nonetheless, the attributes constituting board demographics had negative values for skewness and kurtosis, but within the recommended range; a near-normal distribution, signifying that members portrayed similar attributes on average across all the boards of housing co-operatives.

4.2.5 Descriptive Statistics for Inputs and Output

The inputs and output variables were selected using the intermediation approach. The inputs were labour costs, operating expenses, cost of investment/sales, and output was total revenue. The statistics for inputs and output are presented in tables 4.18 to 4.26.

4.2.5.1 Labour Costs

The labour costs comprised salaries and wages, and committees' allowances paid to board members. Table 4.18 displays the analysis of labour costs distribution across housing co-operatives for 435 observations over a five-year period from 2012-2016.

Table 4.18: Labour Costs for Housing Co-operative Societies

Labour Costs (sh.)	Frequency (N)	Percentage (%)
Up to 50,000	143	32.87
Above 50,000 up to 450,000	149	34.25
Above 450,000 up to 850,000	47	10.80
Above 850,000 up to 1,250,000	19	4.37
Above 1,250,000 up to 1,650,000	25	5.75
Above 1,650,000 up to 2,500,000	12	2.76
Above 2,500,000 up to 2,450,000	11	2.53
Over 2,450,000	29	6.67
Total	435	100%

As depicted in Table 4.18, labour costs were a nominal expense for housing co-operatives; more than 67.12% of the housing co-operatives had not incurred labour costs exceeding sh.450,000. The implication here is that most of the co-operatives did not have employees and relied on their members who performed the co-operatives' activities on voluntary services. Only 9.2% of the housing co-operatives had labour costs above sh.2.5 million.

4.2.5.2 Operating Expenses

The operating expenses included the interest on deposits/savings, administrative expenses, interest expenses, finance costs, and other charges. The frequency distribution of operating expenses over a five-year period is outlined in Table 4.19.

Table 4.19: Operating Expenses of Housing Co-operative Societies

Operating Expenses (sh.)	Frequency (N)	Percentage (%)	Cumulative (%)
Up to 50,000	33	7.59	7.59
Above 50,000 up to 250,000	176	40.46	48.05
Above 250,000 up to 450,000	51	11.72	59,77
Above 450,000 up to 650,000	18	4.14	63.91
Above 650,000 up to 850,000	13	2.99	66.9
Above 850,000 up to1,050,000	8	1.84	68.74
Above1,050,000 up to1,250,000	10	2.30	71.04
Over 1,250,000	126	28.97	100
Total	435	100%	

The findings in Table 4.19 disclose that 63.91% of the housing co-operatives had not incurred operating expenses exceeding sh. 650,000, the implication being that operating expense was a minimal expenditure head for housing co-operatives. The operating expenses in excess of sh.650,000 could have come from interest on members deposits.

4.2.5.3 Cost of Investment

Investment cost denotes the cost of sales relating to the purchase of land for sale or development by housing co-operatives. The analysis of the costs of investment for the five-year period is presented in Table 4.20.

Table 4.20: Cost of Investment

Cost of Investment (sh.)	Frequency (N)	Percentage (%)
Up to 500,000	43	9.89
Above 500,000 up to 2,500,000	133	30.57
Above 2,500,000 up to 4,500,000	46	10.57
Above 4,500,000 up to 6,500,000	31	7.13
Above 6,500,000 up to 8,500,000	21	4.83
Above 8,500,000 up to10,500,000	161	37.01
More than 9,000,000	32	36.8%
Total	435	100%

As highlighted in Table 4.20, most of the housing co-operatives (63.2%) had a cost of investment of less than sh. 9,000,000. From this analysis, the conclusion can be made that most of the housing co-operatives could not purchase land for sale to members and development. The average amounts spend on the cost of investment raises a concern regarding the viability of a high number of housing co-operative societies in Nairobi.

4.2.5.4 Total Revenue

The total revenue comprises the revenue receipts, which was the output of this study. Table 4.21 presents total revenue from operations for the five-year observations.

Table 4.21: Total Revenue

Total Revenue (sh.)	Frequency (N)	Percentage (%)
Up to 50,000	73	16.78
Above 50,000- upto 250,000	103	23.68
Above 250,000- upto 450,000	37	8.51
Above 450,000- upto 650,000	25	5.75
Above 650,000 - upto 850,000	15	3.45
Above 850,000- upto1,050,000	17	3.91
More than 1,050,000	165	37.93
Total	435	100.0%

The data in Table 4.21 indicates that 62.07% of the housing co-operatives had total revenue not exceeding sh.1,050,000, suggesting that almost half of the sampled units were operating at very small scale and could not have saved enough money to buy land for sale to members. This implies that most housing co-operatives did not generate adequate revenue in tandem with the cost of the investment/sale.

4.2.5.5 Inputs and Output for Housing co-operatives

The selection of inputs and output for the decision-making units followed the intermediation approach. The inputs for labour costs, operating expenses, and cost of investment/sales were categorised according to their function, and the output used was total revenue. Measures of central tendency and dispersion namely standard deviation, mean, range, coefficient of variation, skewness, and kurtosis were descriptive statistics for this study. Table 4.22 presents results of the analysis over a five-year period.

Table 4.22: Descriptive Statistics for Inputs and Output

	Component	N	Mean (sh.)	Std. Dev.(sh.)	CV.	Min. (sh.)	Max. (sh.)	Skewness	Kurtosis
Inputs	Labour Costs	435	954,739	2,890,486	3.028	0	29,806,574	6.419	50.71
	Operating Expenses	435	3,128,217	20,007,055	6.396	5,000	351,675,438	13.99	225
	Cost of Investment	435	18,006,372	52,049,419	2.891	0	754,692,373	10.11	128.4
Output	Total Revenue	435	7,320,888	30,666,055	4.189	1,000	370,997,016	7.941	75.29

The findings displayed in Table 4.22 reveal that dispersion and variance (standard deviation and coefficient of variation) were very high thus indicating a wide variation of labour costs from the mean across all housing co-operatives. Additionally, the value of skewness and kurtosis were outside the recommended range thus demonstrating an asymmetric distribution. This is an indication that labour costs widely varied across the housing co-operatives.

The results on operating expenses as per standard deviation and coefficient of variation show a wide variation and dispersion from the mean, indicating that the operating expenses were heterogeneous across the housing co-operatives. Furthermore, the values for skewness and kurtosis were outside the range of normally distributed data. Subsequently, the data was not from a normally distributed dataset hence operating expenses varied greatly across the housing co-operatives.

The analysis for the cost of investments/sales indicates a high level of standard deviation and coefficient of variation, which reveals the existence of a big difference across housing co-operatives in terms of the amount of cost of investment/sale. The skewness was positively and outside the recommended range of normal distribution (-0.5 and 0.5). Further, the kurtosis value was also outside the recommended peakedness as it was outside -3 or +3, thus making the cost of investment/sale not normally distributed.

The output constituted the total revenue of housing co-operatives. The standard deviation and coefficient of variation reported a wide variation and dispersion way from the mean. The range was also high. This insinuates that total revenue varied greatly across the housing co-operatives. Further analysis revealed a positive value for skewness that was outside the recommended range of -0.5 and 0.5 and value for kurtosis that was far beyond the recommended values of between -3 or +3. This suggests that total revenue was not normally distributed and differed significantly across the housing co-operative societies.

Lastly, the results from the analysis point to a widespread data across the housing co-operatives. The variables with the highest dispersion were those from the financial structure, such as non-interest-bearing liabilities and institutional capital. Other variables were operating expenses and asset tangibility. Board demographics attributes were the least spread since they did not vary greatly across the housing co-operatives.

4.2.6 Descriptive Statistics for Efficiency Scores

The DEA application in STATA modelled in terms of variable returns to scale and input-oriented (Cooper et. al., 2006) generated efficiency scores. The study used the standard measure of operating efficiency as constant returns to scale technical efficiency (crs_te) better known as technical efficiency. The crs-te$= \frac{\sum_{i=1}^{m} u_i y_{is}}{\sum_{j=1}^{n} v_j x_{js}}$ is the percentage of the summation of the weights of the amount of output to the sum of the weights of the amount of inputs. Nevertheless, to establish the reasons for inefficiencies, this study decomposed the constant returns to scale technical efficiency (crs_te) into pure technical efficiency (PTE) and scale efficiency (SE) (Banker et al., 1984).

The causes of inefficiencies result from poor management and economies/diseconomies of scale. The vrs_te, also known as pure technical efficiency (PTE) ascertains the inefficiencies attributed to poor management, while the scale efficiency assesses the wrong scale/size of operations. The scores were further analysed to establish the sources of inefficiencies by calculating the nature of returns to scale; returns to scale (rts) describe the level of scale of operation of a decision-making unit, and consequently the causes and sources of inefficiencies of such firms.

As put forward by Banker et al. (1984), the sources of inefficiencies would be from firms operating at levels of activities namely constant returns to scale, decreasing returns to scale and increasing returns to scale. A decreasing returns to scale (drs) arises when the vrs_te and nirs_te have similar scores but differs from that of scale efficiency; increasing returns to scale (IRS) occurs when the score for vrs_te and nirs_te are different while constant returns to scale arises when the SE score is one (1). In determining the nature of returns to scale (rts), the scores for crs_te, vrs_te, nirs_te, and scale efficiency were computed for all years and a summary of efficiency scores reported per firm in Appendix VII.

The rule of thumb is that a DEA model is robust when the scores of the most efficient DMU are not significantly different from the next immediate lowest efficient DMUs in the dataset; thus, leading to the inference that the firms have no different processes, possible errors, or wrong inputs-output specifications. The analyses of efficiency scores for 435 observations are displayed in Appendix VII. However, Table 4.23 exhibits the summary of efficiency scores of 435 observations for 87 housing co-operative societies from 2012 to 2016.

4.2.6.1 Efficiency Scores

The efficiency scores provide feedback about the optimal use of resources relative to other peers in the same sector. The summary statistic for technical efficiency, pure technical efficiency, and scale efficiency for 435 observations from 87 housing co-operatives were as shown in tables 4.23 to 4.25.

Table 4.23: Summary of Efficiency Scores

	CRS_TE (technical efficiency)	VRS_TE (pure technical efficiency)	SE(Scale efficiency)
N	435	435	435
Mean (Average)	0.6776	0.7665	0.8862
Min.	0.1112	0.1007	0.1023
Max.	0.1641	0.1314	0.1154
Std. Dev.	0.3652	0.5725	0.4746
C.V	1.0000	1.0000	1.0000
Skewness	0.5405	0.5570	-1.166
Kurtosis	4.5630	2.6240	4.2210

Results in Table 4.23 specify that mean crs_te is 67.76 %, vrs_te 76.65 %, and SE 88.62 %. The standard deviation specifies that the scores varied moderately from the mean. Despite the variation, coefficient of variation points out that the efficiency score did not vary under the three spectrum of efficiency measurements. This demonstrates that the management procedures and scale performance were not significant unrelated across the housing co-operatives. The findings agree with the outcome of Worthington (1999) and Li et al. (2015) who determined that measuring efficiency required very little distinction in geographic and institutional characteristics.

Further, crs_te and, vrs_te scores were positively skewed and close to the recommended range of -0.5 and 0.5 except for scale efficiency that was negative and outside the normal distribution curve. This indicates that the efficiency scores did not vary significantly over the firms save

for the size of the operations of the housing co-operatives. The kurtosis value was outside the recommended range of -3 or +3 for the efficiency scores, implying that the distribution had high peakedness thus not normal.

4.2.6.2 Distribution of Efficiency Scores

The efficiency scores were classifications as low efficiency, moderate efficiency, upper efficiency and optimal efficiency. The technical efficiency was a standard measure of efficiency and usually decomposed into pure technical efficiency and scale efficiency. The pure technical efficiency evaluates the level of efficiency attributed to good management practices, where an efficiency score below 100% (1) points to a management inefficiencies in managing the inputs or maximizing output at a given minimum level of inputs (Coelli et al., 2005). For scale efficiency, a score below 100% (1) infers that a firm is operating at a wrong size/scale of operation (diseconomies of scale). Table 4.24 presents the summary of the distribution of efficiency scores for 435 observations from 87 housing co-operatives as indicated in appendix VI.

Table 4.24: Frequency Distribution of Level of Efficiency

Efficiency Level	CRS_TE	PTE	SE
Below 0.5 (Low Efficiency)	1 (1.15%)	0 (0.00%)	0 (0.23%)
0.5-0.75 (Moderate Efficiency)	72 (82.76%)	44 (50.57%)	5 (5.75%)
0.75-0.99 (Upper Efficiency)	14 (16.09%)	43 (49.43%)	78 (89.66%)
1 (Optimal Efficiency)	0 (0.00%)	0 (0.00%)	4 (4.60%)
Total	87 (100%)	87 (100%)	87 (100%)

The data displayed in Table 4.24 indicates that DMUs that had optimal efficiency score were 4 (4.60%) as indicated in the SE column. This leads to the deduction that the majority of the housing co-operatives were inefficient under all spectrums of efficiency measurement, including the poor management and wrong scale of operations. The results on the vrs_te column show that 100% of the housing co-operatives did not have efficient management while the SE column indicates that 95.4% (100 - 4.6%) of the DMUs had wrong size/scale of operations. Overall, the firms were technically inefficient (crs_te) and the causes of inefficiency could have arisen from other factors beyond the control of the management.

4.2.6.3 Returns to Scale

Returns to scale is widely studied within the framework of DEA. According to Cooper et al. (2004), the returns to scale have extended the applicability of DEA in various fields of study. In defining the nature of returns to scale, two paths are followed in treating returns to scale in DEA. One path is by Färe, Grosskopf, Norris, & Zhang, (1994) who determined return to scale by use of ratio, while the other is from the work by Banker et al. (1984) who extended the work of Fare et al. to include additive and multiplication model. Banker et al. noted that this approach adds insight into the nature of returns to scale.

The nature of returns to scale includes; increasing returns to scale, constant returns to scale, and decreasing returns to scale. Increasing returns to scale arises when the output grows faster than inputs. This could be due to technical and managerial indivisibilities, as well as specialisation of labour. Constant returns to scale apply when the inputs and outputs grow at the same proportion, for example - when the inputs double, the output also doubles. The constant returns to scale arise from limits of economies of scale and indivisibility of inputs. Nevertheless, when the inputs rise faster than the outputs, the returns to scale is termed as decreasing returns to scale and arises when a firm has large management or holding idle assets especially in this case land intended for sale and development.

This study adopted Banker et al.'s (1984) approach in determining the returns to scale for the DMUs. The variable returns to scale envelopment model identified the frontier. The frontier curve shows all DMUs exhibiting increasing returns to scale (irs) or decreasing returns to scale (drs), and constant returns to scale (Zhu 2003). This presents a summary of all 435 observations for 87 DMUs in consideration of determining the nature of returns to scale. Table 4.25 provides the results on the distribution of returns to scale.

Table 4.25:Distribution of Returns to Scale

Returns to Scale	Frequency (N)	Percentage (%)
Constant returns scale (crs)	4	4.60
Increasing returns to scale (irs)	61	70.11
Decreasing returns scale (drs)	22	25.29
Total	87	100%

Results shown in Table 4.25 reveal that the majority of the housing co-operatives were operating at increasing returns to scale. Compared to the input costs, the output (total revenue) increased at a higher proportion. This could be arising from voluntary services by members to the co-operative hence low labour cost and operating expenses, a characteristic for micro and small enterprises.

In addition, about a quarter of housing co-operatives reported decreasing returns to scale; an aspect associated with poor management or wrong scale of operations, or diversity of board members leading to the delayed decision-making process, or probably DMUs not rightly utilizing members' deposits in the purchase of land. This made inputs to increase without an increase in the total revenue. Such DMUs should increase their output or consider merging with other small housing co-operatives in order to become economical - by increasing capacity. Lastly, the results revealed that less than 5% of DMUs operated at constant returns to scale, implying that about 95% of the housing co-operatives were inefficient due to poor management and wrong scale of operations.

4.3 Diagnostic Tests

The study tested for the assumptions of the linear regression models on the dataset by carrying out pre-estimation tests before analyzing data using regression models. The tests included the normality tests, linearity tests, multicollinearity tests, test for heteroscedasticity, correlation analysis, and Hausman test for model specification.

4.3.1 Test for Normality

The normal P-P plots tested for normality of dataset. The P-P plot is a graphical technique meant to ascertain the extent of departure of data points from a normal curve. The raw data points on a normal probability plot identify the skewness and kurtosis of the dataset. The data distribution is normal when the dots (residuals) form a straight diagonal line or closely follow the fitted line (Hair, et al., 2006).

The visual expression of the expected (standardized residuals) and fitted values of four variables are shown in Figures 4.1 to 4.7.

The visual expression of the anticipated outcome on the indicator of operating efficiency

(technical efficiency) versus the actual/observed outcome is presented in Figure 4.1.

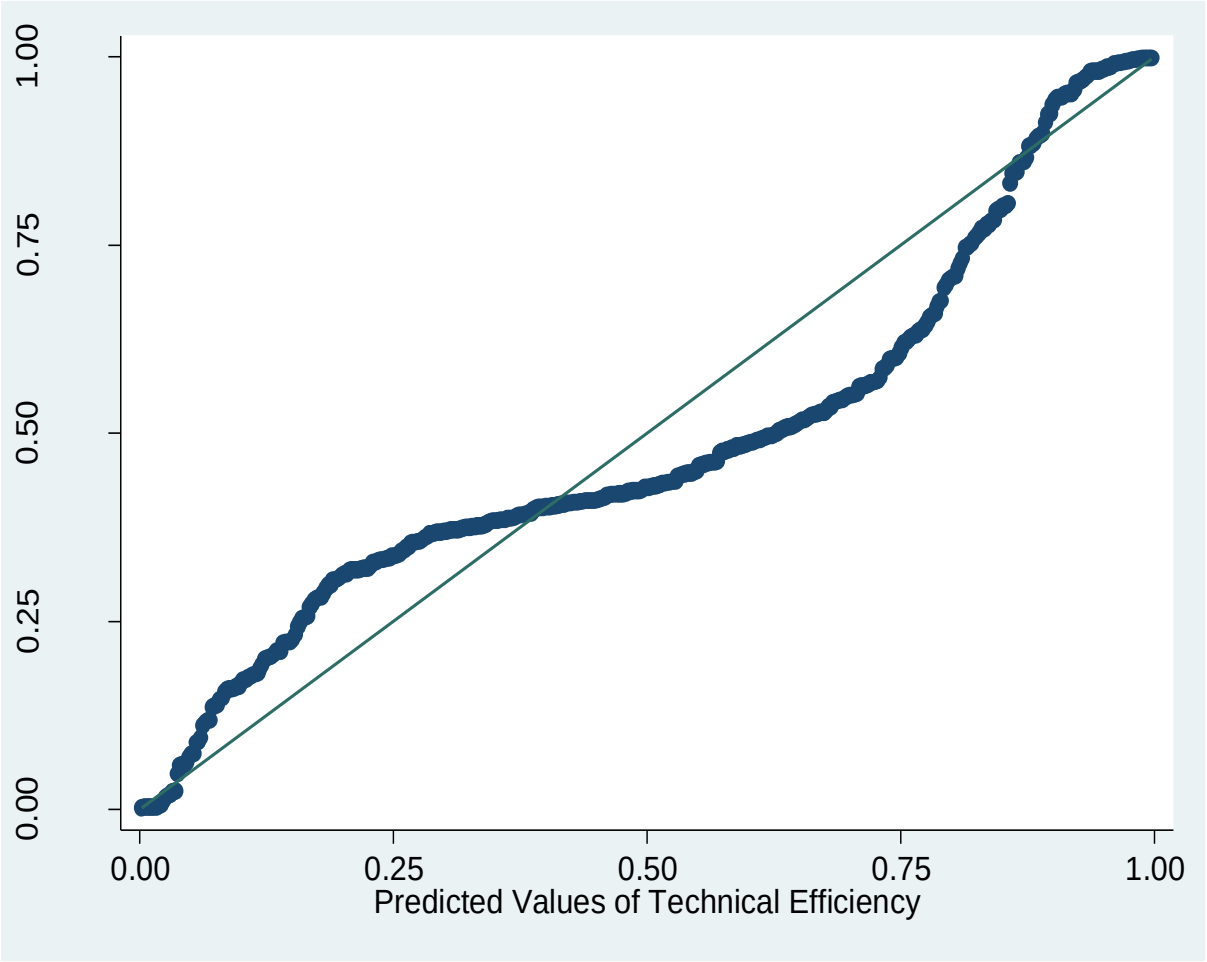

Figure 4.1: Normal P-P Plots of Technical Efficiency

As shown in Figure 4.1, the P-P plots for operating efficiency (technical efficiency) were off the line of best fit. Presumably taking an S-like shape but supposedly roughly asymmetric with a substantial percentage of data not normally distributed. Despite this, Greene (2012) held that variables that are not normally distributed have no effect on the use of regression analysis.

The visual appearance is presented in Figure 4.2 for indicators of the financial structure against the observed outcome.

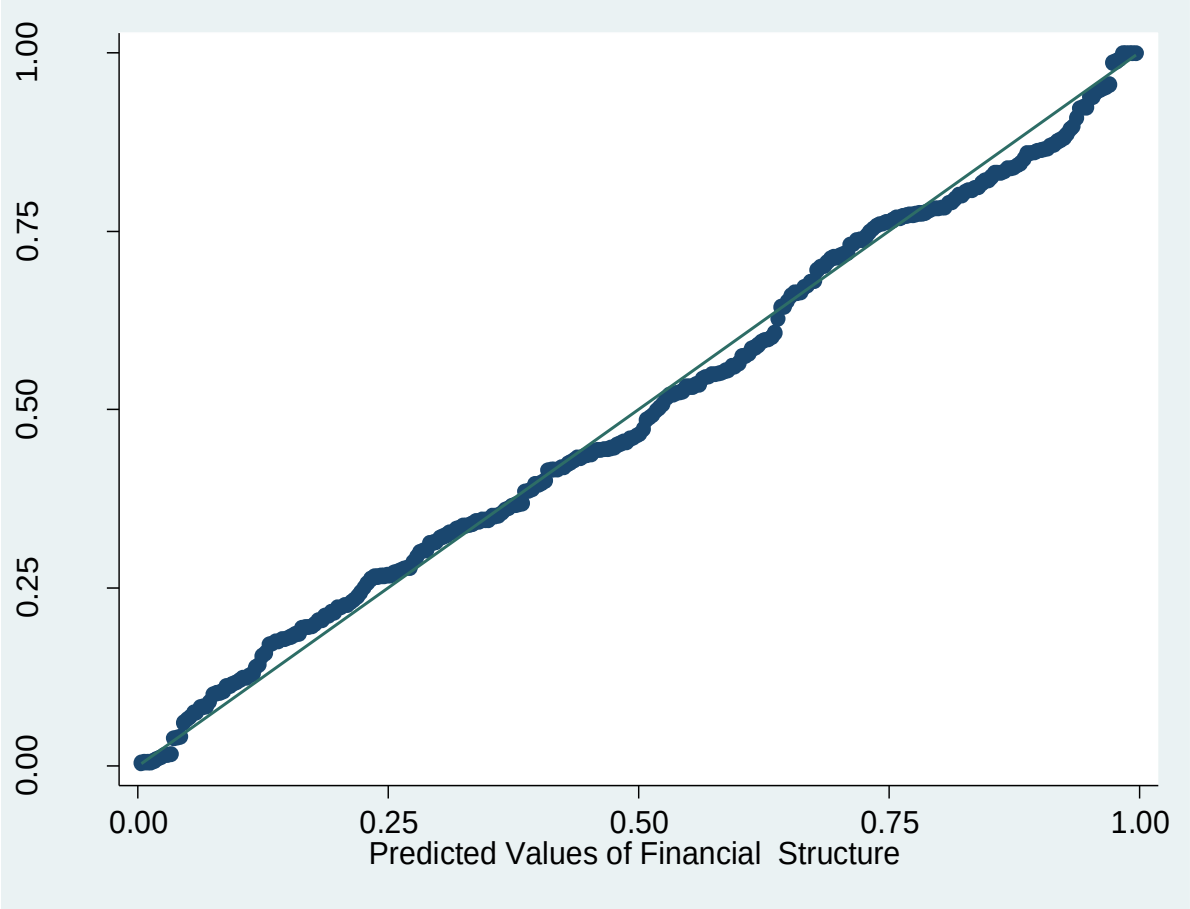

Figure 4.2: Normal P-P plots of Financial Structure

The outcome rendered in Figure 4.2 shows that P-P plots for the financial structure were close to the line of best fit, an indication that the dataset was not far from normal distribution. Greene, (2012) indicates that non-normal data distribution do not affect use of regression analysis. Figure 4.3 shows a pictorial expression of the expected outcome of asset structure against the actual outcome.

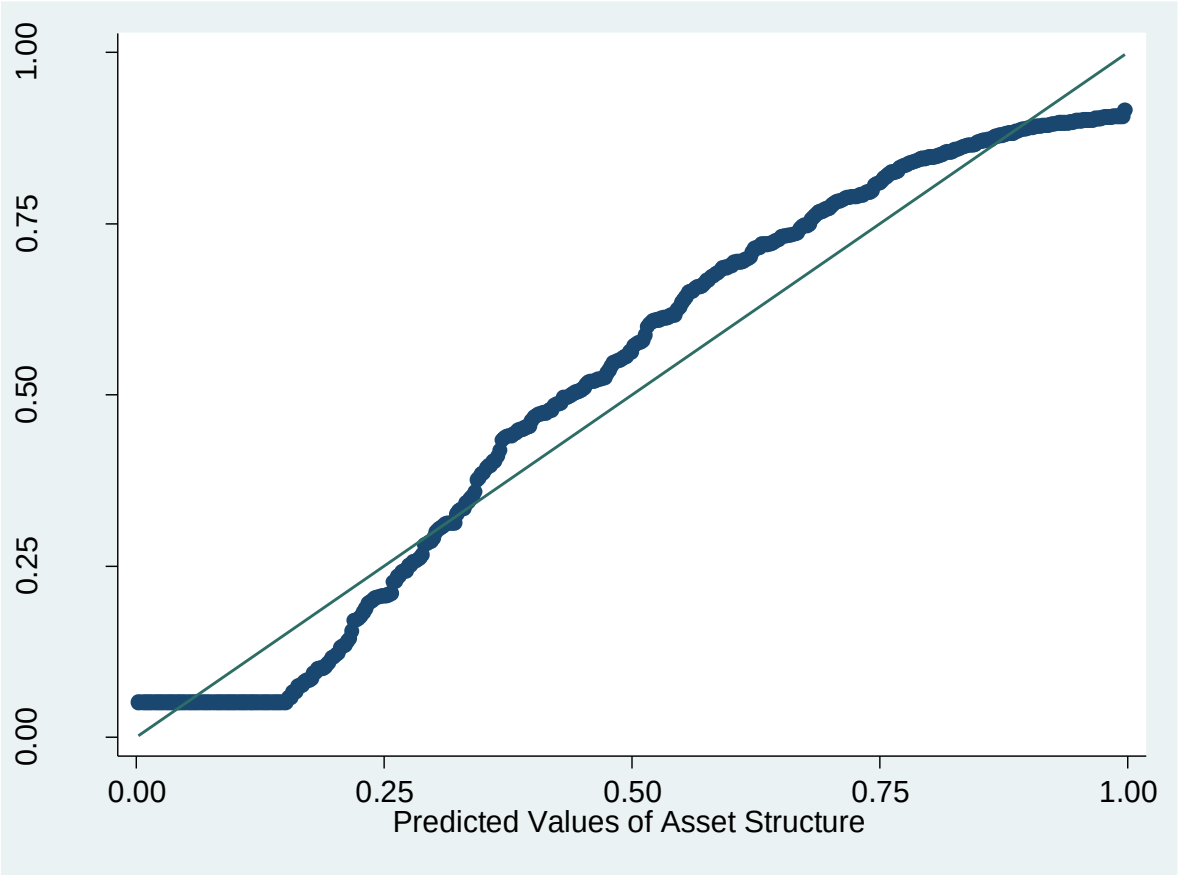

Figure 4.3: Normal P-P Plots of Asset Structure

The visual appearance in Figure 4.3 demonstrates that the observed values of asset structure slightly deviated from the line of best fit, relatively suggesting that data distribution for asset structure was not normally distributed.

A visual expression of the expected result of board demographics versus the observed outcome is illustrated in Figure 4.4.

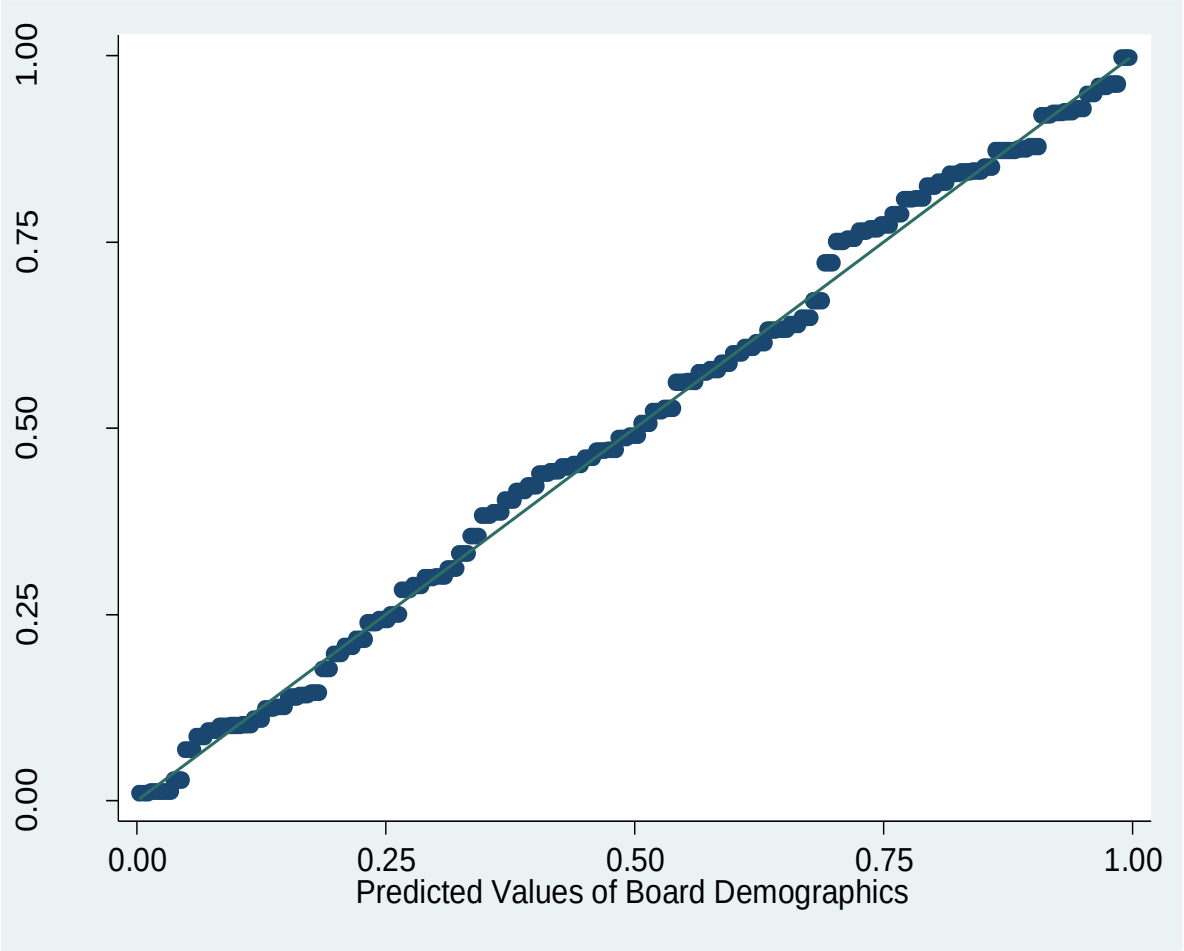

Figure 4.4: Normal P-P plot of Board Demographics

The graphical inspection of Figure 4.4 reveals that the observed values for board demographics marginally deviated from the fitted line. This point out that board demographics was not normally distributed. The visual presentations conform to the results of Shapiro-Wilk test results ($p<0.05$) that the data was not normally distributed, therefore the null hypothesis was rejected.

4.3.2 Test for Linearity

The study ascertained the linearity through a scatter plot of standardized residuals plotted against fitted/predicted values of the respective variable. Figures 4.5, 4.6, and 4.7 present a visual relationship between each of the study variables.

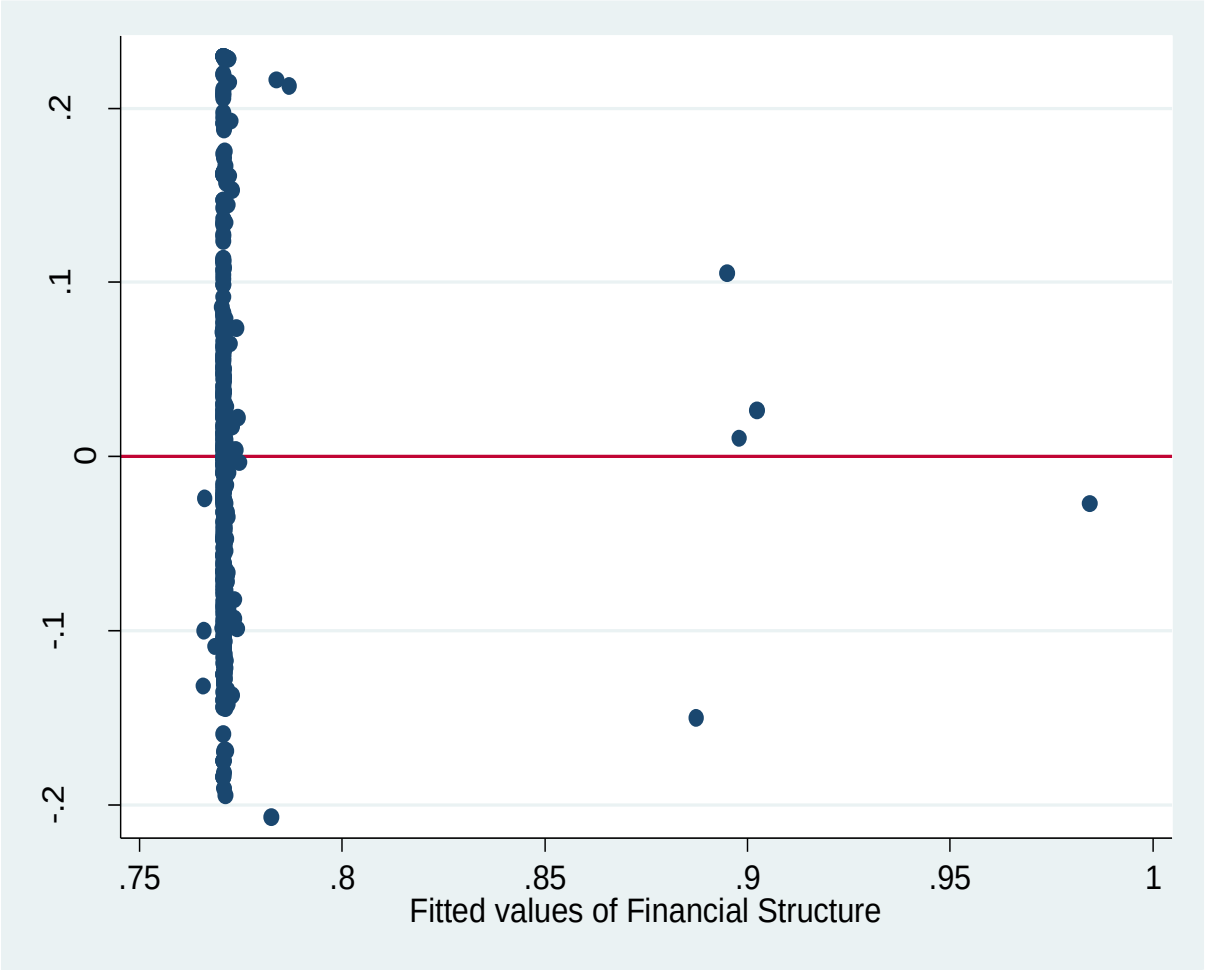

Figure 4.5: Linearity Test of the Financial Structure

The results in Figure 4.5 express non-violation of linearity assumption because the data points are not randomly dispersed away zero.

Figure 4.6 is a visual expression of the scatter plot of standardized residuals (standard error) against standardized fitted (predicted) for asset structure

Figure 4.6 Linearity Test of Asset Structure

The results (illustrated in Figure 4.6) show that asset structure is linearly related thus suggesting non-violation of the linearity assumption. The data points are evenly and dispersed around zero.

Figure 4.7 shows the scatter plot of standardized residuals against standardized fitted (predicted) values for board demographics.

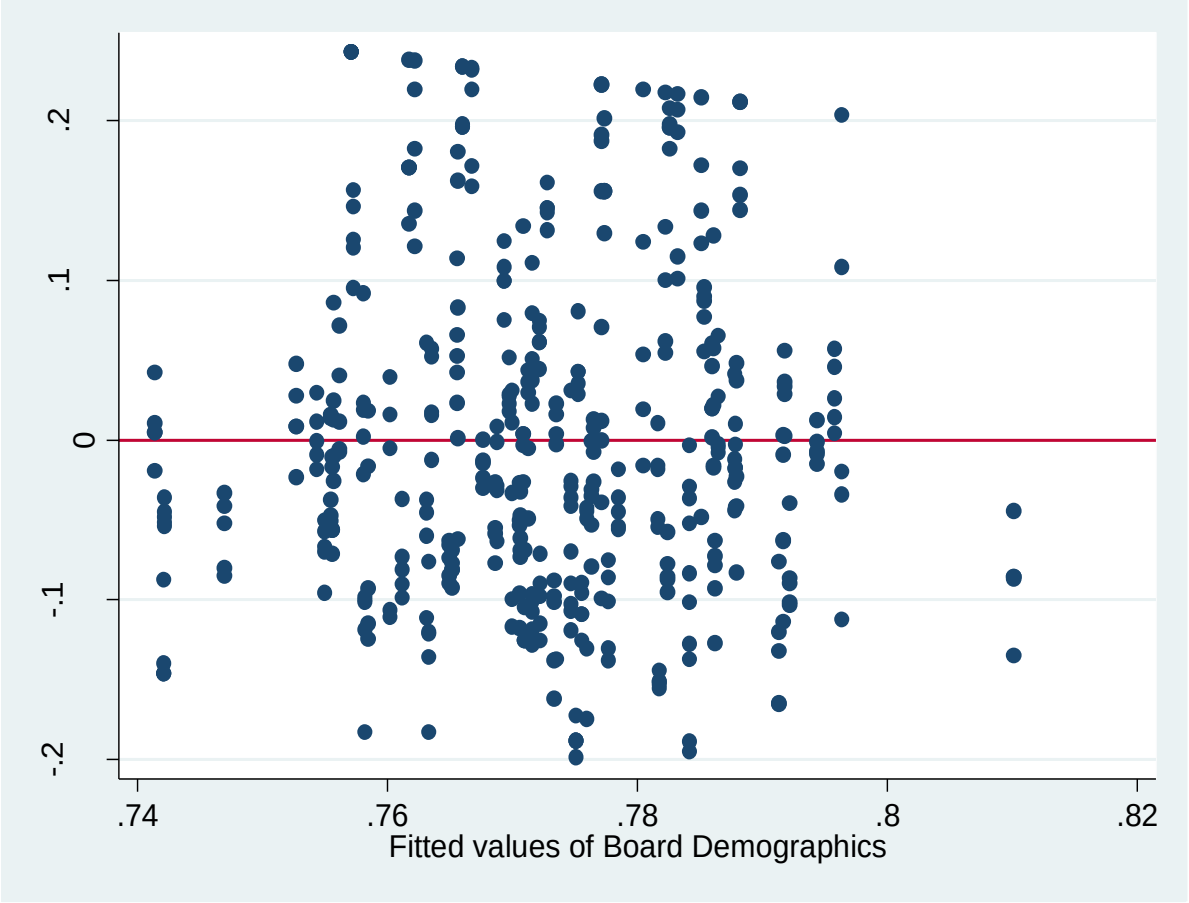

Figure 4.7: Linearity Test of Board Demographics

As demonstrated in Figure 4.7, board demographics had a linear relationship because the data points are random and dispersed around zero, implying non-violation of the linearity assumption. In summary, all the independent variables portray a straight-line correlation with the dependent variable, and therefore, they did not violate linearity assumptions.

4.3.3 Test for Multicollinearity

This study applied the VIF and tolerance approach to testing for multicollinearity. The rule of the thumb indicates that tolerance of less than 0.1 and the variance inflation factor of more than 10 points out the existence of multicollinearity of the independent variables. A tolerance of more than 0.1, according to Denis (2011) implies the absence of multi-collinear in the variables. Table 4.26 presents the results for multicollinearity test using the variance inflation factor and tolerance value.

Table 4.26: Test for Multicollinearity

Variable	VIF	Tolerance
Asset Tangibility	2.91	0.344087
Members deposit	2.87	0.348538
Asset liquidity	2.49	0.401969
Non-interest bearing	1.97	0.508509
Education Diversity	1.33	0.753102
Ethnicity Diversity	1.24	0.807387
Interest bearing	1.23	0.815346
Age Diversity	1.21	0.827805
Share Capital	1.16	0.859250
Board Experience	1.16	0.861312
Gender Diversity	1.05	0.953203
Mean VIF	**1.69**	

As shown in Table 4.26, the mean-variance inflation factor for the variables is 1.69. The VIF and tolerance values for the variables were within the accepted range. As a result, based on the threshold of VIF and tolerance, the independent variables did not display characteristics of multicollinearity. The VIF and tolerance were at the accepted range of less than 10 for VIF and above 0.1for tolerance, this suggests that the regression model could use all the variables.

4.3.4 Test for Heteroscedasticity

The Breusch-Pagan/Cook-Weisberg test was used to test for heteroscedasticity. The test adopts the null hypothesis of the constant variance of the regression residuals, where the null

hypothesis assumed homoscedasticity and the alternative hypothesis heteroscedasticity. The testing of the null hypothesis was at a significant level of 5%, thus we fail to reject the null hypothesis if the p-value is greater than 0.05 (p>0.05). However, if this condition is not satisfied, we fail to accept the null hypothesis and assume the data was heteroscedasticity. Results for the Breusch-Pagan test are shown in Table 4.27.

Table 4.27: Test for Heteroscedasticity

Test	**P-value**
$\chi^2(1) = 0.01$	$prob > \chi^2 = 0.9220$

The data (in Table 4.27) gives the result for the Breusch-Pagan test, where chi-square was $\chi^2(1) = 0.01$, (p > 0.05) (0.9220). At 5% level of significance, we failed to reject the null hypothesis because the p-value was nonsignificant and noted a linearity assumption of homoscedastic. This implies that the regression residuals were homoscedasticity and that there was no existence of heteroscedasticity in the regression estimation.

4.3.5 Correlation Analysis

A correlation matrix shows the nature of the relationship between independent variables, in addition to the associated effect on the predictor variables. The correlation outcome was reported at a significant level of 0.05. Multicollinearity is present when the correlation level of predictor variables is more than 0.9 (Field, 2013). Table 4.28 displays the results of the correlation coefficients of components for financial structure, asset structure, board demographics, and operating efficiency.

Table 4.28: Correlation Matrix for components of Financial Structure, Asset Structure, and Board Demographics

	Share capital	Institutional capital	Members deposit	Asset tangibility	Asset liquidity	Gender diversity	Age diversity	Ethnic diversity	Board experience diversity	Education diversity
Share capital	1.0000									
Institutional capital	0.1845* (0.0001)	1.0000								
Members deposit	0.1006* (0.0360)	0.3879* (0.0000)	1.0000							
Asset tangibility	0.2049* (0.0000)	0.9565* (0.0000)	0.5828* (0.0000)	1.0000						
Asset liquidity	0.2899* (0.0000)	0.3869* (0.0000)	0.7309* (0.0000)	0.5345* (0.0000)	1.0000					
Gender diversity	0.0674 (0.1606)	-0.0370 (0.4410)	0.1135* (0.0179)	0.0041 (0.9326)	0.0562 (0.2417)	1.0000				
Age diversity	0.0411 (0.3921)	0.1140* (0.0174)	0.0172 (0.7207)	0.1206* (0.0118)	-0.0061 (0.8989)	-0.0384 (0.4245)	1.0000			
Ethnic diversity	0.0177 (0.7125)	-0.1217* (0.0110)	0.1330* (0.0055)	-0.0661 (0.1689)	0.1265* (0.0083)	0.1304* (0.0065)	-0.2735* (0.0000)	1.0000		
Board experience diversity	-0.0571 (0.2347)	0.0221 (0.6458)	-0.2065* (0.0000)	-0.0701 (0.1445)	-0.1128* (0.0186)	-0.1314* (0.0061)	-0.1278* (0.0076)	-0.0889 (0.0640)	1.000	
Education diversity	-0.0261 (0.5867)	0.1565* (0.0011)	-0.0769 (0.1093)	0.1032* (0.0314)	-0.0705 (0.1422)	-0.0280 (0.5598)	0.3553* (0.0000)	-0.3312* (0.0000)	-0.1969* (0.0000)	1.000

Note: p-values in parentheses. * indicates level of significance: * $p < 0.05$

Table 4.28 indicates that institutional capital, members' deposits, asset tangibility, and asset liquidity significantly correlated with share capital while the attributes of board demographics were insignificant and did not correlate with share capital. Conversely, the institutional capital significantly correlated with all variables excluding gender and board experience. Further, age and education level were insignificant with members' deposits while other variables were significant with members' deposits. The asset tangibility significantly correlated with asset liquidity, age, and education, though the other variables that were not significant. Similarly, asset liquidity significantly correlated with ethnic diversity and board experience, unlike other variables. Gender was significant and correlated with ethnic diversity and board experience.

The attributes of the ethnicity, board experience, and education level were significantly associated with age diversity. In addition, ethnic diversity significantly correlated with education level but insignificant with board experience. Lastly, board experience had a significant relationship with education level. Therefore, the study variables did not suffer from multicollinearity and had a weak correlation. For that reason, as Gujarati & Porter (2009) allude the variables were jointly used in the regression analysis and hypothesis testing.

4.3.6 Hausman Test for Model Specification

Hausman test for model specification tested whether the regression model was appropriate for estimation. Considering that some variables had missing or incomplete observations, a choice was made whether to use random effect or pooled OLS models of estimation. In the pooled OLS regression, all the observations are simply pooled together ignoring the cross-section and time-series data. If observations are pooled together, the heterogeneity or individuality that exists between the variables is eliminated. Alternatively, the justification of the random effects model is that the individual-specific effect or variation across entities is assumed. This implies that the individuals' error term is uncorrelated with the predictor that allows time-invariant variables to play a role as explanatory variables.

The study carried out the Hausman test under the null hypothesis. The Random effect model was assumed correctly specified model against the alternative hypothesis that implied the model was misspecified. In other words, the null hypothesis implies that the pooled OLS regression is misspecified against the alternative that pooled OLS regression be correctly specified. The results of the Hausman test are displayed in Table 4.29.

Table 4.29: Hausman test

Test Ho:	**The difference in coefficients not systematic**
chi2(7)	= (b-B)'[(V_b-V_B)^(-1)](b-B)
	= 32.90
Prob>chi2	= 0.0000

The data in Table 4.29 indicates that based on the Hausman test, the chi-square statistics was 32.90 and a p-value of 0.0000, therefore we failed to accept the null hypothesis thus concluded that pooled OLS regression was the appropriate model for estimation.

4.4 Chapter Summary

The chapter presented the results of descriptive statistics for financial structure, asset structure, board demographics, and operating efficiency. The measures of central tendency and dispersion provided detailed statistical distribution for all the variables of the study.

The DEA model generated efficiency scores of all sampled DMUs over the five-year period. The technical efficiency, pure technical efficiency and scale efficiency provided information about the efficiency of housing cooperatives. Further returns to scale ascertained the level of inefficiencies attributed from poor management or wrong scale of operations. Generally, housing co-operatives were found to have suffered from inefficiencies during the five-year period that this study covered. According to the findings, the technical efficiency had a mean score of 67.76%; pure technical efficiency at 76.65% and scale efficiency at 88.62%.

Technical efficiency is the standard measure of operating efficiency. The study revealed that the overall mean technical efficiency for housing co-operatives operating in Nairobi City County was at 67.76%. This implies that housing co-operatives could save 32.24% of the inputs (labour costs, operating expenses, and cost of investment/sales) while generating the same total revenue, or generate the same output (total revenue) with only 67.76% of the inputs. Housing co-operatives with the lowest score had an operating efficiency of 11.12%. The results denote that most of the housing co-operatives were not efficient in terms of resources utilization, and therefore the co-operatives' management has a responsibility of ascertaining the reasons and causes of inefficiencies.

Results indicate that only four (4) housing co-operatives were technically efficient, representing 4.6% of the housing co-operatives. Under the pure technical efficiency and scale efficiency, it was found that 95.4% of the co-operatives experienced poor management practices and scale inefficiencies. The implications of the findings is that co-operatives would cut wastages by management by 23.35% and reduce the scale of operations by 11.38% while generating the same output. Further, the findings disclosed that the majority of housing co-operatives suffered from diseconomies of scale probably linked to bureaucratic management resulting to lengthy chains of communication. Decreasing returns to scale infers that a one-unit increase in input (s) would contribute to disproportionate change in the outputs by a lower amount. These results support the findings of Veenstra et al. (2016) that housing corporations

operated under diseconomies of scale and merger of firms could not address the problem of inefficiencies. Therefore continued registration of housing co-operatives as part of policy directives undermines the purpose of forming co-operatives (GoK, 2015).

Equally, a moderate percentage (25.29%) of housing co-operatives suffered from scale inefficiency (decreasing returns to scale). This would infer that a rise in inputs resulted in a more than the disproportionate increase in outputs. Therefore, housing co-operatives holding a large number of inputs such as land, plant, or equipment should increase their scale of production.

The diagnostic tests for normality using visual expression of the scatter plot of standardized residuals (standard error) against standardized fitted (predicted) values were slightly off the line of best fit, hence confirming that some variables were not very far from normally distributed datasets. The results for the test of linearity in the scatter plot showed that the variables of the study were linearly related. The variance inflation factor tested for the presence of multicollinearity and the results cited non-existence of problems of multicollinearity in the study variables: the mean VIF value was not above 10. To test for heteroscedasticity, Breusch-Pagan test was carried out to test for heteroscedasticity and the results confirmed that the variance/residual were constant, meaning that the residuals were homoscedastic thus making linear regression an appropriate model to regress technical efficiency scores on independent variables. Lastly, the Hausman test for model specification depicted that pooled OLS regression was the appropriate model for estimation. Having determined that, we proceeded to present and discuss the regression results as per the objectives of the study.

CHAPTER FIVE

HYPOTHESES TESTING AND DISCUSSION OF FINDINGS

5.1 Introduction

This Chapter presents the results for tests of null hypotheses in the study and the respective interpretations and concludes with a table of summary of statistical tests and a discussion of the findings for each tested hypothesis.

5.2 Hypothesis Testing and Findings

The results of the hypothesised relationship of independent variables on operating efficiency are presented in this section. DEA results highlighted the efficient and inefficient DMUs and the potential improvement required relative to peers. In pursuance of the hypothesised relationship between constant returns to scale efficiency scores (crs-te)/technical efficiency and the independent variables, the scores were regressed on the components of financial structure, asset structure, and board demographics. The regression analyses were harmonious with the research objectives and null hypotheses.

The first null hypothesis tested the association between financial structure and operating efficiency; the second null hypothesis was about testing the mediating effect of asset structure on the relationship financial structure and operating efficiency. While the third null hypothesis tested the moderating effect of board demographics and finally an hypothesis testing the combined effect of all variables on technical efficiency scores. Results in tables 5.1 to 5.10 were obtained using a hierarchical approach (Baron & Kenny, 1986; Preacher, et al., 2007). The efficiency scores were regressed separated on the components of the mediator and moderator variables (Ararat et al., 2015). Nonetheless, the reference point for interpreting the regression results was the coefficient of determination, especially when the variables in the model(s) had both significant and insignificant beta.

5.2.1 Relationship between Financial Structure and Operating Efficiency

The first objective determined the link between financial structure and operating efficiency of housing co-operative societies. The technical efficiency/crs_te was the proxy for measuring operating efficiency. The DEA modelled under input-oriented approach and variable returns

to scale technical efficiency (vrs_te) produced the technical efficiency scores (Coelli et al., 2005) for 435 observations over the five-year period from 2012 to 2016.

The technical efficiency scores/crs_te scores were regressed on the components of financial structure with a view to reject or confirm the null hypothesis. The multiple linear regression determined the hypothesized relationship between the components of financial structure and operating efficiency. Nevertheless, the results in Table 5.1 for model 6 provided the final interpretation of the hypothesized relationship. The study operationalized financial structure as the ratio of core capital to liabilities where core capital comprises share capital and institutional reserves. This infers that an increase in the proportion of core capital would lead to a reduction in liabilities and vice versa. To this end, the study adopted a regression-based framework to test the null hypothesis as indicated below:

H_{01} The relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County is not significant. The prediction equation as shown in chapter three is:

$Y = \alpha_0 + \beta_1 X_1 + \varepsilon$ *section 3.8.2.1 provides the definition of the variables.*

The variables are; X_1 is financial structure; Y is the operating efficiency estimated by technical efficiency, a constant (α_0) in the model and ε an error term. To examine the hypothesised relationship the crs-te was regressed on each component of financial structure including the share capital, institutional capital, members' deposits, non-interest-bearing liabilities, and interest-bearing liabilities. This study estimated six regression models as indicated in Table 5.1, where each model constituted a regression function of component(s) of financial structure on constant returns to scale technical efficiency. However, the results in model 6 using adjusted R^2 formed the basis of interpretation of the null hypothesis on testing the relationship between financial structure and operating efficiency because it included all the components. Table 5.1 depicts the results of the regression analysis using simple and multiple linear regression of the component(s) of financial structure and constant returns to scale technical efficiency- a proxy of operating efficiency.

Table 5.1: Regression Results on the Relationship between Financial Structure and Operating Efficiency

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	CRS_TE	**CRS_TE**	**CRS_TE**	**CRS_TE**	**CRS_TE**	**CRS_TE**
Share Capital	0.0482**					0.0429**
	(0.002)					(0.007)
Institutional Capital		0.00643**				0.00803*
		(0.003)				(0.011)
Members Deposits			-0.00698*			-0.0127**
			(0.049)			(0.002)
Non-Interest Bearing Liabilities				0.00133*		0.000202
				(0.027)		(0.816)
Interest Bearing					-0.00230	-0.00131
					(0.311)	(0.589)
Constant	0.769***	0.771***	0.776***	0.772***	0.773***	0.773***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	435	435	435	435	435	435
R^2	0.021	0.021	0.009	0.011	0.0024	0.064
Adjusted R^2	0.019	0.018	0.007	0.009	0.0001	0.053
F-Stat	9.410	9.121	3.895	4.939	1.027	5.862
Degrees of Freedom	(1, 433)	(1, 433)	(1, 433)	(1, 433)	(1, 433)	(5, 429)
p-value of F stat	0.0000	0.0027	0.0491	0.0268	0.3115	0.0000

P-values in parentheses * *indicates level of significance,* * p<0.10, ** p<0.05, *** p<0.01

Observed in Table 5.1 are regression results for models (1) to (6). Model (1) estimated the hypothesised relationship concerning share capital and crs-te/technical efficiency. The findings indicate that share capital had a positive and significant effect on operating efficiency [β= 0.0482, P < 0.05(0.002)] at 5% level of significance: an indication that a one-unit increase in share capital contributed to an increase in operating efficiency by 0.0482 units. This presumes that housing co-operatives when sourcing for additional resources should prioritize funds from members' equity over other sources because this contributed the highest units in operating efficiency. These findings negate the agency theory's principle that debt-financed firms have fewer agency costs and are more efficient than equity-financed entities.

Model 2 displays the results of the association between the institutional reserve and technical efficiency. The results indicate a positive relationship between institutional reserves and operating efficiency [β= 0.00643, P < 0.05) (0.003)] at 5% level of significance. The findings

infer that a one-unit increase in the institutional capital contributed to an increase in operating efficiency by 0.00643 units. The inference drawn here is that housing co-operatives should prioritise the use of institutional capital in financing activities of the firms since a one-unit increase from this source of finance contributed to an increase in operating efficiency.

The results in model 3 present the findings on the members' deposits in relation to operating efficiency. The outcomes reveal a significant but negative association between members' deposits and operating efficiency $\beta = -0.00698$, $p < 0.10$ (0.049) at a 10% level of significance. This led to the deduction that an increase in funding through members' deposit contributed to a decrease in operating efficiency, probably suggesting a potential increase in agency problems arising from the use of this source of finance.

Model 4 gives the regression results of non-interest-bearing liabilities on operating efficiency. The analysis indicates that the results had a positive-significant effect $\beta = 0.00133$, $p < 0.10$ (0.027) at 10% level of significance between the non-interest bearing liabilities and operating efficiency. Additionally, the findings suggest that a rise in non-interest liabilities contributed to positive changes in operating efficiency by 0.00133 units. Accordingly, housing co-operatives have an option of funding operations through trade payables and accrued expenses.

The findings in model 5 show that interest-bearing liabilities (loans and bank overdraft) had an insignificant and negative effect on operating efficiency $\beta = -0.00230$, $p > 0.10$ (0.311) at 10 % level of significance: indicating that loans and bank overdraft did have non-significant effect on operating efficiency. This relationship fails to support the agency theory's principle that an increase in update of debt finance by a firm leads to a decrease in agency costs and ultimately good performance.

Model 6 represents the financial structure, which comprises the core capital (share capital and institutional capital) and liabilities (members' deposits, non-interest-bearing, and interest-bearing liabilities) in predicting operating efficiency. The model was a good fit in predicting operating efficiency $F(5, 429) = 5.862$, $P < 0.05$ (0.0000). In reference to model (1) -to-model (5), it was observed that upon inclusion of all components of financial structure in model (6) the predictive power (adjusted R^2) greatly increased to 5.3%. This indicates that financial structure contributed to variation in operating efficiency. Therefore, financial structure and operating efficiency had significant correlation thus the null hypothesis was rejected.

5.2.2 Mediating Effect of Asset Structure on the Relationship between Financial Structure and Operating Efficiency

This study's second objective established the effect of the mediation of asset structure on the on financial structure in predicting operating efficiency of housing co-operatives in Nairobi County. The study adopted a regression-based framework to test the null hypothesis through hierarchical regression analysis (Baron & Kenny, 1986; Preacher et al., 2007). The null hypothesis was as indicated below:

H_{02} The mediating effect of asset structure on the relationship between financial structure and operating efficiency of housing co-operative societies is not significant.

The regression equation in chapter three indicates:

$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$; *Section 3.8.2.1 defined the variables.*

The Baron and Kenny (1986) and Preacher et al. (2007) four steps models were applied to determine the effect of asset structure in mediating the relationship between financial structure and operating efficiency. The first model sought to establish the existence of a significant relationship between independent and dependent variables by regressing the independent variable on the dependent variable. Model (2) tested for the existence of a significant relationship between the mediator and the independent variable by regressing the independent variable on the mediator. The third model tested for significant meditation on the relationship between the predictor variable and the outcome variable by regressing the independent variable and the mediator on the dependent variable.

Before proceeding to model (4), the first three models ought to have reported a significant effect. The fourth model tested for the existence of a relationship between the mediator and the dependent variable by regressing the mediator on the dependent variable (Preacher et al., 2007). The transmission effect (mediation) of independent variable on dependent variable was confirmed when the beta for the mediator in model (4) was insignificant. Results in Tables 5.2, 5.3, and 5.4 displays the mediating effect of the asset structure/components on the relationship between financial structure and technical efficiency.

5.2.2.1 Mediating Effect of Asset Tangibility

The regression results Table 5.2 for models 1- 4 presents mediating of asset tangibility on the relationship between financial structure and operating efficiency.

Table 5.2: Regression Results on the Mediating Effect of Asset Tangibility

	Model 1	**Model 2**	**Model 3**	**Model 4**
	CRS_TE	**Asset Tangibility**	**CRS_TE**	**CRS_TE**
Share Capital	0.0429**	0.240*	0.0441**	
	(0.007)	(0.015)	(0.006)	
Institutional Capital	0.00803*	1.451***	0.0154	
	(0.011)	(0.000)	(0.186)	
Members Deposits	-0.0127**	0.609***	-0.00957	
	(0.002)	(0.000)	(0.123)	
Non-Interest Bearing Liabilities	0.000202	-0.0211***	0.0000947	
	(0.816)	(0.000)	(0.914)	
Interest Bearing	-0.00131	0.114***	-0.000735	
	(0.589)	(0.000)	(0.776)	
Asset Tangibility			-0.00506	0.00262*
			(0.511)	(0.046)
Constant	0.773***	0.0518	0.773***	0.771***
	(0.000)	(0.112)	(0.000)	(0.000)
Observations	435	435	435	435
R^2	0.064	0.972	0.065	0.009
Adjusted R^2	0.053	0.972	0.052	0.007
F-Stat	5.862	3029.1	4.950	4.011
Degrees of Freedom	(5, 429)	(5, 429)	(6, 428)	(1, 433)
p-value of F-stat	0.0000	0.0000	0.0001	0.0458

P-values in parentheses * *indicates level of significance*, * p<0.10, ** p<0.05, *** p<0.01

Table 5.2 presents the regression results for models 1- 4. The findings for model 1 reveal that share capital $\beta = 0.0429$, $p < 0.05$ (0.007) and institutional capital $\beta = 0.00803$, $p < 0.10$ (0.011) along with members' deposits $\beta = -0.0127$, $p < 0.05$ (0.002) was found to be statistically significant in predicting operating efficiency. On the contrary, non-interest-bearing liabilities and interest-bearing liabilities were statistically insignificant in relation to operating efficiency. Nevertheless, the overall model $F(5, 429 = 5.862$, $P<0.05$ (0.0000) was found to be statistically significant implying that the first model satisfied the first step of the mediation process.

The second step is presented in model 2. The components of the independent variable (financial structure) were regressed on the mediator variable (asset tangibility), a component of asset structure. The results in model 2 show that share capital, institutional capital, members' deposits, in addition to non-interest-bearing and interest-bearing liabilities were all significant in predicting asset tangibility. Therefore, model two fulfilled the condition for the second step.

Model 3 represents results of step three of mediation process where the components of independent variable and asset tangibility (mediator) were regressed on the dependent variable (technical efficiency). The findings indicate that all components including the overall results of the model- adjusted R^2 were statistically significant, thus the third step was satisfied.

Model 4 displays the regression results on the relationship between technical efficiency and the mediator, by regressing the mediator on dependent variable. The findings point to a significant effect of the mediator on technical efficiency $\beta = 0.00262$, $p<0.10$ (0.046), the results showed a significant reduction on the adjusted R^2 from 5.3% % to 0.7%. As a result, asset tangibility caused a reduction in adjusted R^2 consequently, the requirements of a mediator variable were met, so, the null hypothesis was rejected.

5.2.2.2 Mediating Effect of Asset Liquidity

Asset liquidity was also regressed on crs-te/technical efficiency to find the significant relationship of asset liquidity on the link between financial structure and crs-te. The mediation process followed the four steps presented in models 1- 4. Table 5.3 provides a mediating effect of asset liquidity results.

Table 5.3: Regression Results on the Mediating Effect of Asset Liquidity

	Model 1 CRS_TE	Model 2 Asset Liquidity	Model 3 CRS_TE	Model 4 CRS_TE
Share Capital	0.0429**	0.640***	0.0249	
	(0.007)	(0.000)	(0.127)	
Institutional Capital	0.00803*	0.0474*	0.00670*	
	(0.011)	(0.016)	(0.033)	
Members Deposits	-0.0127**	0.472***	-0.0259***	
	(0.002)	(0.000)	(0.000)	
Non-Interest bearing Liabilities	0.000202	-0.00440	0.000325	
	(0.816)	(0.413)	(0.703)	
Interest Bearing	-0.00131	-0.00311	-0.00122	
	(0.589)	(0.836)	(0.609)	
Asset liquidity			0.0282***	0.00930*
			(0.000)	(0.070)
Constant	0.773***	0.000673	0.773***	0.770***
	(0.000)	(0.983)	(0.000)	(0.000)
Observations	435	435	435	435
R^2	0.064	0.588	0.093	0.008
Adjusted R^2	0.053	0.584	0.080	0.005
F-Stat	5.862	122.7	7.277	3.303
Degrees of Freedom	(5, 429)	(5, 429)	(6, 428)	(1, 433)
P-value of F stat	0.000	0.0000	0.0000	0.0698

P-values in parentheses * *indicates level of significance*, * p<0.10, ** p<0.05, *** p<0.01

The regression results relating to asset liquidity as a mediation of financial structure is shown in Table 5.3. In relation to model 1, the findings reveal that share capital, institutional capital, and members' deposits' capital were statistically significant save for accruals and trade receivables and interest-bearing obligations. Nevertheless, based on the adjusted R^2 = 0.053, the overall model 1 (financial structure) was statistically significant F(5, 429)= 5.862, p<0.01 (0.000); thus, the first condition in step one was fulfilled.

Model 2 presents the results for step two, where asset liquidity, a component of asset structure was regressed on financial structure (each component). The results showed that the components of the financial structure had significant relationship with asset liquidity except for non-interest bearing and interest bearing liabilities that were statistically insignificant.

However, based on the results of the overall model (R^2), the adjusted R^2 = 0.584, F (5, 429)= 122.7, p<0.01, (0.000) was statistically significant. Consequently, the second step was satisfied.

The analysis proceeded to step three as shown in model 3. The results report an insignificant relationship between share capital, non-interest-bearing and interest-bearing liabilities - while other financial structure components were significantly mediated by asset liquidity. However, upon further analysis, the model showed that adjusted R^2 = 0.080, F (6, 428) = 7.277, p<0.01, (0.0000) was statistically significant. Accordingly, the null hypothesis was rejected because model 3 results met the condition for mediation for step three; therefore, the process proceeded to model 4.

Model 4 gives results for step four, which point to a statistically significant mediating effect of asset liquidity on operating efficiency was β = 0.00930, p < 0.05 (0.070). In addition, the adjusted R^2 = 0005, F (1, 433) = 3.303, p>0.05 (0.0698) of the model was insignificant and revealed a great change in decline in adjusted R^2. As a result, the asset liquidity as a mediator met the requirements in the mediation of the financial structure in predicting operating efficiency thus the null hypothesis was rejected.

5.2.2.3 Mediating Effect of Asset Structure

The test for the mediating effect of asset structure on financial structure and operating efficiency followed the four-step process of Baron & Kenny, (1986) and Preacher et al., (2007). Table 5.4 presents the results of the regression models on the mediation effect of asset structure on the financial structure in estimating operating efficiency.

Table 5.4: Regression Results on the Mediating Effect of Asset Structure

	Model 1 CRS_TE	Model 2 Asset Structure	Model 3 CRS_TE	Model 4 CRS_TE
Share Capital	0.0429**	0.212***	0.0424**	
	(0.007)	(0.000)	(0.009)	
Institutional Capital	0.00803*	0.00177	0.00803*	
	(0.011)	(0.862)	(0.012)	
Members Deposits	-0.0127**	0.0374**	-0.0127**	
	(0.002)	(0.004)	(0.002)	
Non-Interest bearing Liabilities	0.000202	0.00000723	0.000202	
	(0.816)	(0.998)	(0.816)	
Interest Bearing	-0.00131	0.00814	-0.00133	
	(0.589)	(0.297)	(0.584)	
Asset Structure			0.00218	0.00611
			(0.885)	(0.680)
Constant	0.773***	0.519***	0.772***	0.769***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	435	435	435	435
R^2	0.064	0.084	0.064	0.000
Adjusted R^2	0.053	0.073	0.051	-0.002
F-Stat	5.862	7.831	4.877	0.171
Degrees of Freedom	(5, 429)	(5, 429)	(6, 428)	(1, 433)
P-value of F stat	0.0000	0.0000	0.0000	0.0000

P-values in parentheses * *indicates level of significance,* * p<0.10, ** p<0.05, *** p<0.01

Table 5.4 displays the results of the four-step process that was used in testing for the mediating effect of asset structure. The results in model 1 indicate that the beta coefficients for share capital, institutional capital, and members' deposits were statistically significant; while non-interest-bearing and interest-bearing liabilities, the same coefficients were non-significant. Due to the conflicting results of indicators of different variables, the evaluation of the mediating effect of the asset structure was founded on a p-value of F-statistics. In reference to adjusted R^2= 0.053, F (5, 429) = 5.862, p<0.01 (0.0000), model 1 indicate statistically significant results, signifying that the first condition for mediation was satisfied.

Model 2 presents the analysis for step two. Asset structure was regressed on financial structure components, and the results show that the correlation between share capital and members' deposits on asset structure was significant. The institutional capital, non-interest-bearing liabilities, and interest-bearing liabilities were insignificant. The interpretation of significance effect was drawn from the p-value of F-statistics where adjusted R^2 = 0.073, F (5, 429) =7.831, p < 0.01 (0.0000). This confirms that a significant relationship the mediator and independent variable existed in step two hence, the analysis proceeded to the third step.

Model 3 provides the results for step three. This step involved regressing crs-te scores on the elements of financial structure and asset structure. The results show that share capital, institutional reserves, and members' deposits were significant. The non-interest-bearing liabilities and the interest-bearing ones were not significant. Resultantly, P-value of F-statistics ascertained the significant effect of the model in step three. The adjusted R^2 = 0.0.051, F (6, 428) = 4.877, p < 0.01 (0.0000) points to a significant effect of the model. Hence, by inference, the first three steps of mediation were met. The analysis proceeded to step four, where insignificant effect between asset structure and technical efficiency was tested.

In model 4, the results for step four are depicted. In testing for mediation, the mediator was regressed on the dependent variable. Therefore, the asset structure was regressed on technical efficiency scores. As revealed through the results, asset structure was statistically insignificant β =0.0611, p>0.10 (0.680), and adjusted R^2 = -0.002, F (1, 433) =0.171, p < 0.01 (0.0000) reported a significant decline. Following the Baron and Kenny (1986) and Preacher et al., (2007) mediation process, the fourth step should be insignificant for mediation to have occurred. In this case, the mediation process had occurred between asset structure and technical efficiency, thus the null hypothesis was rejected.

5.2.3 Moderating Effect of Board Demographics on the Relationship between Financial Structure and Operating Efficiency

The third objective sought to determine how board demographics moderates the association between financial structure and operating efficiency. The board demographics comprised

board diversity (gender, age, and ethnicity) and board competence (board experience, industry experience, and education background). The component of industry experience was dropped from the analysis because only a small number of board members had indicated having industry experience. In formulating the indices for attributes of board diversity, board competence, and board demographics, the Shannon index of diversity formula was used (Appendix VIII). The indices as per descriptive statistics did not vary significantly since board members served for a period of 3 years with an option of seeking re-election. To this end, the study adopted a regression-based framework in testing the following null hypothesis:

H_{03} The moderating effect of board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies is not significant.

The estimation equation in chapter three is shown below:

$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_3 + \beta_3 X_1 X_3 + \varepsilon$; *note: The variables are defined in section* 3.8.2.1

In testing for the moderation effect of board demographics, the interaction term ($X_1 X_3$) was included in the model; for this study, the interaction term was determined by obtaining the product of the centered values of component(s) of financial structure and centered values of attributes of board demographics. The centered values were created by obtaining the mean for each variable, which was deducted from the value of the variable. The product of the two-centered value for independent variable and moderator variable obtained an interaction term that was used in the regression model. Centering made the results more meaningful and easy to interpret since it changed the estimated main effects (Preacher et al., 2007).

According to Baron and Kenny (1986) and Preacher et al. (2007), moderation occurs when the change in magnitude of the moderator causes the strength or direction of dependent to vary, upon inclusion of a moderator. Alternatively, when the inclusion of the interaction term in the model causes a change on the overall effect of the model (R^2), and the new interaction term has a significant effect as well as the independent variable, then moderation is presumed to have occurred. Further when the predictor and the moderator are not significant upon inclusion of an interaction term, then complete moderation has occurred. In addition, moderation is also found to have occurred when the predictor and moderator, as well as the main effect, have a significant effect after the interaction term was included in the regression model.

The test for moderation followed the hierarchical multiple regression methods (Preacher et al, 2007). The following process was involved; the first step determined the correlation between financial structure and operating efficiency; the second step predicted the operating efficiency (dependent variable) from both the independent variable (financial structure) and the moderator (board demographics), to confirm whether there was any change in the dependent variable. The third step involved the introduction of an interaction term, which was obtained by centering the financial structure components and board demographics attributes indices. In order to enrich the results, the moderator, that is board demographics - was disaggregated into the attributes of gender, age, ethnicity, board experience, and education background board members. The individual components of financial structure and board demographics attributes were regressed and thereafter an interaction term was added to model 3 to determine the effect of moderation. The results for the moderation effect of board demographics attributes are presented in tables 5.5, 5.6, 5.7, 5.8, and 5.9.

5.2.3.1 Moderating Effect of Gender Diversity on the Relationship between Financial Structure and Operating Efficiency

Gender is an attribute of board diversity. The Shannon index formula calculated the gender diversity index (Appendix VIII); the index indicates the level of dominance or abundance (evenness) of the gender attribute in the board of directors. A high gender diversity index signifies equal representation, while an index of zero or close to zero indicates dominance of one gender attribute; thus, inequality in representation. For this reason, the effect of gender diversity as a moderator was based on the interpretation of gender diversity index. Table 5.5 presents the results of the moderating effect of gender diversity.

Table 5.5: Regression Results for the Moderating Effect of Gender Diversity

	Model 1	Model 2	Model 3
	CRS_TE	CRS_TE	CRS_TE
Share Capital	0.0429***	0.0479***	0.0526***
	(0.007)	(0.002)	(0.004)
Institutional Capital	0.00803**	0.00694**	-0.000746
	(0.011)	(0.026)	(0.966)
Members Deposits	-0.0127***	-0.0103***	-0.0517***
	(0.002)	(0.010)	(0.000)
Non-Interest bearing Liabilities	0.000202	0.000236	0.00146
	(0.816)	(0.780)	(0.693)
Interest Bearing	-0.00131	-0.00140	0.00555
	(0.589)	(0.555)	(0.592)
Gender Diversity		-0.106***	-0.0708
		(0.000)	(0.331)
Interaction Term (share capital * Gender Diversity)			-0.317
			(0.190)
Interaction Term (Institutional capital * Gender Diversity)			-0.154
			(0.374)
Interaction Term (Members Deposit * Gender Diversity)			0.297**
			(0.012)
Interaction Term (Non-interest Bearing * Gender Diversity)			0.0298
			(0.541)
Interaction Term (Interest Bearing *Gender Diversity)			-0.0667
			(0.463)
Constant	0.773***	0.828***	0.813***
	(0.000)	(0.000)	(0.000)
Observations	435	435	435
R^2	0.064	0.106	0.130
Adjusted R^2	0.053	0.094	0.107
F-Stat	5.862	8.485	5.72
Degrees of Freedom	(5, 429)	(6, 428)	(11, 423)
P-value of F-stat	0.0000	0.0000	0.0000

P-values in parentheses* *indicates level of significance,* * p<0.10, ** p<0.05, *** p<0.01

The results shown in Table 5.5 demonstrate that based on p-values of F-statistics, models 1-3 are statistically significant at 1% level of significance. Before the inclusion of the moderator

(gender diversity) in the regression model, the financial structure components in model 1 explained adjusted R^2 was 5.3% in variation of operating efficiency. Nevertheless, when gender diversity (moderator) was included - as indicated in model 2 - gender diversity was statistically significant (β = -0.106, p < 0.01(0.000) and adjusted (R^2) increased to 9.4 %. This implies that moderation was taking place on the financial structure in predicting operating efficiency.

Model 3 presents the interaction term results. The interaction term was created by centering the product of the components of financial structure * gender diversity index. The findings are shown in model 3 exhibit an insignificant changes in the magnitude of all coefficients of the interaction terms for gender diversity save for members deposit (β = 0.2972, p < 0.05 (0.012), nonetheless the model pointed out a significant change in adjusted R^2 from 9.4% % to 10.7%. This led to the inference that moderation had occurred thus gender diversity caused changes in financial structure consequently affecting operating efficiency.

Comparing the results of gender diversity in models 2 and 3, the magnitude of the beta coefficient increased from β = -0.106) to β = -0.0708 which was insignificant. In reference to gender diversity index, the descriptive statistics indicated inequality in representation. The findings show that a one-unit change in gender diversity index caused operating efficiency to decline by a similar magnitude, although by chance. The implication here is that attempts to reduce gender inequality that is increasing women in the boards of housing co-operatives contributed to decline in operating efficiency. Thus, gender diversity considered separately had insignificant moderating effect on the relationship between financial structure and operating efficiency. However, based on the results of model 2 and 3 adjusted (R^2) had changed after inclusion of the moderator, therefore, the null hypothesis was rejected.

5.2.3:2 Moderating Effect of Age Diversity on the Relationship between Financial Structure and Operating Efficiency

The classification of the age of board members was in three bands: up to 35 years, above 35 years but up to 65 years, and above 60 years. The Shannon index formula computed the age diversity index (Appendix VIII). Referring to descriptive statistics in chapter four, the age diversity had positive skewness, while the mean age diversity index was very low, an indication of the dominance of board members of the same age category. This section presents

the effect of age diversity when moderated the association between financial structure and operating efficiency. The moderation test involved regressing the financial structure components and age diversity in regression model 2; and the regressing of financial structure, age diversity, and the interactive term was computed after the centering of the variables as presented in model 3. The results for the moderating effect of age diversity are presented in Table 5.6.

Table 5.6: Regression Results for the Moderating Effect of Age Diversity

	Model 1 CRS_TE	Model 2 CRS_TE	Model 3 CRS_TE
Share Capital	0.0429**	0.0430**	0.0336*
	(0.007)	(0.007)	(0.051)
Institutional Capital	0.00803*	0.00810*	-0.0398
	(0.011)	(0.011)	(0.243)
Members Deposits	-0.0127**	-0.0127**	-0.0194***
	(0.002)	(0.002)	(0.000)
Non-Interest bearing Liabilities	0.000202	0.000195	0.00977**
	(0.816)	(0.822)	(0.031)
Interest Bearing	-0.00131	-0.00129	-0.00209
	(0.589)	(0.595)	(0.731)
Age Diversity		-0.00399	0.0177
		(0.836)	(0.607)
Interaction Term (share capital * Age Diversity)			-0.147
			(0.101)
Interaction Term (Institutional capital *Age Diversity)			0.186
			(0.119)
Interaction Term (Members Deposit *Age Diversity)			-0.0177
			(0.455)
Interaction Term (Non-interest Bearing *Age Diversity)			-0.0353**
			(0.026)
Interaction Term (Interest Bearing *Age Diversity)			0.00706
			(0.826)
Constant	0.773***	0.774***	0.771***
	(0.000)	(0.000)	(0.000)
Observations	435	435	435
R^2	0.064	0.064	0.099
Adjusted R^2	0.053	0.051	0.076
F-Stat	5.862	4.881	4.24
Degrees of Freedom	(5, 429)	(6, 428)	(11, 423)
P-value of F stats	0.0000	0.0001	0.0000

P-values in parentheses * *indicates level of significance* * p<0.10, ** p<0.05, *** p<0.01

As shown in Table 5.6, model 2 results reveal that age diversity was an insignificant variable in the moderation of the relationship between financial structure and operating efficiency (β=

-0.00399, p>0.10 (0.836). This suggests that age diversity is not a key attribute to be prioritized when constituting a balanced board. Even after incorporating the interaction term (components of financial structure*age diversity) in the third model, the interaction terms were insignificant except for non-interest-bearing liabilities (β = -0.0353, p < 0.0026 (0.000) which was statistically significant at 5 percent.

The findings point to a negative relationship between non-interest bearing liabilities and operating efficiency, implying that an improvement in age diversity could lead to negative changes in operating efficiency. However, despite the interaction term being negative and insignificant, there was a significant change in adjusted (R^2) to 7.6%, as observed in model 3, from a down of 5.3% in model 2. This demonstrates that moderation had occurred because of the observed adjusted R^2 change after addition of the interaction term in the model. It is hence concluded that age diversity caused the relationship between financial structure and operating efficiency to change, and based on R^2, we reject the null hypothesis.

5.2.3.3 Moderating Effect of Ethnic Diversity on the Relationship between Financial Structure and Operating Efficiency

Ethnic diversity refers to the distribution of board members by the tribe. This was an attribute of board diversity. The distribution of ethnic groups spread across 13 tribes in all housing co-operatives. In computing the ethnic diversity index, the Shannon index formula was used (Appendix VIII). According to the descriptive statistics in chapter four, the ethnic distribution was moderate and negatively skewed, the implication being that there was unequal representation across the boards of housing co-operatives by tribe. The variables were first centered then interaction term computed and thereafter included in model 3. The moderating effect of ethnic diversity on the relationship between financial structure and operating efficiency is in the regression models presented in Table 5.7.

Table 5.7: Regression Results for the Moderating Effect of Ethnic Diversity

	Model 1 CRS_TE	Model 2 CRS_TE	Model 3 CRS_TE
Share Capital	0.0429**	0.0432**	0.0125
	(0.007)	(0.006)	(0.478)
Institutional Capital	0.00803*	0.00768*	0.0844**
	(0.011)	(0.017)	(0.040)
Members Deposits	-0.0127**	-0.0122**	-0.0491***
	(0.002)	(0.003)	(0.000)
Non-Interest bearing Liabilities	0.000202	0.000232	0.00612*
	(0.816)	(0.789)	(0.081)
Interest Bearing	-0.00131	-0.00128	-0.0116
	(0.589)	(0.599)	(0.295)
Ethnicity Diversity		-0.00673	0.0527**
		(0.542)	(0.026)
Interaction Term (share capital *Ethnicity Diversity)			0.0929
			(0.233)
Interaction Term (Institutional Capital * Ethnicity Diversity)			0.113**
			(0.038)
Interaction Term (Members Deposit * Ethnicity Diversity)			0.0695***
			(0.010)
Interaction Term (Non-interest Bearing * Ethnicity Diversity)			0.0139**
			(0.037)
Interaction Term (Interest Bearing * Ethnicity Diversity)			0.0221
			(0.297)
Constant	0.773***	0.778***	0.776***
	(0.000)	(0.000)	(0.000)
Observations	435	435	435
R^2	0.064	0.065	0.119
Adjusted R^2	0.053	0.052	0.096
F-Stat	5.862	4.939	5.20
Degrees of Freedom	(5, 429)	(6, 428)	(11, 423)
P-value of F stat	0.0000	0.0001	0.0000

P-values in parentheses * *indicates level of significance* * p<0.10, ** p<0.05, *** p<0.01

Model 2 results (shown in Table 5.7) indicate that ethnic diversity had a no significant moderating effect (β= -0.00673, p>0.05 (0.542) when it was estimated on the association

between financial structure and operating efficiency. The findings infer that an increase in ethnic diversity index by an index of the ethnic group could only affect operating efficiency by chance. Nonetheless, after inclusion of the interaction term (components of financial structure* ethnic diversity) in model 3, beta coefficient changed from non-significant to positive significant effect (β= 0.0527, p<0.05 (0.026). Based on the findings it is inferred that an effort to enhance equity in ethnic representation would cause operating efficiency to increase by 0.0527 units. Similarly, adjusted R^2 in model 2 changed from 5.2 % to 9.6 % in model 3, suggesting that moderation had occurred. In conclusion, findings in model 2 demonstrate that ethnic diversity was an important attribute in contributing to operating efficiency. Overall, when the interaction term was added to model 3, the interaction terms coefficient were significant except for share capital and interest-bearing liabilities. But overall the adjusted R-squared improved; accordingly, it can be concluded that ethnic diversity caused operating efficiency to change due to associated effect of the moderator on financial structure since reported R-squared changed, therefore, the null hypothesis was rejected.

5.2.3:4 Moderating Effect of Board Experience Diversity on the Relationship between Financial Structure and Operating Efficiency

Board experience was an attribute of board competence. The members' experience was divided into two tiers: those board members with experience of up to 3 years, and those with above 3 years of board experience. The Shannon index formula calculated the board experience index (Appendix VIII). The analysis of descriptive statistics in chapter four showed that the board experience index was moderate and negatively skewed. The majority of the board members had up to three years of board experience. The regression results of the moderating effect of board experience are shown in Table 5.8.

Table 5.8: Regression Results for the Moderating Effect of Board Experience Diversity

	Model 1	Model 2	Model 3
	CRS_TE	CRS_TE	CRS_TE
Share Capital	0.0429**	0.0463**	0.0455***
	(0.007)	(0.003)	(0.004)
Institutional Capital	0.00803*	0.00676*	0.0160*
	(0.011)	(0.031)	(0.057)
Members Deposits	-0.0127**	-0.00932*	-0.0231***
	(0.002)	(0.022)	(0.002)
Non-Interest bearing Liabilities	0.000202	0.000251	0.00204
	(0.816)	(0.768)	(0.210)
Interest Bearing	-0.00131	-0.000875	-0.00502
	(0.589)	(0.714)	(0.539)
Board Experience		0.0695***	0.0156
		(0.000)	(0.767)
Interaction Term (share capital * Board Experience Diversity)			-0.0862
			(0.587)
Interaction Term (Institutional capital * Board Experience Diversity)			0.120
			(0.174)
Interaction Term (Members Deposit * Board Experience Diversity)			-0.0156
			(0.572)
Interaction Term (Non-interest Bearing * Board Experience Diversity)			-0.0467
			(0.137)
Interaction Term (Interest Bearing * Board Experience Diversity)			-0.00669
			(0.629)
Constant	0.773***	0.772***	0.774***
	(0.000)	(0.000)	(0.000)
Observations	435	435	435
R^2	0.064	0.100	0.119
Adjusted R^2	0.053	0.087	0.096
F-Stat	5.862	7.890	5.21
Degrees of Freedom	(5, 429)	(6, 428)	(11, 423)
P- value of F-stat	0.0000	0.0000	0.0000

P-values in parentheses * *indicates level of significance* * p<0.10, ** p<0.05, *** p<0.01

Model 2 results (in Table 5.8) are clear that board experience diversity was statistically significant at 1% level of significance (β= 0.0695, p<0.01 (0.000) in contributing to changes in operating efficiency. As a result, an increase in board member's experience by one unit (one year) caused operating efficiency to increase by 0.0695 units, and adjusted R^2 changed from 5.3 % in model 1 to 8.7 % in model 2.

After including the interaction term (components of financial structure*board experience) in model 3, the board experience diversity reported insignificant effect, β= 0.0156, p>0.01 (0.767). In addition, all other interaction terms were also insignificant, though adjusted R^2changed from 8.7 % to 9.6 % after inclusion of the interaction term. This is an indication that despite insignificant effect of individual interaction terms in model 3, the board member experience contributed to increasing (R-squared) of the effect of variables in explaining the operating efficiency, thus moderation had occurred. We, therefore, reject the null hypothesis because board member experience had an effect on the changes in the financial structure in predicting operating efficiency.

5.2.3:5 Moderating Effect of Education Diversity on the Relationship between Financial Structure and Operating Efficiency

The classification of board member level of education was by the highest level of academic qualification. The board members' level of education was in the following four levels: primary, secondary, diploma/certificate, and degree. To compute the education diversity index, the Shannon index formula was applied (Appendix VIII). The results of the descriptive statistics in chapter four indicated a moderately skewed index toward a university degree. This section looks at the effect of education diversity as a moderator on the association between financial structure and operating efficiency. An interaction term was computed for financial structure components and education diversity by way of centering the variables. Table 5.9 depicts the regression results of the moderating effect of education diversity.

Table 5.9: Regression Results for the Moderating Effect of Education Diversity

	Model 1	Model 2	Model 3
	CRS_TE	CRS_TE	CRS_TE
Share Capital	0.0429**	0.0443**	-0.0110
	(0.007)	(0.005)	(0.601)
Institutional Capital	0.00803*	0.00695*	-0.00492
	(0.011)	(0.031)	(0.881)
Members Deposits	-0.0127**	-0.0117**	-0.0261***
	(0.002)	(0.004)	(0.000)
Non-Interest bearing Liabilities	0.000202	0.000278	0.0200***
	(0.816)	(0.747)	(0.000)
Interest Bearing	-0.00131	-0.00118	-0.00892
	(0.589)	(0.626)	(0.343)
Education Diversity		0.0217*	0.00481
		(0.069)	(0.791)
Interaction Term (share capital * Education Diversity)			0.0378
			(0.454)
Interaction Term (Institutional capital * Education Diversity)			-0.165***
			(0.002)
Interaction Term (Members Deposit * Education Diversity)			0.00792
			(0.454)
Interaction Term (Non-interest Bearing * Education Diversity)			-0.0324***
			(0.000)
Interaction Term (Interest Bearing * Education Diversity)			-0.0156
			(0.447)
Constant	0.773***	0.773***	0.775***
	(0.000)	(0.000)	(0.000)
Observations	435	435	435
R^2	0.064	0.071	0.120
Adjusted R^2	0.053	0.058	0.098
F-Stat	5.862	5.463	5.26
Degrees of Freedom	(5, 429)	(6, 428)	(11, 423)
P- value of F-stat	0.0000	0.0000	0.0000

P-values in parentheses * *indicates level of significance,* * p<0.10, ** p<0.05, *** p<0.01

Model 2 results (shown in Table 5.9) point to a significant moderation effect of education diversity (β= 0.0217, p < 0.10 (0.069). However, after the inclusion of the interaction term in the regression model, the effect became insignificant (β= 0.00481, p>0.10 (0.791). The findings indicate that improving the level of board members' education diversity did contribute to insignificant effect on operating efficiency. Nevertheless, the R^2 changed from 7.1% in model 2 to 12% in model 3, inferring that education diversity caused an increase in the predictive power of financial structure on operating efficiency, therefore moderation had occurred thus the null hypothesis was rejected.

5.2.4 Combined Effect of Financial Structure, Asset Structure, and Board Demographics on Operating Efficiency

The fourth objective of this study examined the combined effect of financial structure, asset structure, and board demographics on operating efficiency. The calculation of board demographics index was based on the Shannon index (H) of diversity formula, which provided the overall distribution of attributes of board members collapsed into a composite index, the board demographics index. Nevertheless, the individual indices were loaded into a multiple regression to ascertain the combined effect. The interpretation of regression results was with respect to descriptive statistics in chapter four. To this end, the study adopted a regression-based framework to test the following null hypothesis:

H_{04} The combined effect of financial structure, asset structure, and board demographics on operating efficiency of housing co-operative societies in Nairobi City County is not significant.

The prediction equation as shown in chapter three is:

$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$; note*: The variables are as defined in section* 3.8.2.1

A multiple regression model estimated the combined effect of financial structure, asset structure, and board demographics on the operating efficiency of housing co-operative societies. Models 1, 2 and 3 are a precursor to model 4 which were derived from null hypothesis one two and three. Model 4 combined all the individual components of the variables of the study to explain the hypothesised relationship. The results of the regression analysis of all independent variables are displayed in Table 5.10.

Table 5.10: Regression Results for the Combined Effect of Financial Structure, Asset Structure, and Board Demographics on Operating Efficiency

	Model 1	**Model 2**	**Model 3**	**Model 4**
	CRS_TE	**CRS_TE**	**CRS_TE**	**CRS_TE**
Share Capital	0.0429**	0.0262	0.0527***	0.0360*
	(0.007)	(0.108)	(0.001)	(0.026)
Institutional Capital	0.00803*	0.0199	0.00632*	0.0122
	(0.011)	(0.084)	(0.048)	(0.285)
Members Deposits	-0.0127**	-0.0210**	-0.00948*	-0.0198**
	(0.002)	(0.002)	(0.019)	(0.003)
Non-Interest bearing Liabilities	0.000202	0.000138	0.000271	0.000302
	(0.816)	(0.874)	(0.748)	(0.722)
Interest Bearing	-0.00131	-0.000178	-0.000868	-0.000164
	(0.589)	(0.944)	(0.715)	(0.948)
Asset Tangibility		-0.00915		-0.00505
		(0.232)		(0.505)
Asset liquidity		0.0295***		0.0284***
		(0.000)		(0.000)
Age Diversity			-21.40	-25.22
			(0.232)	(0.156)
Gender Diversity			-21.49	-25.31
			(0.230)	(0.154)
Board Experience Diversity			64.16	75.63
			(0.233)	(0.156)
Ethnicity Diversity			-21.38	-25.21
			(0.233)	(0.156)
Education Diversity			0.0262*	0.0258*
			(0.041)	(0.042)
Constant	0.773***	0.774***	0.816***	0.814***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	435	435	435	435
R^2	0.064	0.096	0.119	0.147
Adjusted R^2	0.053	0.081	0.098	0.123
F-Stat	5.862	6.448	5.728	6.072
Degrees of Freedom	(5, 429)	(7, 427)	(10, 424)	(12, 422)
P-value of F stat	0.0000	0.0000	0.0000	0.0000

P-values in parentheses* *indicates level of significance,* * p<0.10, ** p<0.05, *** p<0.01

The results (as shown in Table 5.10) of the combined effect of the variables of the study in model 4. The findings reveal that R^2 increased from 6.4% in model 1 to 14.7% in model 4. In

addition, model 4 was statistically fitted, F (12, 422) = 6.072, p<0.01 (0.0000). The results lead to the inference that the combined effect of financial structure, asset structure, and board demographics on operating efficiency was statistically significant since R^2 varied with the loading of explanatory variables in the model. As a result, the null hypothesis was rejected. The findings indicate that share capital, members' deposits, asset liquidity, and level of education were statistically significant and caused the financial structure to change the explanatory power (R^2) of the model. Consequently, the combined regression was re-examined to include only the significant coefficients in the model:

In conclusion, Table 5.10 provides results that culminated in the interpretation of the regression models in Table 5.11.

Table 5.11: Summary of Statistical Tests of Hypotheses and Interpretation of Results

Research Objective	Hypothesis	Results	Remarks
Objective 1: Determine the relationship between FS and OE of housing co-operative societies in Nairobi City County, Kenya.	The relationship between FS and OE of housing co-operative Societies is not significant	The relationship between financial structure and operating efficiency had a statistically significant effect. Adjusted R^2 =.0.053 F (5, 429) = 5.862, p < 0.01 (0.000)	Rejected the null hypothesis
Objective 2: Establish the mediating effect of AS on the relationship between FS and OE of housing co-operative societies in Nairobi City County, Kenya.	The mediating effect of AS in the relationship between FS and OE of housing co-operative societies is not significant.	Asset structure had a statistically significant mediating effect on the relationship between financial structure and operating efficiency. Adjusted R^2 = 0.081 F (7, 427), 6.448, p < 0.01 (0.0000)	Rejected the null hypothesis
Objective 3: Assess the moderating effect of BD on the relationship between FS and OE of housing co-operative societies in Nairobi City County, Kenya	The moderating effect of BD on the relationship between FS and OE of housing co-operative societies is not significant	Board demographics had a significant moderation effect on the relationship between financial structure and operating efficiency. Adjusted R^2 = 0.098 F (10, 424), 5.728, p < 0.01 (0.0000)	Rejected the null hypothesis
Objective 4: Determine the combined effect of FS, AS and BD on OE of housing co-operative societies in Nairobi City County, Kenya	The combined effect of FS, AS, and BD on OE of housing co-operatives societies is not significant.	The combined effect of financial structure, asset structure and board demographics had a statistically significant operating efficiency. Adjusted R^2 = 0.123 F (12,422), 6.072 p < 0.01 (0.0000)	Rejected the null hypothesis

5.3 Discussion of Findings

This section presents discussions of the research findings for each specific research objective and corresponding hypothesis. The discussions of research findings are in reference to descriptive statistics and hypotheses tested in chapters four and five, respectively. The general objective for this study was to establish the effect of asset structure and board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies in Nairobi City County, Kenya. The subsequent sections outline the discussions of research findings for each specific objective of the study.

5.3.1 Operating Efficiency

The data envelopment analysis as linear programming based mathematical tool was used to calculate the efficiency scores for 87 housing co-operatives over a five-year period. During the study period, 435 observations were recorded. The study used unbalanced panel data using a pooled ordinary least square method. Operating efficiency was estimated using DEA model for which the results for the technical efficiency scores are presented in Appendix VI. According to the findings, three efficiency scores were obtained through DEA; crs-te/technical efficiency, variable return to scale technical efficiency/pure technical efficiency and scale efficiency. The regression analyses used technical efficiency scores for 435 observations over the five-year period since it is a standard measure for operating efficiency. The pure technical efficiency and scale efficiency are products of the decomposition of technical efficiency and provided information about the causes and sources of inefficiencies across housing cooperatives.

5.3.2 Financial Structure and Operating Efficiency

In its first objective, this study set out to find the connection between financial structure and operating efficiency of housing co-operative societies. The hypothesis derived from the objective was to establish whether the relationship between financial structure and operating efficiency of housing co-operative societies was not significant. Considering the level of capitalization relative to the nature of functions of the decision-making units, most housing co-operatives were undercapitalised with 64.60 % having a share capital and reserves of less than sh. 2 million. The current cost of land and building of a house in Nairobi County is far above the equity contributed by members.

The results indicate that share capital and institutional capital were positively significant whilst members' deposits had an inverse relationship with operating efficiency. This communicates that co-operatives should focus on increasing financing through shareholder funds and less from members' deposits. The findings support the pecking order theory's claim that firms usually prefer internally generated funds (Myers & Majluff, 1984), suggesting that the appropriate financing mix will contribute to operating efficiency.

In establishing association between the financial structure and operating efficiency, simple and multiple linear regression analysis were use. The results from the six models insinuated that housing co-operatives were holding excess members' deposits, which caused operating efficiency to decline. Even after regressing all the components jointly on operating efficiency, the significant effect of the variables remained steady except for non-interest-bearing that turned insignificant. Interest bearing had an insignificant relationship with operating efficiency even model 6 reported insignificant results based on the coefficients.

The kurtosis values infers that the preferred choice for sources of finances were institutional capital and non-interest-bearing liabilities. This signifies that the hierarchy of financing followed the pecking order theory (Myers & Majluff, 1984) and that the management could be averse to interest-bearing liabilities, resulting in low external monitoring of the management.

This study's findings are consistent with Hailu et al.'s (2007) that co-operatives with sufficient equity capital in the financial structure exhibited variations in the cost efficiency and improved their efficiency. However, the findings contradict Worthington (1999) who established that credit unions using commercial loans were relatively more efficient. The findings of this study reported an insignificant relationship between interest-bearing liabilities and operating efficiency and also contradicted results of Vo and Nguyen (2014) which indicated that high proportion of debt financing compels managers to minimize perquisites (inputs) which propel efficiency. Nevertheless, the results indicate that increased debt uptake was inversely related to operating efficiency though insignificant. Thus, the regression results rejected the null hypothesis H_{0^1} that financial structure had a significant association with operating efficiency across housing co-operative societies.

5.3.3 Financial Structure, Asset Structure and Operating Efficiency

The study's second objective was to establish the mediating effect of asset structure in the relationship between financial structure and operating efficiency of housing co-operative societies. The study hypothesized that the mediating effect of asset structure in the relationship between financial structure and operating efficiency of housing co-operative societies was not significant. The findings indicate that changes in each element (asset tangibility and asset liquidity) of asset structure significantly accounted for the variation in the operating efficiency, the findings pointed to changes in adjusted R-squared when the mediator was included in the model thus signifying mediation had taken place. The asset tangibility and asset liquidity did cause financial structure to contribute to an increase in operating efficiency. This was contrary to asset structure that had a non-significant effect consequently suggesting the synergetic effect of the two components of assets did not have any effect on financial structure in predicting operating efficiency.

The findings depicted that a high level of asset liquidity influenced changes in financial structure that ultimately contributed to significant changes in operating efficiency. The findings agreed with Sibilkov's (2009) assertion that asset liquidity supports the view that the cost of financial distress and inefficient liquidation are economically important since they affect capital structure decision. Even so, on regressing the asset liquidity together with the components of financial structure, the findings revealed a positive significant association that was more robust compared to that asset tangibility. The rationale for the robust effect of asset liquidity relies on the idea that less liquid assets have higher cost that increases the costs of liquidation and debt.

According to the findings, when cash and cash equivalent are isolated from the components of financial structure, the significant influence of the model became weak, signifying that firms that are endowed with cash do not borrow or source for credit facilities. These findings contradict Rajan and Zingales (1995) who were of the view that firms with high levels of asset liquidity negotiate better interest rates leading to increased performance. Still, the synergy of components of financial structure and asset liquidity improved the R-squared. However, one needs to evaluate the role of the attitude of management, agency costs, and information asymmetry on the choice of assets.

Further, the findings disagree with Fukuyama's (1996) study, which established that pure technical inefficiency improved when credit co-operatives' asset size increased. In conclusion, housing co-operatives are holding idle assets. Any additional asset tangibility would worsen operating efficiency. Despite this, the predictive power of the model (R-squared) improved when the components of the asset structure were added to the regression model in predicting operating efficiency.

5.3.4 Financial Structure, Board Demographics and Operating Efficiency

The third objective of this study assessed the moderating effect of board demographics on the relationship between financial structure and operating efficiency of housing co-operative societies. The study hypothesized that the moderating effect of board demographics on the relationship between financial structure and operating efficiency was not significant. Diverse attributes defined the characteristics of board demographics that confirmed the strength and direction of the relationship between financial structure and operating efficiency.

Building on the analysis of board demographics, the indices computed for each attribute of board diversity and board competence were used in the regression model together with components of financial structure and asset structure. The findings revealed that reducing inequality in gender diversity (male dominance) contributed to a decrease in operating efficiency. Given that board representation was skewed towards male members, the findings imply that increasing female representation in the boards would contribute to a reduction in operating efficiency. The results pointed to an inverse causal relationship between gender diversity evenness and operating efficiency. As shown in the results, changes resulting in enhanced gender equality caused a decrease in operating efficiency. The findings, therefore, suggest that variation of gender diversity contributed to changes in operating efficiency. As a result, housing co-operatives should pay little attention to gender representation in the boards, since the perceived diverse management practices brought by gender diversity appear not to improve co-operative performance.

The next stage of the analysis was on age diversity, regarding which the findings revealed that age diversity was an insignificant attribute. Referring to the descriptive statistics of this study, the highest prevalence of board members was in the age bracket of 35-60 years; exhibiting higher dominance relative to gender diversity. The findings indicate that changes in board

membership by one age bracket did not have any implications on the variations in operating efficiency. The results imply that board members in the age bracket of 35-60 years could be in the prime age of ideal board member or alternatively age is not relevant when constituting boards of directors. Therefore, the findings on age diversity provide very little evidence in failing to reject hypothesis three.

The ethnic diversity of boards varied across housing co-operatives. Broadly, the pattern of cross-sector variation in ethnic diversity was less pronounced in comparison to that found for gender and age diversity. The findings concur with those of a study by Brammer, Millington, & Pavelin (2007) that ethnic diversity was relatively consistent across the sectors and less pronounced among executive positions. The aspect of ethnicity consideration did not have any causal effect on operating efficiency. Although upon inclusion of interaction term, a variation in the coefficient was observed thus signalling that ethnic diversity had a contributory effect on the financial structure in predicting operating efficiency. Taken together, these findings for board ethnic diversity provide very little insight in support of the hypothesis.

In contrast, the board diversity for the three attributes established that gender diversity was the most significant attribute that influenced operating efficiency. Nevertheless, despite ethnic diversity having the highest mean diversity index, it had a moderate contribution in comparison to other board diversity attributes. The implication here is that ethnic diversity evenness was not a key attribute in influencing operating efficiency. These findings are consistent with Ramly et al.'s (2015) contention that gender diversity on bank efficiency had a significant negative effect on cost and profit efficiency. On the other hand, the findings differ with Ekadah and Mboya (2011) who found that gender diversity had no effect on the performance of banks in Kenya. This places diversity of board members in terms of age and ethnicity as an unimportant attribute in the election of the board of directors of co-operative societies.

The study also focused on board competence diversity, whose attributes were board experience and education background. The Shannon index formula computed board experience index and board education index. Referring to descriptive statistics in chapter four, the dominance group for board experience were board members with up to three years in the board and the level of education by those with a university degree. The findings indicated that the effect of board experience contributed to changes in the relationship between financial structure and operating

efficiency. The results showed that R-squared changed by 1.9% upon inclusion of the interaction term. This indicates that board experience caused positive changes in the overall in explaining operating efficiency. This denotes that board experience caused the relationship between the financial structure and the total revenue to vary. Therefore, the experience of a board member is a key attribute that should be considered when electing board members of housing co-operatives.

Nevertheless, board education level had a positive causal effect since adjusted R- squared increased at a higher percentage even though the beta coefficient for education diversity had weakened the relationship between the financial structure and operating efficiency. Descriptive statistics in demonstrated that board experience had an index a moderate index that was higher than education diversity, hence showing less dominance in board experience over education diversity. The findings are clear that board experience contributed to changes compared to that of board education level in the relationship between financial structure and operating efficiency. Besides, the regression analysis results for board education level indicate that a one-unit increase in the level of education would contribute to an increase in operating efficiency. However, from the perspective of an index for education level, enhancing education diversity in boards improved efficiency. The findings seem to infer a broad-based board representation with evenness of individuals with different levels of education. This was found to contribute to higher operating efficiency. Consequently, emphasis on board members' education diversity abundance (evenness) is key for a successful housing co-operative society.

The results showed a great increase in operating efficiency, and the findings indicated that a significant change in adjusted R-squared increased. This is pointing to the presence of synergy on the combination of financial structure, asset structure, and board demographics in explaining the variation of operating efficiency. In addition, in relation to the other component of board demographics, which was board competence (member education and board experience), the results reported a statistically positive significant moderating effect. This suggests that firms intending to increase efficiency should pay more attention to attributes of the board member's education level and board experience, but less on gender, age and ethnic diversity.

Findings for gender diversity differ with that of Ekadah and Mboya (2011) who found no effect of gender diversity on the performance of commercial banks in Kenya. Further, the findings contradict the results of Mwangi (2014) who did not find any significant relationship between management competence and the efficiency of Saccos. On the other hand, the findings concur with Darmadi's (2013) argument that CEOs with university education performed significantly better than those who did not have university degrees.

From the critical point of the review, the interaction term for financial structure and board diversity and/or financial structure and board competence revealed changes in operating efficiency. The election of board members based on gender diversity should not take precedence because increasing equity in gender representation has a negative influence on operating efficiency. Age diversity and ethnic diversity should not have been more prominence since they have insignificant effect as moderators despite ethnic diversity turning significant upon inclusion of the interaction term, implying complete moderation had taken place. Therefore, the focus should be on the board experience and education background. Housing co-operatives should build capacity by equipping board members with adequate education and experience.

5.3.5 Financial Structure, Asset Structure, and Board Demographics on Operating Efficiency

The fourth and last objective of this study examined the combined effect of financial structure, asset structure, and board demographics on operating efficiency of housing co-operative societies in Nairobi City County, Kenya. The null hypothesis tested, established whether the combined effect of financial structure, asset structure, and board demographics on operating efficiency was not significant. It is from this background the study tested whether the combined effect of the variables of the study was non-significance on operating efficiency.

The overall findings of the combined effect of the variables of the study point out that the combined effect was statistically significant. All the variables (financial structure, asset structure, and board demographics) cumulatively contributed to the highest adjusted (R^2) variation in explaining operating efficiency. This is clear that with the loading of an additional variable into the model, the reported R^2 was increasing and the combined effect was statistically significant, thus the null hypothesis was rejected.

In summary, the findings indicate that institutional capital, non-interest bearing liabilities, interest-bearing, and asset tangibility were not significant. This also includes the attributes of gender, age, ethnic diversity, and board member experience. Therefore, making the attributes unimportant when selecting board members. However, share capital, members' deposits, asset liquidity and board member level of education had a significant effect. Also, as alluded earlier in this chapter, there is a need to establish an institutional framework that will increase the board competence' index abundance or evenness across the boards of housing co-operative societies.

CHAPTER SIX

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

6.1 Introduction

The study sought to establish the relationship among the financial structure, asset structure, board demographics, and operating efficiency of housing co-operatives in Nairobi City County in Kenya. This chapter presents the following: a discussion of the summary of the study findings for each null hypothesis; the study conclusion and implications; recommendations; a discussion of the study's contribution to knowledge and theory, managerial policy and practice; and finally, the study limitations and suggestions for further research.

6.2 Summary of Findings

The focus of the study was housing co-operative societies operating in Nairobi County, Kenya. The general objective was to establish the effect of asset structure and board demographics on the relationship between financial structure and operating efficiency of housing co-operatives in Nairobi City County, Kenya. The specific objectives derived from the theoretical and empirical literature reviewed guided in the development of null hypotheses. The test of the null hypotheses were per each objective of the study.

The study's descriptive statistics have indicated that the number of members per housing co-operatives was very few with; the majority of the co-operatives had more than 150 members. This signifies that most of the co-operatives were operating as large enterprises. Additionally, the financial structures were significantly distinct across housing co-operatives, with most of the co-operatives reporting a negative institutional capital over the five-year period. Equally, asset tangibility and asset liquidity were different across the housing co-operatives. Despite this, the analysis of attributes of board members were similar across the majority of the housing co-operatives' boards, an observation supporting the theory of social capital: the theory fosters broad participation of people - belonging to the local communities - in the democratic development of their areas.

The data were analysed in two stages: the DEA and regression analysis. The DEA output reported efficiency scores of 435 observations for 87 housing co-operatives. The technical efficiency scores, decomposed into pure technical efficiency and scale efficiency, established the causes and sources of inefficiencies of the housing co-operatives. Overall, the study determined that the mean score for technical efficiency was 67.76%, pure technical efficiency had a mean score of 76.65%, and that for scale efficiency was 88.62%. The inference drawn from this is that housing co-operatives were inefficient across the three spectrums of efficiency measurements.

In terms of technical efficiency, housing co-operatives could reduce inputs by 32.24% or employ 67.76% of inputs while earning the same output (total revenue). Referring to pure technical efficiency, the co-operatives suffered from poor management and operated at the wrong size. The results indicate that management could cut wastages of resources by 23.35% and similarly reduce the scale of operations by 11.38% yet still generate similar output. Additionally, the co-operatives suffered from diseconomies of scale; the results indicated that 25.29% of the co-operatives experienced decreasing returns to scale, 70.11% suffered from increasing returns to scale, and 4.6% operated at constant returns to scale. This implies that co-operatives had unequal inputs and outputs, something that contributed to scale inefficiencies. The standard measure for operating efficiency was by technical efficiency, and therefore the study applied technical efficiency scores (crs-te) in the regression model as an outcome variable in the stage-two analysis.

The study answered four research questions stated in the form of null hypotheses. The first null hypothesis, (H_{01}) tested the relationship between financial structure and operating efficiency. Simple linear regression tested the hypothesis that the relationship between financial structure and operating efficiency was not significant. The findings indicated a significant and positive effect of financial structure in explaining the variation in operating efficiency. Nonetheless, non-interest-bearing liabilities and interest-bearing liabilities had an insignificant and negative effect on operating efficiency. Finally, financial structure generally contributed to significant variation in operating efficiency; therefore, the null hypothesis was rejected.

The second null hypothesis, (H_{02}) of the study established the mediation effect of asset structure in the relationship between financial structure and operating efficiency. The results revealed that asset structure mediated financial structure and as a result, the null hypothesis was rejected. The regression result specified that asset tangibility and asset liquidity had a mediation relationship between financial structure and operating efficiency. In addition, the R-squared pointed out a significant change upon inclusion of asset structure as a mediator in the model; consequently, the null hypothesis was rejected.

The third null hypothesis (H_{03}) followed the stepwise regression analysis the moderating effect of board demographics on the relationship between financial structure and operating efficiency. The board diversity comprising gender, age, and ethnicity while board competence was board members experience and board member level of experience. The regression results showed that adjusted R^2 varied when the interaction term of the attributes of board demographics were included in the models. Besides, the findings indicated that the moderation effect of board demographics' attributes contributed to an increase in adjusted R-squared. Accordingly, the null hypothesis was rejected. This denotes that the board demographics' attributes play a key part in operating efficiency.

The fourth null hypothesis (H_{04}) analysed the combined effect of financial structure, asset structure, and board demographics on operating efficiency. The multiple linear regression analysis tested the ensuing null hypothesis, with the regression results disclosing that the mixture of the predictor variables greatly increased R^2 in contrast to individual models. The coefficient of determination (R^2) in the model (1) was 5.3%; 8.1% in model (2); model (3) had 9.8% and finally, model (4) - which combined all the variables - had R^2 of 12 .3% at 5% level of significance. For this reason, the effect was greater than the individual effect of financial structure, asset structure, or board demographics on operating efficiency. Therefore, the null hypothesis was rejected.

6.3 Conclusion and Implications

The general objective of this study determined the effect of asset structure and board demographics on how they affect the relationship between financial structure and operating efficiency of housing co-operative societies. The pecking order theory (Myers & Majluff, 1984) was the anchoring theory for the study. Other theories underpinning this study were

agency theory (Jensen & Meckling, 1976), and the theory of social capital (Lin, 1982). The study aimed to bridge the knowledge gaps (conceptual, contextual, and methodological) observed from the past empirical literature. For its research orientation, the study chose positivism philosophy and had descriptive research as the study design. The study focus was on all housing co-operatives registered in Nairobi City County, a county that has the highest level of concentration of housing co-operatives, hence a good representation of the country's population. The theories and quantitative nature of the study and the testing of the hypotheses influenced the choice of positivism philosophy.

As mentioned in the preceding section, the DEA model results established the root sources of inefficiencies across the housing co-operative societies in Nairobi City County. The findings exhibited technical efficiency scores of the sample housing co-operative societies that were not optimum. Consequently, the DMUs can reduce inputs by 32.24%, while at the same time generating the same revenue. The findings revealed that 95.4% of DMUs operating in Nairobi City County, Kenya were technically inefficient, the implication being that they were operating at both increasing returns to scale or at decreasing returns to scale, probably because of poor management and wrong scale of operation.

Based on the findings of the DEA-technical efficiency scores were used as dependent variable; where the study established the effect of asset structure and board demographics in explaining the relationship between financial structure and operating efficiency. The conclusion and implications of the study is discussed below.

The study discovered the relationship between financial structure and operating efficiency was positive and significant. Specifically, an increase in core capital would contribute to an increase in operating efficiency. This suggests that co-operatives with sound share capital and institutional capital would contribute to better operating efficiency. In addition, non-interest-bearing liabilities had a positive significance effect, whereas, for interest-bearing liabilities, the relationship with operating efficiency was negative and insignificant. This notwithstanding, the proportion of member's deposits was significant though inversely related to operating efficiency.

Analysis of the effect of mediation of asset structure on the relationship between financial structure and operating efficiency disclosed that asset tangibility and asset liquidity contributed to the association between financial structure and operating efficiency. This leads to the inference that sound asset base would lead to sound financial resources, hence a basis for seeking or negotiating cheap loans by housing co-operatives that have ideal asset structure. In light of this, the costs of acquiring and retaining loans would decrease; therefore, a rise in performance. Accordingly, the loan portfolio would compel the management to exercise caution because of debt covenants, which, if violated, the result would be liquidation. This will cause the management to utilize the inputs efficiently.

Regarding the effect of board demographics in moderating the relationship between financial structure and operating efficiency, the study discovered that the change in magnitude of board demographics had a significant moderation effect on the relationship of the aforementioned. Specifically, the diversity of gender, ethnicity, board experience, and board education significantly moderated the relationship between financial structure and operating efficiency. Conversely, age did not have any significant moderating outcome. Based on the Shannon index of diversity, the gender diversity results indicated a disproportionate representation; as the diversity index increased, inferring bridging the inequality across gender, there was a significant decrease in operating efficiency. This implies that enhancing gender equality across the boards of housing co-operatives would lead to a decline in operating efficiency.

On the moderating effect of ethnic diversity, the results revealed that an attempt to improve equity in ethnic representation would lead to a decrease in operating efficiency. The indication here is that enhancing the existing ethnic equity representation in the housing co-operatives' boards would lead to a decline in operating efficiency.

The results relating to the moderating effect of board experience made clear that one unit increase in board members' experience resulted in a rise in operating efficiency, therefore having a moderating effect. The results imply that additional board experience to board members would increase their networking capabilities, as well as enable them to have better-negotiating skills. Accordingly, the lenders and suppliers would offer better credit facilities that translate to reduced operating costs, thus improved performance.

With respect to the moderation effect of board members' education, the results indicated that an improvement in the level of board members' education diversity had a positive and significant effect on operating efficiency. The implication of this would be that having board members of the same level of education are likely to delay decision-making processes, leading to reduced operating efficiency.

The fourth objective sought to investigate the significance of the combined effect of financial structure, asset structure, and board demographics on operating efficiency. The outcomes of the study revealed that financial structure, asset structure, and board demographics together contributed to superior efficiency. This hints that the synergy between a firm's resources - which comprise attributes of the board members and asset base - influence the means of financing and eventually affect the operating efficiency of the firm.

6.4 Recommendations

From the study findings the following policy recommendations are made:

Housing co-operatives should grow organically or merge in order to take advantage of economies of scale. The DEA results pointed out that most of the housing co-operatives were inefficient and merging them could lead to reduced operational costs and enhanced management abilities, hence benefiting from economies of scale.

The boards of directors of housing co-operatives should invest in projects that will maximize members' economic and social benefits. The findings in objective two of the study established that the proportion of members' deposits was disproportionate to the level of investment. Therefore, monies received from the members should be immediately invested in income-generating projects.

Housing co-operatives should invest in real assets while maintaining strong asset liquidity at any given time in order to have strong basis of negotiating for better credit facilities. This recommendation emanates from the fact the study findings established asset tangibility and asset liquidity as a mediator enhanced the relationship between financial structure and operating efficiency. While investment in real assets reduces the cost of acquiring and retaining loans, which translates to increased asset liquidity and hence improved performance.

Housing co-operatives should not focus on gender diversity when deciding on the composition of board members. This was based on the findings relating to the moderating effect of board demographics that revealed enhancing gender evenness across the boards had an inverse relationship with operating efficiency.

Ethnic diversity evenness among board member is not an aspect to be given prominence when forming boards of housing co-operatives. The findings on the moderating effect of board demographics suggested that reducing the dominance of ethnic diversity representation across board would amount to decrease in operating efficiency.

The need for provision for the board of directors to serve for a longer period - of more than two terms on the board. The findings indicated that this would contribute to an increase in operating efficiency if the board experience was enhanced.

The need to consider having a representation of different levels of education when determining the composition of housing co-operatives' board members. Additionally, the board members should adhere to the co-operatives' principles of education and training in order to build the competencies, skills, and knowledge necessary for monitoring the activities of the management. The findings indicated that enhancing boards' evenness across levels of education of board members would contribute to increased operating efficiency.

Housing co-operatives should place emphasis on attributes such education, gender, ethnicity, and experience of board members, together with the level of assets held since these jointly influence the choice of financing mix, asset structure, and operating efficiency. This recommendation is based on the finding that synergy amongst the firm's resource and attributes of the individual board members influence the means of financing, ultimately affecting operating efficiency.

6.5 Contributions of the Study

The study findings would contribute to theories of finance and managerial practice in several ways, as discussed below:

6.5.1 Contributions of Theory

The findings and in particular, the test of the hypothesis H_{01} confirm that the use of the hierarchical order of financing as advanced by the pecking order theory (Myers & Majluff, 1984). Housing co-operatives get finances from share capital and members' deposits. This position supports the principle advanced by the theory of social capital (Lin, 1982). Additionally, interest-bearing liabilities (debt finance) contributed a small percentage of the financial structure relative to other sources finance, an aspect advanced by the pecking order theory.

This study also contributes to agency theory in that the choice of finance instils financial discipline among board members. A large percentage of debt finance in the financial structure compels the board to exercise caution on their remuneration and operating expenses with a view to avoiding a hostile takeover. Therefore, this discourages board members from getting involved in activities that could lead to agency problems.

The study reveals that asset structure is a mediator of financial structure for housing co-operatives, an assertion widely reported in financial literature for investor-owned firms.

Lastly, the study applied the Shannon index of diversity, an index commonly used in ecology for species' dominance and evenness. This brings a new dimension in the use of the indices for board demographics in the social sciences. Generally, the study opens up the research frontier to the use of the two-stage model - the application of DEA and regression analysis - in modelling operating efficiencies of housing co-operative societies in Kenya and beyond.

6.5.2 Contributions to Knowledge

Previous studies have focused on the comparative analysis of the performance of co-operatives and investor-owned firms using DEA (Farrell et al., 1957). Subsequent studies such as those by Veenstra et al. (2016), Othman et al. (2014), evaluated and compared the performance of co-operatives. This study, however, expands the knowledge frontier on multiple objectives of housing co-operatives through empirical studies in Kenya.

Secondly, the findings of this study present DEA as an alternative approach to measuring the operating efficiency of housing co-operative societies. Most of the previous empirical studies on DEA have focused on descriptive studies and Tobit regression analysis but did not establish the causes of inefficiencies of DMUs, a gap this study focused on.

Thirdly, there is no known study in Kenya that has used the ecological approach to profile board demographics using Shannon-wiener's index to construct a board diversity index and board competence index. A study by Ararat et al. (2015) used Blau index to determine the indices for board diversity; this index limits analysis to the nominal scale of measurement when interpreting the results, unlike Shannon index which is a ratio scale.

Lastly, the components of board demographic indices constructed may prove useful to researchers.

6.5.3 Contributions to Managerial Policy and Practices

The findings of this study are deemed important to different parties comprising board members, stakeholders, administrators, government, and members of housing co-operatives. The financial structure is undoubtedly one of the most important financial risk factors for any organisation. The findings of this study may raise some important managerial implications concerning the optimization of investments and financial structure. They would provide empirical support for the importance of contextual factors in the relationship between financial structure and operating efficiency. The members involved in policy implementation can devise ways of optimizing resources and recommend areas of improvement towards attaining operating efficiency. They can use the findings to revise regulations on borrowing and control the registration of housing co-operatives in Kenya.

The findings prove that the mediation of asset structure on the financial structure is far from straightforward since asset tangibility showed contrasting results predicting operating efficiency using simple and multiple regression. This study would, therefore, contribute to the managerial knowledge on mediators of financial structure and the effect of asset structure in the context of industry-country correlation.

Regulators will use the findings in formulating policy recommendations relating to attributes of housing co-operatives' boards. The results also indicate that the mere existence of financial structure and asset structure is an insufficient factor - in the absence of appropriate board members demographics - in enhancing operating efficiency. Resultantly, the study's findings on board demographics attributes would be of help to housing co-operatives in their processes of constituting their boards.

6.6 Limitations of the Study

The following limitations were encountered:

Availability of empirical literature relating to housing co-operatives was limited. Few studies have focused on housing co-operative societies. Consequently, the study conceptualized the variables of the study from other types of co-operative societies and from the industry since the principles of financing and board members are universal.

Accessing historical data on operating efficiency of housing co-operatives overtime was difficult because of the fragmented nature of recordkeeping found in housing co-operative societies. Lack of data for some years led to the use of pooled OLS which ignored the time-variant and cross-section of firms. This approach limited the comparative analysis of the firms over the years, therefore, some sections of the analysis focused on the sampled population.

The study encountered a limitation in the application of the DEA model. Some housing co-operatives had not filed their financial statements with the commissioner of co-operatives, and as a result, some variables in this study had some missing observations. Additionally, some small housing co-operatives purely used voluntary services of board members; thus difficult to quantify some expenses comprising labour cost and operating expenses not recorded. This limited the study in DEA modelling and analysis because the model does not work when some observations or data are missing. Despite this, the situation was mitigated by considering the housing co-operatives with complete dataset hence reducing the number of the analyzable sample from 124 to 87.

DEA technique is based on extreme points and relates each unit to the best performers. This specific feature makes the DEA analysis more sensitive to data noise and measurement errors. This limitation was addressed through sensitivity analysis where the results for the first run were compared for any super efficiency scores.

It is worth mentioning that the aforementioned limitations did not undermine the quality of the findings of the study. The study design was scientific as it was based on broad theoretical and empirical literature framework. A conceptual model was developed, and hypotheses tested via statistical methods. These limitations, consequently, did not have adverse effects on the outcomes of the study. Largely, it is expected that the findings of the study will significantly add knowledge to the existing body of finance.

6.7 Suggestions for Further Research

A comparable study should be done on other financial intermediaries registered in Kenya in order to capture the industry dynamics as a whole. This study only focused on housing co-operative societies in Nairobi City County.

An equivalent study can be initiated but applying the stochastic frontier analysis to make use of specific stochastic procedures in parametrically evaluating the efficiency frontiers. Stochastic frontier analysis, unlike the DEA model, considers the deviations from the production functions as having both the random error and inefficiencies.

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APPENDICES

Appendix 1: Letter of Introduction to the Respondent

Appendix II: Research Authorization

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Appendix III: Research Permit

Appendix IV: Research Question Guide

This research question guide will help in the collection of data from existing housing co-operative societies in Nairobi City County Kenya. It will gather general information for housing co-operative societies in Nairobi City County, Kenya. The data shall be for academic purposes only and treated with strict confidence. Your participation in facilitating this study is highly appreciated.

Demographic information for housing co-operative society

(a) What is the scope of operation of the housing co-operative in the country?

(i) National [ ] (ii) County [ ] (iii) Sub-County [ ]

(b) What type of real estate does your housing co-operative deals in?

(i) Land buying [ ] (ii) Housing construction [ ]

(iii) Both land and housing construction [ ] (iv) Others Specify_____

(c) What is the affiliation of members of your housing co-operatives?

(i) Public Sector Employees [ ]

(ii) Private sector Employees [ ]

(iii) Community Based living in the location of the land [ ]

(v) Faith based (Religious community) [ ]

(vi) Members from the same Tribe/Community [ ]

(vii) Professionals [ ]

(vii) Others (specify) _____ [ ]

Demographic information for board members

a) How many board members are in the age of:

(i) Below 35 years [ ]

(ii) Between 35 years and 60 years [ ]

(iii) Above 60 years [ ]

b) What is the composition of gender in your board of directors i.e. The number of board members who are: Male [ ] Female [ ]

c) What is the composition of board members coming from one ethnicity background

i) Not more one third from one tribe [ ]

ii) More than one third from one tribe (state the %age) [ ]

d) How many years the current board member have served in the housing co-operative societies as at 31 Dec 2016

i) For Not more than 3 years [ ]

ii) For more than 3 years [ ]

e) Are there board members who have served or are serving in the same capacity in other co-operatives, and for how long

(i) No of board members serving in other co-operatives [ ]

(ii) Average number of years for each board members in other co-operatives [ ]

(iii) None [ ]

(f) How many board members have educational qualifications at:

(i) Primary level [ ] (ii) Secondary Level [ ]

(iii) Tertiary/College level [ ] (iii) University [ ]

Appendix V: Data Collection Form

This data collection form will gather data from the financial statements of all housing co-operative societies in Nairobi City County, Kenya. The data will be strictly for academic purposes and confidential. Your participation in facilitating this study is highly appreciated.

C/S NO._____ Year of Registration_____

Name of housing co-operative society _____

Location of the housing co-operative (Sub-county) _____

1. Independent Variable: Financial Structure

	Share Capital + Reserves (Core capital)		Liabilities			No. of Members	Comment
Year	Share Capital (Members equity)	Reserves (Institutional Capital) Statutory reserves, General reserves and revenue reserves,	Members Deposits/ Savings	Non-interest bearing Liabilities(Accruals and trade payables)	Interest-bearing Liabilities		
2016							
2015							
2014							
2013							
2012							
Average							

2. Operating Efficiency

	Inputs			Output	Comments
Year	Labour Costs (Staff costs i.e. salaries and wages committees allowances	Operating Expenses (interest on deposits/ savings, administrative expenses, interest expenses, finance costs and other charges	Cost of Investment/ Sales i.e. Cost of land held for sale and development)	Total Revenue	
2016					
2015					
2014					
2013					
2012					
Average					

3. Intervening Variable: Asset Structure

	Asset Tangibility (*A)*	Asset Liquidity *(B)*		Comment
Year	Property, Plant and Equipment Sh.	Trade Receivables and Prepayments Sh.	Cash & Cash Equivalent, and short-term investments Sh.	
2016				
2015				
2014				
2013				
2012				
Average				

C/S NO._____ Name of housing co-operative society_____ Financial Year 2016

3. Moderating Variable: Board Demographics: For each year from 2012-2016

	Board Diversity						Board Competence							
	Age			Gender		Ethnicity	Board experience		Industry Experience		Education Background			
	35yrs and below	More than 35 yrs & up to 60yrs	More than 60yrs	Male	Female	Tribe	Less than 3 yrs	More than 3 yrs	Less than 3 yrs	More than 3 yrs	Prior. Sch cert. & below	Sec. such. Cert.	Diploma cert.	University degree cert.
Management committee														
Chairman														
V. chairman														
Hon. Secretary														
Treasurer														
Committee Member														
Committee Member														

Committee Member														
Committee Member														
Committee Member														
Supervisory Committee:														
Chairman														
Secretary														
Committee Member														

Notes:

i. Age of Board members: Determined in terms of the %age of board members Aged 35 and below; %age of board members Aged ≥35 and less than 60, and %age of board members aged over 60 years: Each expressed as a %age of total board members for each of the years from 2012- 2016.

ii. Ethnicity: Number of board members from one ethnicity expressed as a %age of total board members for each year in the past 5 years

iii. Gender: Female / Male board members expressed as a %age of total board members for each of the past five years

iv. Board Experience and Industry Experience: The number of years each board member has served as a board member for each year from 2012-2016.

C/S NO._____ Name of housing co-operative society_____ Financial Year 2015

3. Moderating Variable: Board Demographics

	Board Diversity						Board Competence							
	Age			Gender		Ethnicity	Board experience		Industry Experience		Education Background			
	35yrs and below	More than 35 yrs & up to 60yrs	More than 60yrs	Male	Female	Tribe	Less than 3 yrs	More than 3 yrs	Less than 3 yrs	More than 3 yrs	Pri. Sch cert. & below	Sec. Sch. Cert.	Diploma cert.	University degree cert.
Management committee														
Chairman														
V. chairman														
Hon. Secretary														
Treasurer														
Committee Member														
Committee Member														

Committee Member														
Committee Member														
Committee Member														
Supervisory Committee:														
Chairman														
Secretary														
Committee Member														

Notes:

i. Age of Board members: Determined in terms of the %age of board members Aged 35 and below; %age of board members Aged ≥35 and less than 60, and %age of board members aged over 60 years: Each expressed as a %age of total board members for each of the years from 2012- 2016.

ii. Ethnicity: Number of board members from one ethnicity expressed as a %age of total board members for each year in the past 5 years

iii. Gender: Female / Male board members expressed as a %age of total board members for each of the past five years

iv. Board Experience and Industry Experience: The number of years each board member has served as a board member for each year from 2012-2016.

C/S NO._____ Name of housing co-operative society_____ Financial Year 2014

3. Moderating Variable: Board Demographics

Board Diversity							Board Competence							
Age				Gender		Ethnicity	Board experience		Industry Experience		Education Background			
	35yrs and below	More than 35 yrs & up to 60yrs	More than 60yrs	Male	Female	Tribe	Less than 3 yrs	More than 3 yrs	Less than 3 yrs	More than 3 yrs	Pri. Sch cert. & below	Sec. Sch. Cert.	Diploma cert.	University degree cert.
Management committee														
Chairman														
V. chairman														
Hon. Secretary														
Treasurer														
Committee Member														
Committee Member														
Committee Member														

Committee Member														
Committee Member														
Supervisory Committee:														
Chairman														
Secretary														
Committee Member														

Notes:

i. Age of Board members: Determined in terms of the %age of board members Aged 35 and below; %age of board members Aged ≥35 and less than 60, and %age of board members aged over 60 years: Each expressed as a %age of total board members for each of the years from 2012- 2016.

ii. Ethnicity: Number of board members from one ethnicity expressed as a %age of total board members for each year in the past 5 years

iii. Gender: Female / Male board members expressed as a %age of total board members for each of the past five years

iv. Board Experience and Industry Experience: The number of years each board member has served as a board member for each year from 2012-2016.

C/S NO._____ Name of housing co-operative society_____Financial Year 2013

3. Moderating Variable: Board Demographics

	Board Diversity						Board Competence							
	Age			Gender		Ethnicity	Board experience		Industry Experience		Education Background			
	35yrs and below	More than 35 yrs & up to 60yrs	More than 60yrs	Male	Female	Tribe	Less than 3 yrs	More than 3 yrs	Less than 3 yrs	More than 3 yrs	Pri. Sch cert. & below	Sec. Sch. Cert.	Diploma cert.	University degree cert.
Management committee														
Chairman														
V. chairman														
Hon. Secretary														
Treasurer														
Committee Member														
Committee Member														
Committee Member														

Committee Member														
Committee Member														
Supervisory Committee:														
Chairman														
Secretary														
Committee Member														

Notes:

i. Age of Board members: Determined in terms of the %age of board members Aged 35 and below; %age of board members Aged ≥35 and less than 60, and %age of board members aged over 60 years: Each expressed as a %age of total board members for each of the years from 2012- 2016.

ii. Ethnicity: Number of board members from one ethnicity expressed as a %age of total board members for each year in the past 5 years

iii. Gender: Female / Male board members expressed as a %age of total board members for each of the past five years

iv. Board Experience and Industry Experience: The number of years each board member has served as a board member for each year from 2012-2016.

C/S NO._____ Name of housing co-operative society_____Financial Year 2012

3. Moderating Variable: Board Demographics

	Board Diversity						Board Competence							
	Age			Gender		Ethnicity	Board experience		Industry Experience		Education Background			
	35yrs and below	More than 35 yrs & up to 60yrs	More than 60yrs	Male	Female	Tribe	Less than 3 yrs	More than 3 yrs	Less than 3 yrs	More than 3 yrs	Pri. Sch cert. & below	Sec. Sch. Cert.	Diploma cert.	University degree cert.
Management committee														
Chairman														
V. chairman														
Hon. Secretary														
Treasurer														
Committee Member														
Committee Member														
Committee Member														

Committee Member														
Committee Member														
Supervisory Committee:														
Chairman														
Secretary														
Committee Member														

Notes:

i. Age of Board members: Determined in terms of the %age of board members Aged 35 and below; %age of board members Aged ≥35 and less than 60, and %age of board members aged over 60 years: Each expressed as a %age of total board members for each of the years from 2012- 2016.

ii. Ethnicity: Number of board members from one ethnicity expressed as a %age of total board members for each year in the past 5 years

iii. Gender: Female / Male board members expressed as a %age of total board members for each of the past five years

iv. Board Experience and Industry Experience: The number of years each board member has served as a board member for each year from 2012-2016.

Appendix VI: DEA Data and Results

The following is the summary of data envelopment analysis results by housing co-operative for the years from 2012-2016

Variable Returns to Scale Frontier: (decreasing returns to scale (drs), constant returns to scale (crs), increasing returns to scale (irs), and results not reported (-).

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
1	1	2012	0.65	0.75	0.65	0.87	irs
2	1	2013	0.57	0.81	0.57	0.7	irs
3	1	2014	0.65	0.74	0.65	0.88	irs
4	1	2015	0.65	0.73	0.65	0.89	irs
5	1	2016	0.67	0.75	0.67	0.9	irs
6	2	2012	0.64	0.75	0.64	0.85	irs
7	2	2013	0.61	0.78	0.62	0.78	irs
8	2	2014	0.65	0.77	0.65	0.85	irs
9	2	2015	0.64	0.74	0.64	0.86	irs
10	2	2016	0.65	0.75	0.65	0.87	irs
11	3	2012	0.63	0.81	0.64	0.78	irs
12	3	2013	0.64	0.78	0.64	0.81	irs
13	3	2014	0	0	0.68	0	-
14	3	2015	0.69	0.8	0.70	0.86	irs
15	3	2016	0.57	0.82	0.58	0.69	irs
16	4	2012	0.68	0.68	0.70	0.99	drs
17	4	2013	0.68	0.68	0.70	1	irs
18	4	2014	0.67	0.67	0.69	1	irs
19	4	2015	0.66	0.66	0.68	1	irs
20	4	2016	0.65	0.66	0.68	1	drs
21	5	2012	0.65	0.82	0.65	0.79	irs
22	5	2013	0.69	0.79	0.69	0.86	irs
23	5	2014	0.68	0.83	0.68	0.82	irs
24	5	2015	0.39	0.83	0.39	0.47	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
25	5	2016	0.44	0.85	0.44	0.52	irs
26	6	2012	0.57	0.84	0.58	0.68	irs
27	6	2013	0.82	0.88	0.91	0.93	drs
28	6	2014	0.69	0.77	0.69	0.9	irs
29	6	2015	0.74	0.81	0.75	0.92	irs
30	6	2016	0.76	0.77	0.76	0.99	irs
31	7	2012	1	1	1	1	crs
32	7	2013	0.94	0.95	0.93	0.99	irs
33	7	2014	0.95	0.97	0.97	0.98	irs
34	7	2015	0.89	0.9	0.88	0.98	irs
35	7	2016	0.91	0.92	0.91	1	irs
36	8	2012	0.65	0.65	0.65	0.99	irs
37	8	2013	0.64	0.67	0.67	0.97	drs
38	8	2014	0.65	0.71	0.74	0.92	drs
39	8	2015	0.67	0.74	0.78	0.9	drs
40	8	2016	0.68	0.77	0.8	0.88	drs
41	9	2012	0.63	0.66	0.64	0.96	irs
42	9	2013	0.63	0.66	0.63	0.96	irs
43	9	2014	0.63	0.64	0.63	0.99	irs
44	9	2015	0.57	0.58	0.57	0.99	irs
45	9	2016	0.65	0.66	0.65	0.99	irs
46	10	2012	0.7	0.93	0.93	0.76	drs
47	10	2013	0.75	0.91	0.91	0.83	drs
48	10	2014	0.79	1	1	0.79	drs
49	10	2015	0.64	0.74	0.74	0.87	drs
50	10	2016	0.76	0.95	0.96	0.8	drs
51	11	2012	0.64	0.72	0.65	0.89	irs
52	11	2013	0.68	0.81	0.69	0.84	irs
53	11	2014	0.66	0.8	0.67	0.83	irs
54	11	2015	0.69	0.81	0.7	0.86	irs
55	11	2016	0.66	0.77	0.66	0.86	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
56	12	2012	0	0	0.64	0	-
57	12	2013	0.59	0.79	0.59	0.75	irs
58	12	2014	0.65	0.79	0.65	0.82	irs
59	12	2015	0.64	0.77	0.65	0.83	irs
60	12	2016	0.6	0.79	0.61	0.77	irs
61	13	2012	0.56	0.6	0.56	0.93	irs
62	13	2013	0.65	0.73	0.66	0.89	irs
63	13	2014	0.66	0.73	0.67	0.9	irs
64	13	2015	0.57	0.73	0.58	0.79	irs
65	13	2016	0.58	0.65	0.59	0.91	irs
66	14	2012	0.6	0.73	0.61	0.83	irs
67	14	2013	0.62	0.78	0.63	0.8	irs
68	14	2014	0.67	0.8	0.67	0.83	irs
69	14	2015	0.63	0.76	0.63	0.82	irs
70	14	2016	0.63	0.76	0.63	0.82	irs
71	15	2012	0.63	0.74	0.63	0.85	irs
72	15	2013	0.64	0.73	0.64	0.87	irs
73	15	2014	0.65	0.76	0.65	0.86	irs
74	15	2015	0.63	0.72	0.64	0.88	irs
75	15	2016	0.63	0.72	0.63	0.86	irs
76	16	2012	0.91	0.92	0.91	0.99	irs
77	16	2013	0.91	0.92	0.91	0.99	irs
78	16	2014	0.9	0.9	0.9	0.99	irs
79	16	2015	0.91	0.92	0.91	0.99	irs
80	16	2016	0.93	0.93	0.93	0.99	irs
81	17	2012	0.67	0.74	0.78	0.9	drs
82	17	2013	0.69	0.8	0.85	0.86	drs
83	17	2014	0.68	0.76	0.79	0.89	drs
84	17	2015	0.64	0.71	0.74	0.91	drs
85	17	2016	0.64	0.66	0.68	0.97	drs
86	18	2012	0.67	0.77	0.67	0.87	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
87	18	2013	0.66	0.72	0.66	0.91	irs
88	18	2014	0.66	0.72	0.67	0.92	irs
89	18	2015	0.66	0.67	0.67	0.99	irs
90	18	2016	0.70	0.72	0.70	0.96	irs
91	19	2012	0.88	0.92	0.87	0.96	irs
92	19	2013	0.98	0.99	0.98	0.99	irs
93	19	2014	0.98	0.98	0.98	1	drs
94	19	2015	0.98	0.99	1	1	drs
95	19	2016	0.89	0.91	0.88	0.98	irs
96	20	2012	0.65	0.67	0.65	0.98	irs
97	20	2013	0.65	0.67	0.65	0.98	irs
98	20	2014	0.66	0.69	0.66	0.96	irs
99	20	2015	0.67	0.68	0.67	0.99	irs
100	20	2016	0.63	0.65	0.63	0.97	irs
101	21	2012	0.65	0.7	0.66	0.93	irs
102	21	2013	0.64	0.65	0.64	0.99	irs
103	21	2014	0.64	0.66	0.67	0.98	drs
104	21	2015	0.64	0.65	0.64	1	irs
105	21	2016	0.64	0.65	0.64	1	irs
106	22	2012	0.83	0.86	0.83	0.96	irs
107	22	2013	0.85	0.88	0.85	0.97	irs
108	22	2014	0.85	0.89	0.86	0.96	irs
109	22	2015	0.81	0.88	0.81	0.92	irs
110	22	2016	0.81	0.84	0.81	0.96	irs
111	23	2012	0.63	0.64	0.63	0.99	irs
112	23	2013	0.67	0.68	0.67	1	irs
113	23	2014	0.66	0.67	0.69	0.98	drs
114	24	2015	0	0	0.57	0	-
115	23	2016	0.4	0.67	0.4	0.59	irs
116	24	2012	0.63	0.63	0.63	0.99	irs
117	24	2013	0.63	0.63	0.63	0.99	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
118	24	2014	0.62	0.63	0.62	0.99	irs
119	24	2015	0.63	0.64	0.63	0.99	irs
120	24	2016	0.62	0.63	0.62	0.99	irs
121	25	2012	0.77	0.84	0.76	0.92	irs
122	25	2013	0.88	0.9	0.88	0.98	irs
123	25	2014	0.79	0.86	0.79	0.92	irs
124	25	2015	0.58	0.82	0.56	0.7	irs
125	25	2016	0.5	0.83	0.49	0.61	irs
126	26	2012	0.77	0.82	0.78	0.94	irs
127	26	2013	0.64	0.72	0.64	0.89	irs
128	26	2014	0.65	0.65	0.65	0.99	irs
129	26	2015	0.65	0.7	0.66	0.93	irs
130	26	2016	0.69	0.73	0.69	0.95	irs
131	27	2012	0.76	0.88	0.76	0.86	irs
132	27	2013	0.76	0.88	0.76	0.86	irs
133	27	2014	0.8	0.89	0.79	0.89	irs
134	27	2015	0.76	0.91	0.76	0.84	irs
135	27	2016	0.72	0.86	0.71	0.84	irs
136	28	2012	0.64	0.71	0.64	0.9	irs
137	28	2013	0.65	0.67	0.65	0.98	irs
138	28	2014	0.66	0.66	0.66	0.99	drs
139	28	2015	0.67	0.69	0.69	0.97	drs
140	28	2016	0.66	0.71	0.71	0.93	drs
141	29	2012	0.69	0.78	0.69	0.89	irs
142	29	2013	0.68	0.75	0.68	0.91	irs
143	29	2014	0.63	0.72	0.63	0.87	irs
144	29	2015	0.73	0.74	0.73	0.98	irs
145	29	2016	0.69	0.7	0.69	0.99	irs
146	30	2012	0.57	0.57	0.58	0.99	irs
147	30	2013	0.64	0.64	0.64	0.99	irs
148	30	2014	0.64	0.64	0.64	1	drs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
149	30	2015	0.63	0.63	0.63	1	irs
150	30	2016	0.66	0.68	0.69	0.97	drs
151	31	2012	0.37	0.59	0.38	0.64	irs
152	31	2013	0.37	0.59	0.38	0.64	irs
153	31	2014	0.37	0.59	0.38	0.64	irs
154	31	2015	0.37	0.6	0.37	0.61	irs
155	31	2016	0.38	0.58	0.38	0.66	irs
156	32	2012	0.86	0.94	0.85	0.92	irs
157	32	2013	0.86	0.94	0.85	0.92	irs
158	32	2014	0.86	0.94	0.85	0.92	irs
159	32	2015	0.84	0.91	0.84	0.92	irs
160	32	2016	0.93	1	1	0.93	Irs
161	33	2012	0.65	0.68	0.65	0.96	irs
162	34	2013	0	0	0.59	0	-
163	33	2014	0.68	0.69	0.69	0.99	drs
164	33	2015	0.66	0.7	0.7	0.95	drs
165	33	2016	0.65	0.65	0.65	1	irs
166	34	2012	0.65	0.77	0.65	0.84	irs
167	34	2013	0.64	0.76	0.65	0.84	irs
168	34	2014	0.56	0.78	0.57	0.72	irs
169	34	2015	0.67	0.74	0.68	0.9	irs
170	34	2016	0.65	0.83	0.66	0.79	irs
171	35	2012	0.71	0.89	0.73	0.81	irs
172	35	2013	0.77	0.9	0.79	0.85	irs
173	35	2014	0.76	0.91	0.78	0.84	irs
174	35	2015	0.68	0.89	0.7	0.77	irs
175	35	2016	0.53	0.86	0.53	0.61	irs
176	36	2012	0.94	0.94	0.94	1	drs
177	36	2013	0.92	0.92	0.93	1	drs
178	36	2014	0.95	0.96	0.95	0.99	irs
179	36	2015	1	1	1	1	crs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
180	36	2016	1	1	1	1	crs
181	37	2012	0.65	0.93	0.97	0.7	drs
182	37	2013	0.66	1	1	0.66	drs
183	37	2014	0.65	0.92	0.93	0.71	drs
184	37	2015	0.66	0.89	1	0.74	drs
185	37	2016	0.65	0.86	0.96	0.75	drs
186	38	2012	0.67	0.67	0.68	1	irs
187	38	2013	0.68	0.71	0.73	0.96	drs
188	38	2014	0.69	0.75	0.78	0.92	drs
189	38	2015	0.69	0.73	0.79	0.94	drs
190	38	2016	0.67	0.71	0.73	0.94	drs
191	39	2012	0.67	0.76	0.79	0.88	drs
192	39	2013	0.62	0.63	0.64	0.98	drs
193	39	2014	0.67	0.75	0.78	0.89	drs
194	39	2015	0.65	0.77	0.8	0.85	drs
195	39	2016	0.64	0.74	0.77	0.87	drs
196	40	2012	0.37	0.74	0.38	0.5	irs
197	40	2013	0.78	0.9	0.79	0.87	irs
198	40	2014	0.72	0.77	0.73	0.94	irs
199	40	2015	0.7	0.77	0.7	0.9	irs
200	40	2016	0.7	0.77	0.7	0.9	irs
201	41	2012	0.64	0.64	0.65	1	irs
202	41	2013	0.64	0.65	0.66	0.99	drs
203	41	2014	0.64	0.66	0.67	0.98	drs
204	41	2015	0.64	0.67	0.68	0.96	drs
205	41	2016	0.65	0.68	0.7	0.95	drs
206	42	2012	0.66	0.68	0.66	0.96	irs
207	42	2013	0.65	0.66	0.65	0.99	irs
208	42	2014	0.66	0.66	0.67	0.99	drs
209	42	2015	0.66	0.66	0.67	1	irs
210	42	2016	0.66	0.68	0.71	0.98	drs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
211	43	2012	0.86	0.93	0.87	0.93	irs
212	43	2013	0.87	0.97	0.89	0.89	irs
213	43	2014	0.86	0.91	0.87	0.95	irs
214	43	2015	0.86	0.93	0.87	0.93	irs
215	43	2016	0.86	0.93	0.87	0.93	irs
216	44	2012	0.65	0.69	0.7	0.95	drs
217	44	2013	0.65	0.69	0.7	0.95	drs
218	44	2014	0.64	0.68	0.64	0.94	irs
219	44	2015	0.68	0.72	0.75	0.94	drs
220	44	2016	0.65	0.71	0.74	0.91	drs
221	45	2012	1	1	1	1	crs
222	45	2013	0.96	0.97	0.99	0.99	irs
223	45	2014	0.96	0.96	0.99	1	irs
224	45	2015	0.96	0.98		0.99	drs
225	45	2016	0.95	1	1	0.95	drs
226	47	2012	0	0	0.65	0	-
227	46	2013	0.65	0.65	0.65	1	irs
228	46	2014	0.71	0.78	0.78	0.91	drs
229	46	2015	0.69	0.74	0.8	0.93	drs
230	46	2016	0.68	0.73	0.75	0.92	drs
231	47	2012	0.65	0.83	0.65	0.78	irs
232	47	2013	0.67	0.77	0.67	0.87	irs
233	47	2014	0.72	0.8	0.72	0.9	irs
234	47	2015	0.65	0.75	0.66	0.87	irs
235	47	2016	0.63	0.75	0.63	0.84	irs
236	48	2012	0.68	0.85	1	0.8	drs
237	48	2013	0.82	0.84	0.84	0.98	drs
238	48	2014	0.76	0.85	0.92	0.89	drs
239	48	2015	0.73	0.78	0.84	0.94	drs
240	48	2016	0.7	0.79	0.88	0.89	drs
241	49	2012	0.71	0.78	0.72	0.92	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
242	49	2013	0.68	0.78	0.69	0.87	irs
243	49	2014	0.58	0.77	0.58	0.75	irs
244	49	2015	0.72	0.79	0.72	0.91	irs
245	49	2016	0.72	0.75	0.72	0.96	irs
246	50	2012	0.8	0.84	0.91	0.95	drs
247	50	2013	0.81	0.89	1	0.91	drs
248	50	2014	0.74	0.77	0.78	0.95	drs
249	50	2015	0.74	0.76	0.76	0.98	drs
250	50	2016	0.68	0.68	0.68	1	irs
251	51	2012	0.55	0.69	0.55	0.79	irs
252	51	2013	0.58	0.71	0.58	0.81	irs
253	51	2014	0.51	0.72	0.51	0.71	irs
254	51	2015	0.5	0.71	0.5	0.71	irs
255	51	2016	0.54	0.66	0.54	0.83	irs
256	52	2012	0.58	0.8	0.59	0.73	irs
257	52	2013	0.6	0.79	0.61	0.76	irs
258	52	2014	0.6	0.82	0.61	0.73	irs
259	52	2015	0.56	0.8	0.56	0.7	Irs
260	52	2016	0.57	0.79	0.57	0.72	irs
261	53	2012	1	1	1	1	crs
262	53	2013	0.71	0.77	0.7	0.92	irs
263	53	2014	0.82	0.83	0.81	0.98	irs
264	53	2015	0.88	0.9	0.88	0.98	irs
265	53	2016	0.68	0.8	0.67	0.85	irs
266	54	2012	0.67	0.83	0.67	0.8	irs
267	54	2013	0.67	0.83	0.67	0.8	irs
268	54	2014	0.67	0.82	0.68	0.83	irs
269	54	2015	0.68	0.85	0.68	0.8	irs
270	54	2016	0.63	0.84	0.64	0.75	irs
271	55	2012	0.71	0.77	0.72	0.93	irs
272	55	2013	0.71	0.77	0.72	0.93	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
273	55	2014	0.7	0.78	0.71	0.89	irs
274	55	2015	0.7	0.8	0.7	0.87	irs
275	55	2016	0.73	0.75	0.73	0.98	irs
276	56	2012	0.66	0.79	0.66	0.83	irs
277	56	2013	0.66	0.77	0.66	0.86	irs
278	56	2014	0.65	0.75	0.67	0.87	irs
279	56	2015	0.64	0.72	0.66	0.9	irs
280	56	2016	0.64	0.72	0.66	0.89	irs
281	57	2012	0.58	0.74	0.58	0.78	irs
282	57	2013	0.65	0.65	0.65	1	irs
283	57	2014	0.69	0.72	0.72	0.96	drs
284	57	2015	0.68	0.72	0.72	0.95	drs
285	57	2016	0.67	0.67	0.67	1	irs
286	58	2012	0.59	0.6	0.59	0.99	irs
287	58	2013	0.59	0.6	0.59	0.99	irs
288	58	2014	0.59	0.6	0.59	0.99	irs
289	58	2015	0.61	0.65	0.61	0.93	irs
290	58	2016	0.59	0.6	0.6	0.99	drs
291	59	2012	0.77	0.98	0.78	0.79	irs
292	59	2013	0.77	0.98	0.78	0.79	irs
293	59	2014	0.84	0.99	0.85	0.84	irs
294	59	2015	0.75	0.97	0.75	0.77	irs
295	59	2016	0.65	0.98	0.66	0.66	irs
296	60	2012	0.59	0.69	0.59	0.86	irs
297	60	2013	0.6	0.72	0.6	0.83	irs
298	60	2014	0.66	0.66	0.66	0.99	irs
299	60	2015	0.68	0.68	0.68	0.99	irs
300	60	2016	0.65	0.67	0.66	0.97	irs
301	61	2012	0.71	0.85	0.71	0.84	irs
302	61	2013	0.62	0.81	0.63	0.77	irs
303	61	2014	0.67	0.81	0.68	0.83	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
304	61	2015	0.68	0.79	0.69	0.86	irs
305	61	2016	0.66	0.83	0.66	0.79	irs
306	62	2012	0.57	0.81	0.58	0.71	irs
307	62	2013	0.74	0.8	0.74	0.92	irs
308	62	2014	0.72	0.86	0.72	0.84	irs
309	62	2015	0.7	0.82	0.7	0.85	irs
310	62	2016	0.7	0.82	0.7	0.85	irs
311	63	2012	0.98	1	0.99	0.98	irs
312	63	2013	0.93	0.97	0.93	0.96	irs
313	64	2014	0	0	1	0	-
314	63	2015	0.91	0.96	0.92	0.95	irs
315	63	2016	0.91	0.96	0.92	0.95	irs
316	64	2012	0.76	0.95	1	0.79	drs
317	64	2013	0.79	0.9	0.94	0.88	drs
318	64	2014	0.8	0.95	0.99	0.84	drs
319	64	2015	0.72	0.89	0.93	0.81	drs
320	64	2016	0.8	0.89	1	0.9	drs
321	65	2012	0.66	0.7	0.66	0.94	irs
322	65	2013	0.63	0.78	0.63	0.8	irs
323	65	2014	0.59	0.75	0.59	0.78	irs
324	65	2015	0.57	0.76	0.57	0.76	irs
325	65	2016	0.67	0.67	0.68	1	Irs
326	66	2012	0.66	0.82	0.66	0.8	irs
327	66	2013	0.56	0.8	0.56	0.7	irs
328	66	2014	0.64	0.81	0.65	0.79	irs
329	66	2015	0.71	0.84	0.72	0.85	irs
330	66	2016	0.71	0.85	0.71	0.83	irs
331	67	2012	0.44	0.77	0.44	0.58	irs
332	67	2013	0.57	0.83	0.57	0.69	irs
333	67	2014	0.65	0.75	0.66	0.88	irs
334	67	2015	0.63	0.7	0.63	0.89	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
335	67	2016	0.67	0.8	0.84	0.84	drs
336	68	2012	0.65	0.74	0.84	0.87	drs
337	68	2013	0.71	0.73	0.75	0.98	drs
338	68	2014	0.71	0.72	0.73	0.98	drs
339	68	2015	0.69	0.74	0.77	0.93	drs
340	68	2016	0.68	0.75	0.78	0.91	drs
341	69	2012	0.55	0.69	0.55	0.79	irs
342	69	2013	0.63	0.72	0.63	0.86	irs
343	69	2014	0.46	0.69	0.47	0.67	irs
344	69	2015	0.53	0.69	0.53	0.77	irs
345	69	2016	0.38	0.7	0.38	0.54	irs
346	70	2012	0.74	0.78	0.74	0.95	irs
347	70	2013	0.69	0.85	0.69	0.81	irs
348	70	2014	0.76	0.78	0.77	0.98	irs
349	70	2015	0.54	0.76	0.55	0.71	irs
350	70	2016	0.65	0.73	0.66	0.89	irs
351	71	2012	0.65	0.68	0.68	0.96	drs
352	71	2013	0.64	0.64	0.64	1	irs
353	71	2014	0.64	0.65	0.66	0.98	drs
354	71	2015	0.65	0.65	0.65	1	irs
355	71	2016	0.65	0.67	0.67	0.97	drs
356	72	2012	0.62	0.63	0.62	0.99	irs
357	72	2013	0.61	0.71	0.61	0.86	irs
358	72	2014	0.61	0.62	0.63	1	Irs
359	72	2015	0.65	0.67	0.67	0.98	drs
360	72	2016	0.56	0.66	0.56	0.85	irs
361	73	2012	0.63	0.75	0.78	0.84	drs
362	73	2013	0.62	0.64	0.64	0.96	drs
363	73	2014	0.62	0.64	0.67	0.97	drs
364	73	2015	0.63	0.63	0.63	0.99	drs
365	73	2016	0.68	0.73	0.74	0.94	drs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
366	74	2012	0.65	0.7	0.65	0.94	irs
367	74	2013	0.64	0.67	0.64	0.95	irs
368	74	2014	0.64	0.69	0.64	0.94	irs
369	74	2015	0.64	0.68	0.68	0.94	irs
370	74	2016	0.64	0.68	0.68	0.94	irs
371	75	2012	0.68	0.7	0.7	0.96	drs
372	75	2013	0.74	0.75	0.75	0.98	drs
373	75	2014	0.66	0.71	0.71	0.93	drs
374	75	2015	0.65	0.69	0.69	0.95	drs
375	75	2016	0.66	0.69	0.69	0.95	drs
376	76	2012	0.64	0.74	0.64	0.86	irs
377	76	2013	0.61	0.71	0.61	0.87	irs
378	76	2014	0.65	0.74	0.66	0.88	irs
379	76	2015	0.66	0.77	0.66	0.86	irs
380	76	2016	0.67	0.78	0.67	0.86	irs
381	77	2012	0.81	0.91	0.95	0.89	drs
382	77	2013	0.75	0.83	0.85	0.9	drs
383	77	2014	0.74	0.89	0.93	0.83	drs
384	77	2015	0.7	0.74	0.77	0.94	drs
385	77	2016	0.67	0.7	0.7	0.95	drs
386	78	2012	0.57	0.85	0.57	0.67	irs
387	78	2013	0.58	0.78	0.59	0.75	irs
388	78	2014	0.77	0.78	0.78	0.99	irs
389	78	2015	0.71	0.74	0.78	0.97	drs
390	78	2016	0.75	0.78	0.81	0.97	drs
391	79	2012	0.45	0.73	0.45	0.61	Irs
392	79	2013	0.57	0.6	0.58	0.96	irs
393	79	2014	0.42	0.59	0.43	0.72	irs
394	79	2015	0.62	0.65	0.63	0.97	irs
395	79	2016	0.62	0.65	0.63	0.95	irs
396	80	2012	0.65	0.72	0.66	0.9	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
397	80	2013	0.6	0.7	0.6	0.85	irs
398	80	2014	0.59	0.74	0.59	0.79	irs
399	80	2015	0.57	0.71	0.57	0.8	irs
400	80	2016	0.68	0.7	0.68	0.97	irs
401	81	2012	0.59	0.75	0.59	0.79	irs
402	81	2013	0.59	0.75	0.59	0.79	irs
403	81	2014	0.68	0.78	0.69	0.87	irs
404	81	2015	0.49	0.75	0.49	0.65	irs
405	81	2016	0.52	0.72	0.52	0.72	irs
406	82	2012	0.72	0.82	0.73	0.87	irs
407	82	2013	0.62	0.82	0.63	0.76	irs
408	82	2014	0.66	0.78	0.67	0.85	irs
409	82	2015	0.7	0.78	0.71	0.9	irs
410	82	2016	0.61	0.75	0.62	0.82	irs
411	83	2012	0.62	0.66	0.62	0.94	irs
412	83	2013	0.63	0.7	0.64	0.91	irs
413	83	2014	0.66	0.7	0.66	0.94	irs
414	83	2015	0.63	0.69	0.64	0.92	irs
415	83	2016	0.64	0.69	0.65	0.94	irs
416	84	2012	0.46	0.69	0.46	0.66	irs
417	84	2013	0.5	0.71	0.51	0.71	irs
418	84	2014	0.53	0.71	0.53	0.74	irs
419	84	2015	0.66	0.74	0.66	0.89	irs
420	84	2016	0.69	0.74	0.7	0.94	irs
421	85	2012	0.64	0.66	0.69	0.96	drs
422	85	2013	0.64	0.67	0.69	0.96	drs
423	85	2014	0.64	0.68	0.71	0.95	drs
424	85	2015	0.64	0.67	0.69	0.95	drs
425	85	2016	0.64	0.67	0.7	0.95	drs
426	86	2012	0.68	0.74	0.68	0.92	irs
427	86	2013	0.67	0.75	0.67	0.89	irs

Observation	DMU	Year	CRS_TE	VRS_TE	NIRS	SCALE	RTS
428	86	2014	0.67	0.74	0.67	0.9	irs
429	86	2015	0.69	0.77	0.69	0.89	irs
430	86	2016	0.7	0.75	0.7	0.93	irs
431	87	2012	0.51	0.71	0.51	0.71	irs
432	87	2013	0.52	0.7	0.52	0.73	irs
433	87	2014	0.73	0.77	0.73	0.94	irs
434	87	2015	0.75	0.75	0.77	1	irs
435	87	2016	0.69	0.72	0.69	0.96	irs

Source: Research Data (2019)

Appendix VII: Summary of Efficiency Scores for Housing Cooperative Societies

DMU	CRS_TE	VRS_TE	SCALE	RTS
1	0.64	0.75	0.85	irs
2	0.64	0.76	0.84	irs
3	0.63	0.80	0.79	irs
4	0.67	0.67	1.00	crs
5	0.57	0.82	0.69	irs
6	0.72	0.81	0.88	irs
7	0.94	0.95	1.00	crs
8	0.66	0.71	0.93	drs
9	0.62	0.64	0.98	irs
10	0.73	0.90	0.81	drs
11	0.67	0.78	0.85	irs
12	0.62	0.78	0.79	irs
13	0.61	0.69	0.88	irs
14	0.63	0.77	0.82	irs
15	0.64	0.74	0.86	irs
16	0.91	0.92	0.99	irs
17	0.66	0.73	0.91	drs
18	0.67	0.72	0.93	irs
19	0.94	0.96	0.98	irs
20	0.65	0.67	0.98	irs
21	0.64	0.66	0.98	irs
22	0.83	0.87	0.95	irs
23	0.59	0.66	0.89	drs
24	0.62	0.63	0.99	irs
25	0.71	0.85	0.82	irs

26	0.68	0.72	0.94	irs
27	0.76	0.89	0.86	irs
28	0.66	0.69	0.95	drs
29	0.68	0.74	0.93	irs
30	0.63	0.63	1.00	crs
31	0.37	0.59	0.63	irs
32	0.87	0.94	0.92	irs
33	0.66	0.68	0.97	drs
34	0.63	0.78	0.82	irs
35	0.69	0.89	0.77	irs
36	0.96	0.96	1.00	crs
37	0.65	0.92	0.71	drs
38	0.68	0.71	0.95	drs
39	0.65	0.73	0.89	drs
40	0.65	0.79	0.82	irs
41	0.64	0.66	0.98	drs
42	0.66	0.67	0.98	irs
43	0.86	0.94	0.92	irs
44	0.66	0.70	0.94	drs
45	0.97	0.98	0.98	drs
46	0.68	0.73	0.94	drs
47	0.66	0.78	0.85	irs
48	0.74	0.82	0.90	drs
49	0.68	0.77	0.88	irs
50	0.75	0.79	0.96	drs
51	0.54	0.70	0.77	irs
52	0.58	0.80	0.73	irs

53	0.82	0.86	0.95	irs
54	0.66	0.83	0.80	irs
55	0.71	0.77	0.92	irs
56	0.65	0.75	0.87	irs
57	0.66	0.70	0.94	irs
58	0.60	0.61	0.98	irs
59	0.75	0.98	0.77	irs
60	0.64	0.69	0.93	irs
61	0.67	0.82	0.82	irs
62	0.68	0.82	0.83	irs
63	0.93	0.97	0.96	irs
64	0.77	0.92	0.85	drs
65	0.62	0.73	0.85	irs
66	0.65	0.82	0.80	irs
67	0.59	0.77	0.77	irs
68	0.69	0.74	0.94	drs
69	0.51	0.70	0.73	irs
70	0.67	0.78	0.87	irs
71	0.65	0.66	0.98	drs
72	0.61	0.66	0.93	irs
73	0.64	0.68	0.94	drs
74	0.65	0.69	0.94	irs
75	0.68	0.71	0.96	drs
76	0.65	0.75	0.87	irs
77	0.73	0.82	0.90	drs
78	0.68	0.79	0.87	irs
79	0.54	0.64	0.84	irs

80	0.62	0.71	0.86	irs
81	0.57	0.75	0.76	irs
82	0.66	0.79	0.84	irs
83	0.64	0.69	0.93	irs
84	0.57	0.72	0.79	irs
85	0.64	0.67	0.96	drs
86	0.68	0.75	0.90	irs
87	0.64	0.73	0.87	irs
	0.68	0.77	0.89	

VRS Frontier: (decreasing returns to scale (drs), constant returns to scale (crs), increasing returns to scale (irs).

Source: DEA Output, 2019.

Appendix VIII: Board Demographics Indices

Shannon index$= H = \sum_{i=1}^{s} -(\mathrm{Pi} * \ln \mathrm{Pi})$.

DMU No.	Age Diversity Index	Gender Diversity Index	Board Experience Diversity Index	Ethnicity Diversity Index	Education Diversity Index	Board Diversity Index	Board Competence Index	Board Demographics Index
1	0.000	0.377	1.078	1.256	0.000	0.544	0.539	0.541
2	0.287	0.655	0.000	1.148	0.000	0.697	0.000	0.348
3	0.000	0.000	1.011	1.213	0.000	0.404	0.506	0.455
4	0.679	0.637	0.000	0.000	0.918	0.439	0.459	0.449
5	0.410	0.562	0.918	0.974	0.598	0.649	0.758	0.704
6	0.000	0.662	1.011	0.876	0.562	0.512	0.787	0.650
7	0.000	0.683	0.679	0.834	0.000	0.506	0.340	0.423
8	0.000	0.562	0.679	1.401	0.000	0.654	0.340	0.497
9	0.000	0.655	0.562	0.382	0.287	0.346	0.425	0.385
10	0.451	0.451	0.679	0.287	1.089	0.396	0.884	0.640
11	0.000	0.000	0.637	0.476	1.082	0.159	0.859	0.509
12	0.500	0.662	1.099	0.000	1.040	0.387	1.069	0.728
13	0.349	0.637	0.562	0.000	0.995	0.328	0.779	0.554
14	0.000	0.000	0.637	0.000	0.693	0.000	0.665	0.332
15	0.530	0.687	0.562	0.000	0.937	0.406	0.750	0.578
16	0.000	0.598	0.888	1.213	0.000	0.604	0.444	0.524
17	0.000	0.611	0.868	1.473	0.000	0.695	0.434	0.564
18	0.562	0.662	1.011	0.900	1.082	0.708	1.047	0.877
19	0.000	0.662	0.679	1.061	0.662	0.574	0.670	0.622
20	0.000	0.611	1.028	1.144	0.000	0.585	0.514	0.549
21	0.000	0.500	0.451	0.945	0.611	0.482	0.531	0.506
22	0.000	0.325	1.011	0.598	0.943	0.308	0.977	0.643
23	0.000	0.611	1.011	1.044	0.000	0.552	0.506	0.529

24	0.888	0.637	0.000	1.109	0.679	0.878	0.340	0.609
25	0.000	0.693	0.000	1.340	0.693	0.678	0.347	0.512
26	0.000	0.687	0.562	0.105	0.637	0.264	0.599	0.432
27	0.000	0.500	0.679	0.000	0.950	0.167	0.815	0.491
28	0.000	0.586	0.721	0.000	0.000	0.195	0.361	0.278
29	0.000	0.000	0.960	0.984	0.611	0.328	0.785	0.557
30	0.000	0.562	0.000	1.195	0.562	0.586	0.281	0.433
31	0.500	0.611	0.451	0.476	0.673	0.529	0.562	0.545
32	0.562	0.000	0.637	0.000	0.662	0.187	0.649	0.418
33	0.305	0.689	0.824	1.188	0.000	0.727	0.412	0.570
34	0.410	0.410	0.637	1.197	0.683	0.672	0.660	0.666
35	0.000	0.325	0.451	0.733	0.349	0.353	0.400	0.376
36	0.500	0.325	0.960	0.000	1.168	0.275	1.064	0.670
37	0.000	0.451	0.679	1.243	0.451	0.565	0.565	0.565
38	0.325	0.693	0.960	1.268	0.325	0.762	0.642	0.702
39	0.000	0.673	0.918	1.129	0.000	0.601	0.459	0.530
40	0.000	0.349	0.000	1.277	0.937	0.542	0.468	0.505
41	0.000	0.662	0.637	1.493	0.000	0.718	0.318	0.518
42	0.000	0.662	0.637	0.640	0.662	0.434	0.649	0.542
43	0.000	0.562	0.637	0.377	1.004	0.313	0.820	0.567
44	0.000	0.530	0.679	0.611	0.000	0.380	0.340	0.360
45	0.000	0.500	0.562	0.905	0.000	0.468	0.281	0.375
46	0.000	0.679	0.287	1.314	0.000	0.665	0.143	0.404
47	0.377	0.000	0.679	0.798	0.000	0.391	0.340	0.366
48	0.000	0.611	0.721	1.235	0.500	0.615	0.611	0.613
49	0.000	0.562	1.011	1.272	0.000	0.611	0.506	0.559
50	0.000	0.693	0.918	0.867	1.030	0.520	0.974	0.747
51	0.349	0.586	0.562	0.824	0.868	0.586	0.715	0.651
52	0.662	0.000	0.637	0.000	0.900	0.221	0.768	0.494

53	0.566	0.679	0.824	0.087	0.673	0.444	0.748	0.596
54	0.000	0.562	1.028	0.999	0.000	0.521	0.514	0.517
55	0.325	0.693	0.679	1.473	0.325	0.830	0.502	0.666
56	0.410	0.325	0.451	1.275	0.639	0.670	0.545	0.607
57	0.611	0.637	0.721	0.684	0.000	0.644	0.361	0.502
58	0.000	0.598	0.000	0.796	0.000	0.465	0.000	0.232
59	0.683	0.000	0.679	1.004	0.662	0.562	0.670	0.616
60	0.000	0.562	0.637	0.962	0.000	0.508	0.318	0.413
61	0.000	0.693	0.451	0.938	1.055	0.544	0.753	0.648
62	0.000	0.693	0.637	0.640	0.662	0.445	0.649	0.547
63	0.000	0.683	0.637	0.554	0.377	0.412	0.507	0.459
64	0.287	0.637	0.679	0.857	0.000	0.593	0.340	0.466
65	0.000	0.611	0.451	1.089	0.943	0.567	0.697	0.632
66	0.974	0.683	0.637	0.377	0.974	0.678	0.805	0.742
67	0.673	0.673	0.679	0.628	0.673	0.658	0.676	0.667
68	0.000	0.000	0.693	1.126	0.000	0.375	0.347	0.361
69	0.000	0.611	0.451	0.974	0.950	0.528	0.700	0.614
70	0.000	0.637	0.451	0.992	0.000	0.543	0.225	0.384
71	0.000	0.687	0.824	1.149	0.000	0.612	0.412	0.512
72	0.000	0.562	0.679	1.059	1.036	0.541	0.858	0.699
73	0.349	0.637	0.000	1.338	0.000	0.775	0.000	0.387
74	0.000	0.598	0.637	1.154	0.000	0.584	0.318	0.451
75	0.000	0.611	0.562	1.157	1.089	0.589	0.826	0.707
76	0.000	0.687	0.000	0.810	0.943	0.499	0.472	0.485
77	0.000	0.562	0.566	0.645	0.451	0.403	0.508	0.455
78	0.000	0.562	0.637	1.300	0.736	0.621	0.686	0.653
79	0.562	0.679	0.000	0.900	1.099	0.714	0.549	0.632
80	0.000	0.673	0.451	0.639	0.687	0.437	0.569	0.503
81	0.000	0.325	0.451	0.349	0.000	0.225	0.225	0.225

82	0.000	0.500	0.679	1.096	0.000	0.532	0.340	0.436
83	0.000	0.611	1.011	0.000	0.000	0.204	0.506	0.355
84	0.000	0.500	1.028	0.859	0.000	0.453	0.514	0.484
85	0.000	0.377	0.679	0.000	0.000	0.126	0.340	0.233
86	0.000	0.451	0.679	1.378	0.000	0.609	0.340	0.475
87	0.000	0.637	1.011	0.000	0.000	0.212	0.506	0.359

Source: Research data (2019)

Appendix IX: List of Housing Co-operative Societies

	Name Of Housing Co-operative	Co-operative Society No	Region
1	Kibera Udongo Housing	3452	Dagoretti
2	K-Rep Staff Housing	7689	Dagoretti
3	Gakobu Housing	8641	Dagoretti
4	Hazina Estate Housing	8777	Dagoretti
5	Green Pastures Housing	13313	Dagoretti
6	Naiwest Housing	13932	Dagoretti
7	Maono	14187	Dagoretti
8	Wakaridi Housing	14936	Dagoretti
9	Milimani Housing	2414	Embakasi
10	Nasca Housing	6189	Embakasi
11	Outering Road Housing	6759	Embakasi
12	TTT	8248	Embakasi
13	Upendo Steel	3528	Embakasi
14	Kingsize Housing	10496	Embakasi
15	P.C.E.A Kayole Housing	10748	Embakasi
16	Manyatta Saba Housing	12623	Embakasi
17	Shikamana Housing	12734	Embakasi
18	Tasco Housing	12768	Embakasi
19	Smart Vision Sisters Housing	12783	Embakasi
20	Baseroot	13305	Embakasi
21	Buruburu Juhudi Housing	13309	Embakasi
22	Aspco Housing	13480	Embakasi
23	Maendeleo Pamoja Housing	13661	Embakasi
24	Multiple Housing	13749	Embakasi
25	Marafiki Housing	13801	Embakasi
26	Ndege View Friends Housing	14337	Embakasi
27	Umoja Wendani Housing	14348	Embakasi
28	Royal Capital	14431	Embakasi

29	Vawiwi Housing	14386	Embakasi
30	2 Gf Housing	14393	Embakasi
31	Muiranyi Housing	14403	Embakasi
32	Utawala Kama Housing	14534	Embakasi
33	Afcahl Housing	14546	Embakasi
34	Nyotabon Housing	14637	Embakasi
35	Tausi Fairtrade Housing	14817	Embakasi
36	Friends Women Housing	14851	Embakasi
37	Mlango Kubwa Housing	3119	Kamukunji
38	Trade Union Housing	4612	Kamukunji
39	Kambuki Housing	13733	Kamukunji
40	Emmanuel Kanuku Housing	14075	Kamukunji
41	Kamukunji Housing	14095	Kamukunji
42	Nairobi Consumers Housing	14169	Kamukunji
43	Kenyuco	6761	Kasarani
44	Mathare North Mwireri	12675	Kasarani
45	Kamuthi	4689	Kasarani
46	Kamulu Housing	13826	Kasarani
47	Kasarani Landless Housing	13934	Kasarani
48	Tripple T	14108	Kasarani
49	Pesa	14607	Kasarani
50	Alala Kenya	14704	Kasarani
51	Uhuru Garden Housing	4983	Lang'ata
52	Park Road Estate Housing	9922	Lang'ata
53	Amref Housing	10069	Lang'ata
54	Focus Women	10279	Lang'ata
55	Sirikwa	10494	Lang'ata
56	Imani Women	11927	Lang'ata
57	Dunia Moja	11337	Lang'ata
58	Soweto East Zone A	11455	Lang'ata

59	Soweto East Zone B	11454	Lang'ata
60	Soweto East Zone D	11453	Lang'ata
61	Tujiendeleze Women Housing	11925	Lang'ata
62	Ngumo Mbega Housing	12731	Lang'ata
63	Heart	12953	Lang'ata
64	DNS	13312	Lang'ata
65	Yunasi Housing	13654	Lang'ata
66	Lukenya Uiini	13678	Lang'ata
67	Karemen Housing	13812	Lang'ata
68	Thahabu	13847	Lang'ata
69	Beyond 2000 Housing	13981	Lang'ata
70	Future Of The Stars	14106	Lang'ata
71	Bellevue	14199	Lang'ata
72	Ndiwa Housing	14178	Lang'ata
73	La-Pendo Housing	14328	Lang'ata
74	Razak Housing	14329	Lang'ata
75	Aibk	14640	Lang'ata
76	Kenred	14654	Lang'ata
77	Kimua	14859	Lang'ata
78	Conah	5154	Makadara
79	Tetra Pak	6213	Makadara
80	Mawazo Boma	14468	Makadara
81	S.B Employees	8339	Makadara
82	Ofafa Maringo Housing	9590	Makadara
83	GSK Multi-Purpose	11147	Makadara
84	Nyati Housing	12177	Makadara
85	Afyanet	12387	Makadara
86	Hers Housing	12653	Makadara
87	Walishaji	13833	Makadara
88	Hoechem	14078	Makadara

89	Mater Housing	7877	Makadara
90	Kencream	14235	Makadara
91	DHLHousing	14272	Makadara
92	Ranah	14451	Makadara
93	Cincogates Housing	14744	Makadara
94	Platinum Housing	576	Starehe
95	Kenatco Housing	4410	Starehe
96	Nairobi Teachers Housing	5661	Starehe
97	Diplomatique Housing	5819	Starehe
98	Jengo Housing	5965	Starehe
99	Co-Operative Bank Housing	6714	Starehe
100	Chuna Housing	6951	Starehe
101	Kirere Housing	7355	Starehe
102	Chai Housing	7517	Starehe
103	Afya Housing	8614	Starehe
104	Pangani Housing	9067	Starehe
105	Nairobi Housing Co-op	10170	Starehe
106	Sawa Housing	11572	Starehe
107	Njiwa Housing	11629	Starehe
108	Epitome Housing Co-op	11674	Starehe
109	Azaria Women Housing	12515	Starehe
110	Simlaw Housing	12690	Starehe
111	Chetu Housing	12711	Starehe
112	Ex-Grogon Slum Housing	12745	Starehe
113	Muungano Mahira Land & Housing	12744	Starehe
114	Simba Youth	12843	Starehe
115	Nahiho Housing	12876	Starehe
116	Sky Ventures Housing	12918	Starehe
117	Wendos	13147	Starehe
118	Mega Housing	13190	Starehe

119	Fincom Housing	13396	Starehe
120	Icea Housing	13525	Starehe
121	Victors Of Faith Housing	13652	Starehe
122	Kariobangi Housing and Settlement	1531	Starehe
123	Tunda Housing	13843	Starehe
124	Ibera Africa Housing	13863	Starehe
125	Pendu Housing	13913	Starehe
126	Riziki Housing	13920	Starehe
127	Dodcon Housing	14071	Starehe
128	Mother Healthcare Housing	13030	Starehe
129	KICC Housing	14138	Starehe
130	Seed Share Housing	14267	Starehe
131	Taasisi Housing	14276	Starehe
132	Huruma Tuendelea Housing	14304	Starehe
133	Great Tens Housing	14310	Starehe
134	Gitongu Starehe Housing	14436	Starehe
135	Kita - A Housing	14447	Starehe
136	Liscco Housing	14516	Starehe
137	Kandara Bidii Housing	14612	Starehe
38	Ghetto Residents Land & Housing Coop	14715	Starehe
139	Kathita Flow Housing	14833	Starehe
140	Kico Housing	14836	Starehe
141	The County Housing	14919	Starehe
142	Habitat Housing	6325	Westlands
143	Imani Housing	9964	Westlands
144	Kitisuru Housing	17401	Westlands
145	Umoja Wa Karura Housing	11119	Westlands
146	Pambazuko Housing	11160	Westlands
147	Bibilia HOUSING	11546	Westlands
148	Kagera Muleba Housing	11625	Westlands

149	Kk Technical Housing	12029	Westlands
150	Huduma Housing	12418	Westlands
151	Laxma Housing	12416	Westlands
152	Law Society of Kenya Housing	12754	Westlands
153	Kanisa Housing	12800	Westlands
154	Boosi Housing	13306	Westlands
155	Amazing Housing	13356	Westlands
156	Waido Housing	13377	Westlands
157	Occidental Insurance Co. Staff Housing	14005	Westlands
158	Generation Plus Housing	14070	Westlands
159	St. Dorcas Housing	14124	Westlands
160	Cfc Life Agents Housing	14188	Westlands
161	Wanadawa Housing	14242	Westlands
162	Kinga	14275	Westlands
163	Uokoaji Housing	14407	Westlands
164	Precsta Housing	14493	Westlands
165	Ryqa Housing	14512	Westlands
166	Families United Housing	14601	Westlands
167	Nimepata Housing	14600	Westlands
168	Dhamini	14690	Westlands
169	Shelloyees Housing	14721	Westlands
170	Makini Housing	14733	Westlands
171	Compasco Housing	14822	Westlands
172	Jewel Housing	14930	Westlands
173	L'assurance Housing	14937	Westlands

Source: State Department of Co-operatives (2019)

Appendix X: List of Sampled Housing Co-operative Societies

DMU	Name of Housing Co-operative	Location	Housing Co-operative Type
1	Dorato Group Housing	Starehe	Small Business Group
2	Nimepata Housing	Westlands	Private Sector Employees
3	Beyond 2000	Langata	Community Based
4	Kandara Housing	Starehe	Community Based
5	AFCAHL Housing	Embakasi	Private Sector Employees
6	Heart Housing	Langata	Private Sector Employees
7	Calkeni Housing	Embakasi	Private Sector Employees
8	Njiwa Housing	Starehe	Public Sector Employer
9	Kenyatta University Boma Housing	Kasarani	University Employee
10	Kamuthi Housing	Kasarani	Investment Housing
11	Nautil Housing	Dagoreti	Women Based
12	Online Housing	Embakasi	Private Sector Employees
13	Ukistro na Ufanisi Housing	Dagoretti	Faith Based
14	Manyatta Saba Housing	Embakasi	Community Based
15	Waido Housing	Westlands	Community Based
16	Sasra Housing	Starehe	Private Sector Employees
17	Kenyuco Housing	Kasarani	University Employee
18	Transtana Housing	Makadara	Investment Housing
19	Tabuga Housing	Westlands	Private Sector Employees
20	Ukaguzi Housing	Starehe	Professionals
21	ICEA Housing	Starehe	Investment Housing
22	DHL Housing	Makadara	Private Sector Employees
23	KENPIPE Housing	Makadara	Private Sector Employees
24	Nairobi Teachers Housing	Starehe	Public Sector Employer
25	Jewel Housing	Westlands	Private Sector Employees
26	Vista Housing	Dagoretti	Investment Housing
27	Mfones Housing	Starehe	Community Based
28	Umoja Wendani Housing	Embakasi	Community Based
29	Nyati Housing	Makadara	Investment Housing
30	Airport Housing	Embakasi	Private Sector Employees
31	Bands Housing	Embakasi	Small Business Group
32	Neeuah Housing	Dagoretti	Women Based
33	Maono Housing	Dagoretti	Investment Housing

34	Alala Kenya Housing	Kasarani	Faith Based
35	Magnate Ventures Housing	Makadara	Private Sector Employees
36	Base Root Housing	Embakasi	Small Business Group
37	Ukulima Housing	Starehe	Public Sector Employer
38	Karisa Housing	Westlands	Private Sector Employees
39	Wanandege Housing	Embakasi	Private Sector Employees
40	Printers Workers Housing	Kamukunji	Small Business Group
41	Ardhi	Kasarani	Public Sector Employer
42	Future of the Star	Langata	Community Based
43	Ndege View Friends	Embakasi	Community Based
44	Ndega Housing	Starehe	Investment Housing
45	Shirika Housing	Starehe	Public Sector Employer
46	Kenya Medical Association	Dagoretti	Professionals
47	Quanza Housing	Dagoretti	Women Based
48	Queensway Housing	Dagoretti	Investment Housing
49	Utafiti Housing	Dagoretti	Public Sector Employer
50	Kentours Housing	Dagoretti	Private Sector Employees
51	Jogoo Housing	Dagoretti	Investment Housing
52	Friends Women Housing	Embakasi	Women Based
53	Haco Housing	Kasarani	Private Sector Employees
54	AFCO Housing	Kamukunji	Public Sector Employer
55	CoCoTech Housing	Langata	University Employee
56	Aspco Housing	Embakasi	Private Sector Employees
57	Yes Housing	Makadara	Investment Housing
58	Royal Housing	Makadara	Private Sector Employees
59	Multiple Housing	Embakasi	Private Sector Employees
60	Nyumba Housing	Starehe	Investment Housing
61	Maendeleo Pamoja	Embakasi	Community Based
62	Simlaw Housing	Starehe	Private Sector Employees
63	Chetu Housing	Starehe	Private Sector Employees
64	LSK Housing	Westlands	Professionals
65	Taasisi Housing	Starehe	Public Sector Employer
66	Vawiwi Housing	Embakasi	Community Based
67	Mater Housing	Makadara	Public Sector Employer
68	Laxma Housing	Westlands	Professionals

69	Twiga Housing	Makadara	Investment Housing
70	Simba Youth	Starehe	Investment Housing
71	Chai Housing	Starehe	Private Sector Employees
72	Hoechem Housing	Makadara	Private Sector Employees
73	Chuna Housing	Starehe	University Employee
74	Nafaka	Makadara	Public Sector Employer
75	Railway Housing	Starehe	Public Sector Employer
76	Kwetu Housing	Starehe	Community Based
77	Biblia Housing	Westlands	Faith Based
78	Uchumi Housing	Starehe	Investment Housing
79	Kenchic Housing	Embakasi	Private Sector Employees
80	Akwana	Dagoretti	Community Based
81	Wakaridi Housing	Dagoretti	Community Based
82	Notaff Housing	Embakasi	Private Sector Employees
83	Kirere Housing	Starehe	Community Based
84	Zimmerman Cornerstone Housing	Kasarani	Faith Based
85	Platinum Housing	Starehe	Community Based
86	Keninchia Housing	Starehe	Investment Housing
87	Yuneh Housing	Westlands	Community Based

Source: State Department of Co-operatives (2019)