Capital Structure, Product and Banking Market Structure and Performance

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Abstract

This thesis consists of three distinct essays on finance, market structure and performance. Paying particular attention to the degree of industry competition, the first essay investigates the relationship between capital structure and firm performance using panel data consisting of 257 South African firms over the period 1998 to 2009. The essay applies a novel measure of competition, the Boone indicator, to the leverage-performance relationship. The results suggest that financial leverage has a positive and significant effect on firm performance. It is also found that product market competition enhances the performance effect of leverage. The results are robust to alternative measures of competition and leverage.

The second essay examines the extent of banking competition in African subregional markets. A dynamic version of the Panzar-Rosse model is adopted beside the static model to assess the overall extent of banking competition in each subregional banking market over the period 2002 to 2009. Consistent with other emerging economies, the results suggest that African banks generally demonstrate monopolistic competitive behaviour. Although the evidence suggests that the static Panzar-Rosse H-statistic is downward biased compared to the dynamic version, the competitive nature identified remains robust to alternative estimators.

Paying particular attention to the degree of banking market concentration in developing countries, the third essay examines the effect of credit information sharing on bank lending. Using bank-level data from African countries over the period 2004 to 2009 and a dynamic two-step system generalised method of moments (GMM) estimation, it is found that credit information sharing increases bank lending. The degree of banking market concentration moderates the effect of credit information sharing on bank lending. The results are robust to controlling for possible interactions between credit information sharing and governance.

To my Mother, Hannah; you never gave up on me

To my big sister, Mavis; you gave me wings

To my wife, Christiana, for your love and patience

To my sons, Jonathan and Samuel, for the bonding time sacrificed

To my sisters, for your love and support

"Ebenezer, ... Hitherto hath the Lord helped us".

–1 Samuel 7:12 (KJV)

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Chapter 1

Introduction

1.1 Background and motivation

Finance, market structure and information asymmetry play a significant role in both product and banking market outcomes. These factors also exhibit significant interactions in their effects, which arguably are predominantly high in developing countries. Given the more lax regulatory environment in developing countries, the high level of product market concentration is likely to make more financially leveraged firms more susceptible to rivalry predation. Also, weak contract enforcement makes information sharing more desirable for efficient credit allocation in developing countries, especially as banking market competition increases.

Motivated by these facts, this thesis investigates how capital structure, competition (concentration) and information sharing impact on performance in product and credit markets in developing countries. First, the effects on firm performance of capital structure and its interaction with competition are investigated for a sample of South African firms. Second, comparative studies of subregional banking market competition within Africa are conducted. Finally the effects on credit market performance of information sharing, concentration and their interaction in African countries is examined. In what follows, a brief introduction to each of the chapters is presented.

1.1.1 Capital structure, product market competition and firm performance: Evidence from South Africa

Capital structure may have some degree of effects on firm performance. A strand of the literature on capital structure suggests a positive effect of financial leverage on performance. This prediction is mainly based on the trade-off between agency costs of debt and equity (Jensen and Meckling, 1976); the limited liability effect of debt (Brander and Lewis, 1986); and the disciplining effect of debt (Grossman and Hart, 1983; Jensen, 1986). However, given the underinvestment problems associated with debt (Myers, 1977) and stakeholder reactions to leverage (Maksimovic and Titman, 1991; Titman, 1984), financial structure may also adversely affect firm performance.

Recent attention has been attracted to the possibility that leverage opens up opportunities for rivalry predation in concentrated product markets (Bolton and Scharfstein, 1990; Chevalier and Scharfstein, 1996; Dasgupta and Titman, 1998). This possibility suggests that the performance effect of leverage is conditional on the degree of competition in the product market. Empirical attention to this possible interaction between capital structure and product market competition is relatively recent and limited to U.S. firms (Campello, 2003, 2006; Chevalier, 1995a,b; Kovenock and Phillips, 1997; Opler and Titman, 1994). It would be interesting to verify the U.S. evidence against evidence from other parts of the World, particularly from an environment that is characteristically distinct from the U.S.

Another limitation of the existing empirical evidence is that, they all focus on concentration-based measures of competition. There is, however, a firm belief that measures of competition based on concentration ratios may actually fail to capture the degree of product market competition, as high levels of concentration may result from differential efficiency (Demsetz, 1973) or a rather high level of competition (Boone et al., 2005, 2007).

Paying particular attention to the degree of product market competition, Chapter 2 of the thesis seeks to extend the literature on the leverage-performance relationship by providing evidence from South Africa, a potentially highly predatory environment with severe agency costs of equity. This offers a new insight given that South Africa features a highly concentrated and pyramidal ownership structure of firms (Barr et al., 1995; Kantor, 1998), overly concentrated product markets (Fedderke et al., 2007), and a less robust regulatory and legal environment (Roberts, 2004, 2008). Second, the chapter employs a new measure of competition, the Boone indicator (Boone et al., 2005, 2007; Boone, 2008) in addition to the Herfindahl-Hirschman Index. The Boone indicator provides a measure of product market competition by estimating the extent to which firms suffer lost earnings (or market share) as a result of being inefficient. In addition to employing absolute leverage, the chapter employs relative leverage, which measures the degree of a firm's leverage relative to its industry-mean leverage.

1.1.2 Banking competition in Africa: Subregional comparative studies

Banking markets across the globe have witnessed significant reforms in recent years. These reforms have significant implications on banking behaviour, including how they compete. It is unsurprising, therefore, that significant empirical attention has been attracted to investigating competition in banking markets across the globe, particularly the U.S. (Shaffer, 1982), Canada (Nathan and Neave, 1989), European countries (Bikker and Haaf, 2002; Coccorese, 2004; De Bandt and Davis, 2000; Gunalp and Celik, 2006; Mamatzakis et al., 2005; Molyneux et al., 1994; Vesala, 1995), Japan (Molyneux et al., 1996), Arab World (Al-Muharrami et al., 2006), South Asian countries (Perera et al., 2006), Ghana (Biekpe, 2011) and Tanzanian (Simpasa, 2011).

The evidence in the literature confirms that banking competition within African countries have largely received less attention. This is particularly noteworthy given the extent of significant reforms that have taken place over the last two decades. Liberalisation of interest rates and credit markets, and significant privatisation of state-owned banks have impacted greatly on African banking. For instance, the African region has witnessed a significant increase in the numbers of banks in each country, whilst recapitalisation programmes aimed at gaining financial stability have compelled many banks to merge and a few others to exit the market. Hence, banking concentration, though falling, remains significantly high in the region. It remains an empirical question as to whether this structural change is a sign of increasing competition in banking markets within the region. This question lies at the heart of Chapter 3 of the thesis.

Assuming common banking markets within Africa, and employing both the static and dynamic versions of the Panzar-Rosse model, Chapter 3 of this paper attempts to investigate the degree of competition in African banking sectors after years of reforms. It also sheds light on how competition differs across interest-generating activities and overall banking activities within Africa. By attempting a broader empirical investigation of African banking markets, this chapter helps us to compare banking sector competitiveness across Africa with other emerging markets. Moreover, a subregional comparative approach adopted in this chapter helps us to compare competitive outcomes across African subregions and to evaluate the overall effectiveness of continued reforms on African banking. Furthermore, the paper adopts alternative estimation methods (static and dynamic) and specifications to minimise possible risks of misidentifying the competitive nature of the African banking markets. Particularly, in addition to (static) panel fixed effect estimation, the paper adopts a dynamic two-step system generalised method of moments (GMM) estimation method to estimate the dynamic Panzar-Rosse model, thus improving on the methods employed in previous studies. Finally, the paper provides firsthand evidence in support of Goddard and Wilson (2009) that the static H-statistic could be downward biased.

1.1.3 Credit information, consolidation and credit market performance: Bank-level evidence from developing countries

African banking markets to date remain woefully underdeveloped, even by the standards of the developing world (Honohan and Beck, 2007; Mylenko, 2007).

Despite several years of banking sector reforms in Africa, credit penetration in the region is the lowest in the World (Mylenko, 2007); just about one in five of households have access to formal banking services (Beck et al., 2009; Honohan and Beck, 2007). Banks in the region are compelled to lend less because of poor credit information and weak contract enforcement (Honohan and Beck, 2007). This insight underscores the potential benefits of credit information sharing in the African region.

The availability and quality of credit information are crucial for the optimal performance of credit markets (Stiglitz and Weiss, 1981). Credit information sharing helps to disseminate much needed credit information to credit market participants to help facilitate lending (Bennardo et al., 2010; Pagano and Jappelli, 1993), reduce loan default (Padilla and Pagano, 1997, 2000), and increase competition (Pagano and Jappelli, 1993), which may help improve bank lending. It is therefore not surprising that many developed countries have schemes in place that ensure efficient flow of credit information. In many developing countries, however, such schemes of credit information sharing are either absent or in their infancy.

It is also worth emphasising that the benefits of credit information sharing are theoretically suggested to be less in concentrated banking markets (Marquez, 2002). Interestingly, as shown in Chapter 3 of this thesis, high levels of concentration that characterise the African banking markets have assumed a downward trend following years of reforms. This suggests that credit information is becoming increasingly dispersed as the pool of borrowers per bank becomes smaller.

Chapter 4 of the thesis examines the effect of credit information sharing on bank lending in African countries. It further conditions this effect on the extent of banking sector consolidation. This chapter extends the literature by providing the first bank-level evidence of the effect of credit information on credit allocation. This approach helps to account for bank-level heterogeneity. Second, the chapter provides firsthand evidence about the moderating effect of banking sector consolidation on the benefits of credit information sharing. Third, the paper further investigates possible interaction effects on bank lending of credit information sharing and a wider range of institutional factors. Finally, this is the first paper to attempt a comprehensive study of credit information sharing and bank lending in African countries. Thus, the study offers potential for a new insight into the relationship between bank lending and credit information sharing.

1.2 Organization of the thesis

The rest of the thesis is organised as follows: chapter 2 examines the impact of capital structure on firm performance in South Africa, paying particular attention to the ameliorating effect of product market competition. The South African corporate context motivating this study is presented in Section 2.2. The estimation methods employed in this chapter are mainly panel fixed effect and two-step GMM.

Chapter 3 investigates banking competition in African subregional banking markets. Employing a subregional comparative analysis, the chapter seeks to identify the nature of competition exhibited by African banks, and compare the findings to those found for other emerging banking markets.

Chapter 4 of the thesis examines the effect of credit information sharing on bank lending in developing countries, paying particular attention to the degree of banking market concentration. Further extensions are made in this chapter in respect of possible interactions with governance indicators.

Finally, Chapter 5 concludes the study.

Chapter 2

Capital structure, product market competition and firm performance: Evidence from South Africa

2.1 Introduction

Despite several decades of research, there is no generally accepted conclusion about the relationship between capital structure and firm performance. Following the seminal papers of Modigliani and Miller (1958, 1963) suggesting that, but for the tax-advantage of debt, capital structure is irrelevant to firm performance, the relationship between financial leverage and firm performance has attracted much debate and mixed empirical findings. The trade-off between agency costs of debt and equity (Jensen and Meckling, 1976); the limited liability effect of debt (Brander and Lewis, 1986); and the disciplining effect of debt (Grossman and Hart, 1983; Jensen, 1986) all suggest a positive effect of leverage on performance. However, possible underinvestment problems associated with debt (Myers, 1977) and stakeholder reactions to leverage (Maksimovic and Titman, 1991; Titman, 1984) suggest negative effects. Extensions of these theories (Bolton and Scharfstein, 1990; Chevalier and Scharfstein, 1996; Dasgupta and Titman, 1998) suggest that leverage opens up opportunities for predation from rivals in concentrated product markets, thus conditioning the performance effect of leverage on the degree of competition in the product market.

The argument in the literature suggests that, in less competitive markets leveraged firms face a high risk of predation from incumbents. The incumbent aims to send incorrect signals about future prospects to the more leveraged entrant firm, or increase the likelihood of liquidation by the leveraged firm (see Fudenberg and Tirole, 1986; Bolton and Scharfstein, 1990). These predatory practices are less likely in more competitive product markets given that the likelihood of a few firms significantly influencing the market outcomes is relatively less; also, as leveraged firms may be more financially constrained than their less leveraged rivals in concentrated product markets, predatory practices are more likely in concentrated product markets. The existing evidence of these interaction effects of leverage and competition is based on U.S. firms (Campello, 2003, 2006; Chevalier, 1995a,b; Kovenock and Phillips, 1997; Opler and Titman, 1994). The South African experience offers an opportunity to gain new insight. Distinct from the U.S., South Africa features a highly concentrated and pyramidal ownership structure of firms (Barr et al., 1995; Kantor, 1998), overly concentrated product markets (Fedderke et al., 2007), and a less robust regulatory and legal environment (Roberts, 2004, 2008). These attributes suggest distinctively severe agency costs of equity and product market predation.

Using panel data consisting of 257 South African firms over the period 1998 to 2009, this study seeks to address three questions: (1) Does knowledge about product market competition improve our understanding of the leverage-performance relationship in developing countries? (2) To what extent does this relationship hold or vary across alternative measures of competition? (3) To what extent do the effects of leverage on performance and its interaction with competition depend on rival firms' leverage levels?

The findings of this chapter show a significant positive effect of leverage on firm performance. This effect is non-linear but remains significantly positive over the relevant range of leverage. It is also found that the interaction effect of leverage and competition on firm performance is positive. The findings imply that competition enhances the benefits of leverage. Using relative-to-rival firms' leverage yields consistent results.

These findings are broadly consistent with Opler and Titman (1994) and Kovenock and Phillips (1997) in respect of the adverse interaction effect of leverage and product market concentration (uncompetitiveness). However, these authors find statistically insignificant direct negative effects of leverage on firm performance, contrary to the direct positive effects reported in this paper. The observed difference in the direct effect of leverage could be attributed to the nature and severity of agency costs of equity faced by South African firms.

This paper contributes to the existing literature in the following ways: first, by focusing on South African firms, the paper provides firsthand developing country evidence of the interaction effect of leverage and competition on performance.

Given the unique characteristics of South African product markets, this paper provides evidence from a potentially highly predatory environment with severe agency costs of equity. To the author's knowledge, this issue has not been previously addressed. Second, in addition to the Herfindahl-Hirschman Index, this study adopts a new measure of competition, the Boone indicator (Boone et al., 2005, 2007; Boone, 2008), which estimates the extent to which firms suffer lost earnings (or market share) as a result of being inefficient. The Boone indicator helps address potential setbacks in concentration indices used in all previous studies (Opler and Titman, 1994; Chevalier, 1995a,b; Kovenock and Phillips, 1997; Campello, 2003, 2006). For instance, a high level of product market concentration could simply be the outcome of pronounced efficiency (Demsetz, 1973) or the exit of inefficient firms from the market as competition intensifies, in which case the profits of the more efficient firms increase (Boone et al., 2005, 2007; Boone, 2008).

The remainder of this chapter is organised as follows. Section 2.2 provides brief motivation for the study of South African firms. Section 2.3 presents a review of the relevant theoretical literature and empirical evidence; whilst Section 2.4 outlines the research hypothesis. Section 2.5 describes the data and variables used for the study. Section 2.6 discusses the empirical estimation methods. Section 2.7 presents the empirical results. The summary and conclusion of the study are presented in Section 2.8.

2.2 South African corporate context

Concentrated and pyramidal ownership structures, as well as overly concentrated product markets, are some of the key features that distinguish South African firms from their U.S. counterparts. A considerably large proportion of Johannesburg Stock Exchange (JSE) listings are effectively controlled by groups with a pyramidal ownership structure.[1] Hence, South African firms are distinct from U.S. firms by way of the agency problems they face. Conflict of interest is largely between minority and majority shareholders, rather than between managers and shareholder or creditors and shareholders as in the U.S. and U.K. (Barr et al., 1995; Kantor, 1998). In this agency relationship, the minority shareholders are the agents; the majority shareholders, the principals. As noted in Morck et al. (1998), such a system of ownership leads to an extreme level of expropriation of the minority shareholders' wealth since significant control rights can be exercised with little equity stake. This ownership structure, largely sustained by the tax advantage of equity investment, holding companies, cross-holding and voting trusts, has seen little change over time.[2] The agency problems associated with such a system of ownership may possibly be mitigated by the disciplinary measures embodied in debt contracts. Although debt financing comes with its own potential agency problems, with such a system of ownership the disciplinary measures embodied in debt contracts should logically be more desirable.

Although high levels of concentrated ownership, which have emerged from the pyramidal ownership structure (Ntim et al., 2012), may be associated with lower agency costs (Fama and Jensen, 1983; Villalonga and Amit, 2006), the robustness of the regulatory environment plays a major role (Anderson and Reeb, 2003). Compared to the U.S., regulatory quality is less robust in South Africa (Roberts,

[1]For instance, almost 80% of JSE listings was controlled by groups in 1995 and this group structure has seen little change over time (Barr et al., 1995; Kantor, 1998). In fact, as at the end of 2002, 56.2% of the market capitalisation of JSE listings was controlled by four companies (see Rossouw et al., 2002).

[2]For full a review of this control process, see Kantor (1998).

2004, 2008), suggesting that the agency benefits of a concentrated ownership, relative to the associated agency costs, may be less. It is reasonable to suggest that the legal structures in South Africa may offer relatively less protection to investors, thus making the agency problems worse.

Another distinctive feature of South African firms is the degree of concentration in their product markets. Traditionally, South African firms are faced with a very high degree of concentration in market shares, which does not encourage competition. Using both firm level and aggregate industry data, Aghion et al. (2008) find that competition is relatively low in South Africa.[3] Consistent evidence is provided by Fedderke et al. (2007), who document mark-ups twice as high among South African manufacturing firms as among U.S. manufacturing firms. These findings, coupled with relatively suboptimal regulation, suggest a higher likelihood of predation from rivals in South Africa than in the U.S.

Over the past few years, stringent efforts have been made to improve product market competition. In 1999, South Africa's Competition Board was replaced with a new Competition Commission following the implementation of the Competition Act of 1998. These steps are meant to effectively address anticompetitive practices and to promote regulatory independence (Roberts, 2008). Unsurprisingly, Fedderke and Simbanegavi (2008) note that South African manufacturing industries are becoming less concentrated.

The uniqueness of the agency problems faced by South African firms makes it worthwhile to conduct further studies regarding the relationship between leverage, competition and performance. Since the existing evidence is in respect of U.S.

[3]Their proxy for competition is price cost margin measured alternatively as the ratio of price to production cost; the ratio of value added to sales; and the ratio of operating income to sales.

firms, the findings may provide a strong indication of the extent to which the disciplinary effect of leverage can mitigate the agency costs of equity in a potentially highly predatory environment.

2.3 Literature review

2.3.1 Leverage and firm performance

Following the seminal paper of Modigliani and Miller (1958), the study of capital structure has attracted much attention with differing theoretical predictions. Modigliani and Miller (1958) predict that, in a perfect capital market, capital structure of a firm is irrelevant to its value (hence, performance). Capital structure, however, matters for firms for several reasons, which arise mainly from the tax-deductibility of debt interest and agency theory.

Jensen and Meckling (1976) identify two main types of agency costs. The first, agency costs of outside equity, arises from the conflict of interest between the shareholder-manager and outside equity participant. As the shareholder-manager shares profits with the outside equity participant, the former has an incentive to maximise his utility by engaging in moral hazard. Such behaviour calls for increased monitoring and incentive mechanisms or contractual relations. These translate into higher costs which increase with higher outside equity participation. Hence, higher leverage has the potential to reduce costs and enhance performance. Extending this proposition, the benefits of leverage have been attributed to the discipline that comes with leverage through interest payment pre-commitments (Jensen, 1986), the threat of bankruptcy (Grossman and Hart, 1983), and the informational content of debt (Harris and Raviv, 1990).

The second type of agency costs identified by Jensen and Meckling (1976) arises from a conflict of interest between shareholders and debt holders. Shareholders find it rewarding to engage in excessive risk-taking since profits accrue to them, but part of the losses under liquidation are transferred to creditors. As such behaviour will be anticipated by debtholders, the cost of borrowing to the firm may be higher.[4] This suggests that leverage can also have an adverse effect on firm performance, especially if the firm is already highly leveraged. Myers (1977) extends this analysis to the case where leverage may rather lead to suboptimal investment. As debt transfers part of the benefits of investment options to the debtholders, under certain conditions, valuable investment opportunities may be rejected by the levered firm, leading to suboptimal investment and reduced market value of the firm.[5] In another development Stulz (1990) shows that whilst debt financing may be a credible device in mitigating overinvestment problems, it can worsen the underinvestment problems, as regular outflows of cash to debtholders place further resource constraints on managers.

The literature extends the agency costs of debt to the conflict of interest between the firm and its stakeholders. Titman (1984) argues that leverage affects the likelihood of a firm's liquidation, which can be costly to both its customers and creditors depending on the firm's liquidation policy. Customers may then be willing to trade with a highly leveraged firm only if its prices are low. Also, debt holders will be more inclined to impose restrictive covenants. Maksimovic and Titman (1991) argue that customers, under certain circumstances, may perceive

[4] Higher borrowing costs reflect monitoring and bonding expenses.

[5] For example, when the firm is highly leveraged such that the net present value of the investment opportunity is less than debt payment to creditors.

the product quality of a highly leveraged firm to be compromised, making them reluctant to transact with it. Thus, they also suggest that a high level of leverage can be detrimental to firm performance.

The forgoing discussion suggests that financial leverage can have both a positive and a negative effect on firm performance. When agency costs of debt are low, a moderate increase in leverage may be expected to increase firm performance by reducing the agency costs of equity. However, at higher levels of debt, further increase in financial leverage may lead to adverse firm performance resulting from higher agency costs of debt. This suggests that the effect of financial leverage on firm performance may not be monotonic. It does also suggest that market characteristics may play a crucial role in the relationship between financial leverage and performance.

Based on these theories, mixed empirical conclusions have been documented. Several studies report negative effects of leverage on firm performance (King and Santor, 2008; Ghosh, 2008; Bhagat and Bolton, 2008), whilst others report positive effects (Berger and Bonaccorsi di Patti, 2006; Margaritis and Psillaki, 2010; Weill, 2008) or insignificant effects (Phillips and Sipahioglu, 2004). A few studies suggest that the leverage-performance relationship is conditional on the degree of agency problems associated with firms (Ruland and Zhou, 2005; Schoubben and Van Hulle, 2006). For instance, Schoubben and Van Hulle (2006) show that leverage has a positive effect on quoted firms but a negative effect on non-quoted firms. Similarly, Ruland and Zhou (2005) find that leverage enhances the performance of diversified firms, especially small-sized diversified firms that are associated with higher agency costs. Evidence in Ghosh (2008) also conditions the effects of leverage on foreign market participation, noting that, for a sample of Indian firms, the (negative) impact of leverage is higher for firms with foreign debt, and that a leveraged firm's performance is more sensitive to changes in nominal exchange rate.

Recent extensions of the literature (Bolton and Scharfstein, 1990; Chevalier, 1995a,b; Chevalier and Scharfstein, 1996; Dasgupta and Titman, 1998) attach strong significance to product market competition in the leverage-performance relationship, since it gives an indication of the likelihood and the nature of rival firms' reaction following a firm's leverage increase.

2.3.2 Leverage, pricing strategy, competition and firm performance

Leverage has a complex interaction with product market competition. Brander and Lewis (1986) suggest that leverage permits firms to compete more aggressively in a product market due to limited liability. The strategic effect of such behaviour could offset the associated costly agency problems. Wanzenried (2003), however, conditions the effects on profit of such strategic behaviour on the nature of competition and product characteristics. This suggests that the limited liability effect of debt could fail to boost the profitability of the leveraged firm. Specifically, the limited liability effect of debt can lead to a decrease in profit if competition is Cournot. The reason is that limited liability induces a more aggressive production which leads to lower realised prices. The decrease in profit is higher the more substitutable the products are. Also, predation theories and related literature (Fudenberg and Tirole, 1986; Bolton and Scharfstein, 1990; Chevalier and Scharfstein, 1996; Dasgupta and Titman, 1998) suggest that leveraged firms could suffer a significant competitive disadvantage in product markets.

Leveraged firms may be more vulnerable to predation in concentrated product markets. Fudenberg and Tirole (1986) suggest that, given that current period profit is a signal for future prospects in a product market, incumbent firms may have an incentive to predate on entrant firms. Such action lowers the current period profits of the entrant firms and sends incorrect signals about future prospects. As leveraged firms may be more financially constrained than their less leveraged rivals in concentrated product markets, their sensitivity to product market signals is likely to be relatively higher.

A similar argument, which does not make "signal-jamming" a necessary condition for predation, is presented by Bolton and Scharfstein (1990). They show that debt contracts designed to align the interest of managers to creditors often create an opportunity for predation from rivals. An optimal contract requires periodic payment by their leveraged firms to the creditors; failing this, the firm is liquidated. This contract, however, encourages predation from rivals since this can lower the leveraged firm's current period profit, making it more likely to be liquidated and exit the market. This predation from rivals continues for as long as it accrues positive net benefits for the rival firm. In a perfect (or more) competitive industry, each firm accounts for a relatively small proportion of the market. Hence, there should be less incentive to predate in more competitive markets. Also, more intense product market competition (and hence lower profits for the incumbents) reduces the ability of incumbents to engage in and sustain predatory practices.

Chevalier and Scharfstein (1996) extend the above-mentioned model along the lines of switching cost models. They note that leverage constrains a firm's ability to invest in market shares since the fear of default restricts attention to current period performance. Consistently, they show that highly leveraged firms charge higher prices than their less leveraged counterparts during recession. This suggests that high leveraged firms are expected to have a competitive disadvantage in concentrated or uncompetitive industries, given that firms behave less competitively during recession. The magnitude of this disadvantage should decrease with the degree of competitiveness in the product market.

Chevalier (1995a) provides evidence in respect of the competitive disadvantage associated with leverage. In her study of the U.S. supermarket industry, she finds that an increase in leverage leads to increased market value of competitors. Also, when incumbents are highly leveraged, entry and expansion of new firms are likely. Chevalier (1995b) shows that market prices rise following an increase in leverage if rival firms are also highly leveraged. The highly leveraged firms are found to charge higher prices than their less leveraged competitors. The reverse is true when rivals are less leveraged and markets are concentrated: prices drop as highly leveraged firms leave the market. The findings suggest that highly leveraged firms are more vulnerable to predation in product markets with less competition and less leveraged rivals.

Perhaps the most direct evidence of the interaction effects of capital structure and competition is provided by Opler and Titman (1994). They find that highly leveraged firms lose market share to their less leveraged counterparts during industry downturns. Particularly, they find that the lost market share is severe for firms in concentrated markets. In another development, Kovenock and Phillips (1997) find that leverage has an adverse effect on a firm's investment and is positively associated with plant closure. Interestingly, they find that the significance of these effects depends highly on the capital structure and concentration interaction terms, suggesting severe agency problems in concentrated markets. The fact that the evidence presented in these studies is more pronounced in concentrated product markets suggests that highly leveraged firms are more vulnerable to predatory pricing in concentrated (uncompetitive) product markets.

Recent evidence is provided by Campello (2003, 2006). Campello (2003) investigates the impact of leverage on the relative growth of firms' sales in the product market. He finds that leverage has a negative impact on relative-to-industry sales growth of firms in relatively less leveraged industries during recession, but not during boom. This finding can be attributed to less competitive behaviour associated with macroeconomic downturns. The finding further indicates that the effects of leverage significantly depend on the severity of agency problems in the product market. This view agrees, at least in part, with his 2006 study which finds that moderate levels of debt are associated with high sales performance, whilst high levels are associated with poor performance. Particularly, he finds significantly higher effects for firms in concentrated markets compared to their counterparts in competitive markets.

It must be emphasized that, besides the predation-mitigating benefits of competition, the discipline that comes with competition (Aghion et al., 1997; Hart, 1983) reinforces the disciplining effects of leverage or mitigates the agency problems of debt. For instance, Nickell (1996) shows a positive relationship between several measures of competition and firm performance measured as total factor productivity (TFP) growth. In contrast, Aghion et al. (1997) note that fierce competition could cause firms to reduce their leverage, resulting in the reduced disciplining effect of leverage. This effect could be higher than the direct disciplining effect of competition, implying a net reduction in product market discipline. Recent work by Beiner et al. (2011) in respect of 200 Swiss firms suggests a negative relationship between product market competition (measured as HHI) and firm performance.

The review of the theoretical and empirical evidence presented in this section thus far points to appealing interactions between capital structure, competition and firm performance. It is worth emphasising that the empirical evidence taking this interaction into account is all based on U.S. data and employ concentration-based measures of competition. In what follows, the measure of and issues relating to competition are discussed.

2.3.3 Leverage and product market competition: Measurement issues

Whilst a few studies provide some evidence on the interaction between leverage, competition and performance, the proxies for competition may be problematic. Measuring competition normally takes a structural or non-structural approach. The structural approach infers competition from the degree of product market concentration, notably the Herfindahl-Hirschman Index (HHI) as in Campello (2006) and four-firm concentration ratio as in Opler and Titman (1994), Chevalier (1995a,b), Kovenock and Phillips (1997) and Campello (2003). Higher product market concentration is associated with lower competition and vice versa. The non-structural approach, on the other hand, derives the degree of competition from market behaviour. The preference for a non-structural measure of competition stems from the fact that higher concentration may not necessarily imply lower competition. In fact, the efficiency-structure hypothesis notes that a high level of product market concentration could simply be the outcome of pronounced efficiency (Demsetz, 1973). In this regard, differential efficiency may cause some firms to grow relatively fast whilst for other firms efficiency may require downsizing. Likewise, Boone et al. (2005, 2007) argue that a high level of concentration can arise from strong competition forcing inefficient firms out of the market. In this sense, concentration may fail to accurately predict the degree of competition.[6]

In view of these setbacks, Boone et al. (2005, 2007) and Boone (2008) propose a new measure of competition, the Boone indicator (BI). The BI measures the sensitivity of firms' profits (or market shares) to their inefficiency in product markets. It is based on the assumption that in a more competitive product market firms are penalised severely in lost profits or market shares for being inefficient. It assumes that profits increase with efficiency and this increase is higher in more competitive industries. Thus, unlike concentration-based measures of competition, the BI does not suffer from reallocation effects within product markets.[7] In addition to its appealing theoretical properties, the BI is simple in data requirements. Following its pioneering application by van Leuvensteijn et al. (2007) to the European banking industry, the BI has gained increased popularity in the banking literature. A similar measure of competition based on the sensitivity of a firm's profit to rival firms' strategic decisions is proposed by Kedia (2006). However, improper identifi-

[6]For instance, consider the case of a monopoly. Here monopoly price is charged in the market and concentration is highest. Compare this to a duopoly, where firms with asymmetric cost compete under Bertrand. The efficient firm has a lower cost (c_1) compared to the cost (c_2) borne by the less efficient firm (i.e. $c_1 > c_2$). The efficient firm can drive the less efficient firm out of the market by charging a price slightly less than the latter's (i.e. $p_1 = c_2 - e < monopoly\ price$). Assuming this stance leads to the exit of the less efficient firm, concentration is now as high as is the case for the monopoly. However, the market price is lower than the monopoly price; the incumbent firm keeps the price below the monopoly price to keep potential entrants out of the market. Concentration-based measures fail to capture this selection effect of competition: they indicate the same degree of competition under the two scenarios. This constrained monopoly equilibrium is known as limit pricing equilibrium.

[7]That is the reallocation of output from less efficient to more efficient firms. For a detailed review, see Boone et al. (2005, 2007) and Boone (2008)

cation of strategic decisions, or the use of proxies such as sales makes this measure of competition most useful for identifying the nature rather than the intensity of competition. Hence, the BI is the most suitable measure of competition in this study.

In summary, evidence on the interaction of leverage and competition on firm performance is generally limited and particularly lacking for developing countries in general and Africa in particular. This work is hoped to fill in the gap. It is also clear that evidence provided in respect of the leverage-competition relationship uses mainly concentration-based measures of competition. For the first time, this study employs a direct measure of competition in the leverage-performance relationship.

2.4 Research hypotheses

Based on theoretical predictions and past empirical evidence, as well as the South African corporate context, three main testable hypotheses are formulated.

The balance between agency costs of equity and debt, emphasised by Jensen and Meckling (1976) tilts in favour of the latter, given the equity culture and the agency problems associated with South African firms, as well as the regulatory environment within which these firms operate. Furthermore, any increased monitoring necessitated by debt-financing (Jensen and Meckling, 1976), though costly, might be expected to reinforce the discipline that comes with leverage (Grossman and Hart, 1983; Harris and Raviv, 1990; Jensen, 1986). Moreover, the relatively suboptimal regulatory environment in South Africa is expected to reinforce the strategic advantage (limited liability effect) of leverage suggested by Brander and Lewis (1986). Thus, leverage is expected to yield a positive effect on firm performance. This effect is, however, expected to decrease at very high levels of leverage given the likely debt overhang problems emphasised in Myers (1977). This expectation leads to the first hypothesis:

H1: *Leverage has a nonlinear positive effect on firm performance.*

Leverage makes firms vulnerable to predation from rivals in concentrated or uncompetitive product markets, as shown in the extant literature (Bolton and Scharfstein, 1990; Campello, 2003, 2006; Chevalier, 1995a,b; Chevalier and Scharfstein, 1996; Kovenock and Phillips, 1997; Opler and Titman, 1994). Given that the competitive-disadvantage of leverage may be only partially offset by the strategic benefits of leverage emphasised in Brander and Lewis (1986), it is expected that the benefits of leverage are improved (reduced) by product market competition (concentration). A second hypothesis is formulated as follows:

H2: *The agency benefits of leverage increase (decrease) with product market competition (concentration).*

Finally, the argument in the above-mentioned literature further suggests that, when a firm faces a lower threat of predation, and hence manages to increase its leverage to better balance different kinds of agency costs, its performance is likely to be higher. To the extent that the performance effect of leverage is dependent on rival firms leverage and the associated likelihood of predation ((Campello, 2003, 2006; Chevalier, 1995b; Chevalier and Scharfstein, 1996), a related composite hypothesis is formulated:

H3: *High relative-to-rival leverage is associated with high firm performance which increases (decreases) with product market competition (concentration).*

2.5 Data

The study uses an unbalanced panel data consisting of 257 South African firms listed on the Johannesburg Stock Exchange (JSE) Limited from the period 1998 to 2009, available from DataStream. The sample selection was guided by data availability. Every non-financial firm with three or more years of consecutive observation was included.

The sample firms were classified into 8 distinct industries using the Industry Classification Benchmark (ICB), equivalent to the Datastream Global Equity Indices level 2. Firms from the financial and utility industries were excluded. These sectors consisted of firms in banking, insurance, equity investment and real estate, including investment trusts. These exclusions were motivated by regulatory differences and for the ease of comparability of results. For example, unlike firms in other sectors, financial firms are subject to minimum capital requirements, which necessitates extreme caution in the interpretation of their financial leverage. Also, performance of utility firms is strongly influenced by regulations such as pricing, investments and technology restrictions.

2.5.1 Firm-specific variables

The choice of variables and proxies is guided by the literature. The measure of performance is return on assets (ROA), measured as earning before interest, taxes, depreciation and amortisation (EBITDA) divided by total assets. By construction, ROA is a good approximation of the extent to which managers put firms' resources to efficient use. ROA, being an accounting measure of performance, has been criticised because it suffers from the effects of differing accounting standards. However, market measures of performance, including Tobin's Q, are not faultless. Demsetz and Lehn (1985) suggest that ROA better reflects current business conditions whilst Tobin's Q mirrors expected future development. In similar fashion, Demsetz and Villalonga (2001) argue that Tobin's Q suffers from the use of tangible assets whose depreciation falls short of their true economic depreciation. Also, they emphasise that, unlike accounting measure of performance, Tobin's Q is not independent of psychological influences. These notwithstanding, evidence points to a high degree of correlation between ROA and Tobin's Q, suggesting that either is an appropriate measure of performance (Scherer and Ross, 1990). As the study employs data from different industries and firms of varying size, the use of ROA mitigates any size bias in the results.[8]

Leverage (Lev) is measured as total debt divided by total assets. Relative leverage (Rlev) is measured as the difference between each firm's leverage and the mean industry leverage. This is employed to control for the extent to which rival firms are less (or more) leveraged.

The research controls for other relevant firm-specific variables such as sales growth, firm size and mean earnings. Sales growth (Growth), a proxy for growth opportunities (King and Santor, 2008; Maury, 2006), is measured as the difference between sales of firm i at time t and its one-period lagged sales divided by the latter - that is, $\left(Sales_{i,t} - Sales_{i,t-1}\right)/Sales_{i,t-1}$, where the subscripts i and t indices firm

[8]see Lev and Sunders (1979) for detailed review.

i at time t.

Firm size (Size) is measured as the natural logarithm of total assets. While large firms may be associated with a high degree of moral hazard and increased need for monitoring, they may also have the benefits of diversification and economies of scale in monitoring top management (Himmelberg et al., 1999).

Following Ghosh (2008), mean earnings (MROA) is measured as 2-year moving average of profitability (ROA).[9]

Two additional variables are also employed in this paper to serve as external instruments for leverage in order to mitigate possible bias resulting from reverse causality between leverage and profitability. These are tangible assets and non-debt tax shield. Whilst the interest of this paper is to investigate the effect of leverage on firm performance, attention is also paid to the possibility that the causality may run from performance to leverage. Higher performance can serve as a buffer against bankruptcy thereby encouraging more debt finance (Efficiency-risk hypothesis), or, on the contrary, the same can encourage more equity holding in an attempt to protect the resulting franchise value (see Berger and Bonaccorsi di Patti, 2006; Demsetz, 1973; Margaritis and Psillaki, 2010).

Tangibility of assets (Tan) is measured as the ratio of tangible assets to total assets. It plays a major role in firms' access to debt finance (Booth et al., 2001; Campello, 2006). This is especially so in developing countries where creditor protection and contract enforcement is suboptimal. Non-debt tax shield (NDTAX) is depreciation and amortization divided by total assets.

[9] Ghosh (2008) controls for lagged values of these variables.

2.5.2 Competition variables

The variables used to capture competition are alternatively Herfindahl-Hirschman Index (HHI) and the Boone indicator (BI). Following Beiner et al. (2011), HHI is measured as the sum of squared market shares of each firm in a given industry.[10] That is:

$$HHI_{jt} = \Sigma_{i=1}^{Nj} \left(Sales_{ijt} / \Sigma_{i=1}^{Nj} Sales_{ijt} \right)^2 , \tag{2.1}$$

where HHI_{jt} is the HHI for industry j at time t; $Sales_{ijt}$ represents sales of firm i in industry j at time t. Higher values of the HHI indicate more concentration and less competitive markets.

The Boone indicator is a new measure of competition based on the theoretical assumption that, in a more efficient or competitive industry, firms are punished severely for being inefficient (Boone et al., 2005, 2007; Boone, 2008). Hence, for an industry with a high level of competition, it is expected that an increase in marginal cost leads to a drastic fall in variable profits. Therefore, the Boone indicator is measured by estimating the following regression:

$$VROA_{ijt} = \alpha + \beta_{jt} lnMc_{ijt} + \epsilon_{i,t}, \tag{2.2}$$

where $VROA_{it}$ is the variable profit (measured as sales revenue less cost of goods sold of firm i in industry j divided by its total assets); $lnMc_{ij}$ is the natural

[10] Beiner et al. (2011) follow the standard measurement approach used by the Census of Manufacturers to calculate sales-based HHI as the sum of the squared market shares for the top 50 firms (or all firms if less than 50). Ideally, the calculation of the HHI should incorporate all the firms in the various industries. In this paper, data unavailability restricts the number of firms in each industry to the corresponding numbers in the sample. Hence, the actual values could be different from the 'strict' HHI. This notwithstanding, the estimated HHI should still be able to capture the dynamics of competition

logarithm of the marginal cost (approximated by cost of goods sold divided by sales revenue) of firm i in industry j; and β_t is the time-varying parameter, the absolute value of which measures competition. The sign of the coefficients is expected to be negative. The higher the absolute value of the coefficients, the higher is the level of competition in the industry. Hence, BI is the absolute value of β_t.[11]

Table 2.1 provides the mean values of each variable by industry. There is a considerable degree of variability in return on assets, leverage and competition across industries. The basic materials industry has the least (mean) return on assets. This industry is less concentrated and relatively highly leveraged. At the other extreme is the telecommunications industry with the highest return on assets, which is highly concentrated and generally debt-funded.

Although the regression variables exhibit a modest correlation, the correlation matrix shown in Table 2.2 shows no evidence of multicollinearity. It worth noting, however, that Table 2.2 shows a significant negative correlation between BI and HHI. This suggests that the two indices should provide similar results. This is possibly because, for the sample of firms used in this study, concentration is not caused by more efficiency or market selection due to more intense competition, but is the cause of market power. Conversely, more intense competition, as measured by BI, does not tend to have a significant effect on concentration (probably because firms are not too heterogeneous in costs).

[11]Thus, the coefficients are multiplied by -1 so that higher values represent higher competition.

2.6 Empirical model

In order to estimate the effect of leverage on firm performance, a baseline model (equation (2.3)) is formulated as

$$ROA_{i,t} = \alpha + \lambda_t + \mu_i + \beta_1 Lev_{i,t-1} + \beta_2 Com_{j,t} + \psi^{'} x_{i,t} + \varepsilon_{i,t}, \tag{2.3}$$

where $ROA_{i,t}$ is return on assets of firm i at time t; α is the constant term; λ_t is a set of time dummies controlling for macroeconomic events; μ_i represents firm-specific fixed effect; $Lev_{i,t-1}$ is lagged leverage of firm i at time t; $Com_{j,t}$ measures the degree of competition in industry j at time t proxied alternatively by the Herfindahl-Hirschman Index (HHI) and the Boone indicator (BI); $x_{i,t}$ is a set of control variables described in Section 2.5, including the squared term of lagged leverage ($Lev^2_{i,t-1}$); and $\varepsilon_{i,t}$ is the error term. The lagged value of leverage helps address any possible reverse causality between leverage and performance. Also, the inclusion of the squared term of lagged leverage takes account of the possible nonlinear effect of leverage on performance. Likewise the effect of size is unlikely to be linear, hence warrants the inclusion of the squared term ($Size^2_{i,t}$) as in Ghosh (2008)

As pointed out in the preceding sections, product market competition is an important factor in the analysis of *leverage* and firm performance. In order to capture the effect of competition, equation (2.3) is rewritten to include the interaction of *leverage* and product market competition as shown below:

$$ROA_{i,t} = \alpha + \lambda_t + \mu_i + \beta_1 Lev_{i,t-1} + \beta_2 Com_{j,t} + \beta_3 Lev_{i,t-1} \times Com_{j,t} + \psi^{'} x_{i,t} + \varepsilon_{i,t}, \tag{2.4}$$

where $Lev_{i,t-1} \times Com_{j,t}$ is an interaction term: the product of lagged leverage of firm i in industry j at time t and competition in industry j at time t. All other terms are as previously defined. Again, particular attention is paid to the possibility of non-monotonic effect of leverage on performance.

Differentiating equation (2.4) with respect to leverage and competition, alternatively, gives the following:

$$\frac{\partial \left(ROA_{i,t}\right)}{\partial \left(Lev_{i,t-1}\right)} = \beta_1 + \beta_3 Com_{j,t} \tag{2.5}$$

which is modified in all specifications involving the squared term of leverage; and

$$\frac{\partial \left(ROA_{i,t}\right)}{\partial \left(Com_{j,t}\right)} = \beta_2 + \beta_3 Lev_{i,t-1}. \tag{2.6}$$

From equation (2.5), when HHI is used as a measure of competition the effect of leverage on performance of firms in an unconcentrated (perfectly competitive) industry is captured by β_1 whilst $\beta_1 + \beta_3 HHI_{j,t}$ shows the effect of leverage at specified levels of concentration or competition. When BI is used as the measure of competition, however, the interpretation is reversed: β_1 captures the effect of leverage for firms in an uncompetitive industry whilst $\beta_1 + \beta_3 BI_{j,t}$ captures the effect of leverage at specified levels of competition. Using equation (2.5), it is possible to probe the marginal effect of leverage at specified values of HHI or BI. Using the variance-covariance matrix, the standard errors corresponding to the marginal effects of leverage can be obtained (see Aiken and West, 1991).[12] Equation (2.6)

[12]For instance, the standard errors corresponding to these marginal effects for the model with only leverage and competition interaction term are given by $SE(\beta_1 + \beta_3 Com) = \sqrt{V(\beta_1) + Com^2 V(\beta_3) + 2Com Cov(\beta_1, \beta_3)}$ where $V(\beta_1)$ and $V(\beta_3)$ are respectively the variances of β_1 and β_3; $Cov(\beta_1, \beta_3)$ is the covariance between β_1 and β_3; and Com is the specified

also shows that the marginal effect of competition on firm performance is given by $\beta_2 + \beta_3 Lev_{i,t-1}$. Here β_2 captures the effects of competition for non-leveraged firms whilst $\beta_2 + \beta_3 Lev_{i,t-1}$ captures the same effect for leveraged firms.

Also, in order to verify that the leverage effect is driven by predation from rivals, variants of equations (2.3) and (2.4) are estimated by replacing leverage with relative-to-industry mean leverage or simply relative leverage. For marginal effect analysis, equations (2.5) and (2.6) are modified accordingly.

All equations are estimated using panel fixed effect models.[13] The Hausman (1978) specification test is performed in order to assess the suitability of the fixed effect models against random effect models. The Hausman (1978) test is motivated by the fact that the fixed effect and the random effect should not be different for the case where μ_i is uncorrelated with the regressors.

Finally, the study uses cluster-robust standard error to control for possible heteroskedasticity and autocorrelation within firms.

2.6.1 Endogeneity issues

Although lagged values of (relative) leverage are used in the above models to mitigate simultaneity bias, to fully address the simultaneity issues and omitted variable bias in respect of leverage, and also measurement errors in respect of the proxies for competition, equations (2.3) and (2.4) are re-estimated using the 2-step Generalised Method of Moments (GMM) technique. As instruments for leverage, the paper employs tangible assets as in Campello (2006), and non-debt tax shield

value of HHI or BI. For models involving the squared term of leverage the formula is modified. See Aiken and West (1991).

[13]Static modelling approach is the preferred method to make the results comparable to the previous literature. Preliminary exploration of dynamic modelling did not show satisfactory diagnostics such as over-identification restrictions.

(up to two lags). [14] The competition variables are instrumented with up to two lags of their own.

The use of tangible assets and non-debt tax shield as instruments is intuitively appealing and diagnostically satisfactory. First, tangibility of assets is a major determinant of firms' access to finance (Booth et al., 2001; Campello, 2006), and its effect on performance is only through financing, making it a valid instrument for the leverage-performance equation (Campello, 2006). Second, firms with a larger non-debt tax shield are expected to have lower leverage (DeAngelo and Masulis, 1980),[15] and non-debt tax shield is not expected to have a direct effect on firms' operating profits before depreciation and amortisation. This suggests that non-debt tax shield is a valid instrument for leverage. In fact, Fama and French (2002) provide empirical support for the inverse relationship between non-debt tax shields and the level of firms' leverage.

2.7 Results

2.7.1 Leverage-performance relationship

Table 2.3 presents the estimation results of equations (2.3) and (2.4). Models 1 to 4 are alternative specifications in which the HHI is used as the inverse measure of competition. Models 5 to 8, on the other hand, are the models using BI as the main measure of competition. Models 1, 2, 5 and 6 show the baseline results

[14] Lagged values of leverage are not used as instruments due to likely persistence in leverage. Persistence in financial leverage is documented in Lemmon et al. (2008), noting that Compustat nonfinancial firms' financial leverage exhibits very little variation over time, as its determinants are stable over long periods of time.

[15] Non-debt tax shields are inversely related to expected taxable profits and, therefore, the expected payoff from interest tax shields.

obtained from the estimation of equation (2.3).

The results show that financial leverage has positive effects on firm performance. These results suggest that financial leverage mitigates the agency costs of outside equity as noted in Jensen and Meckling (1976), particularly given the conservative use of debt among South African firms. With relatively higher use of equity finance, it is expected that the agency costs of equity will outweigh the agency costs of debt, making the agency benefits of debt much more realisable for South African listed firms. At this point, this finding is broadly consistent with the empirical evidence in Weill (2008) and Berger and Bonaccorsi di Patti (2006). Controlling for the squared term of leverage (models 2 and 6) does not change the results. The coefficients of the leverage squared terms are significantly negative, implying that excessive levels of leverage may have an adverse effect on firm performance. However, given the magnitude of these coefficients, the overall effect of leverage on performance is positive.[16] These findings provide support for Hypothesis 1.

The results show no statistically significant effect of competition on firm performance. The results also show that most of the control variables are significantly related to performance. Consistent with Ghosh (2008), firm size is nonlinearly and significantly related to profitability. Thus, whilst the benefit of size (including diversification and economies of scale) may help boost firm performance, excessive expansion may make moral hazard pervasive (see Himmelberg et al., 1999). Also, growth is found to be insignificantly related to profitability. Expected return (MROA) has a significant positive effect on profitability.

The estimation results for equation (2.4) are shown in models 3, 4, 7 and 8.

[16] Marginal effects are discussed in detail in Section 2.7.3

These estimations differ from the previous regressions by the inclusion of interaction terms between leverage and competition. The effect of leverage on the performance of firms is, again, positive and increases (decreases) with product market competition (concentration). Although the leverage-competition interaction terms and the squared terms of leverage are not significant when jointly included in the same model, a joint test of significance (White F test) confirms they are jointly significant.[17] Hence, models 3 and 7 are re-specified without the squared terms of leverage as shown in models 4 and 8; the coefficients of the interaction terms are significant. Interestingly, concentration (competition) is significant only when interacted with leverage, suggesting the presence of predatory product market interactions which vary directly with financial leverage. The interaction term between leverage and the HHI (model 4) is negative whilst the one between leverage and the BI (model 8) is positive. These findings suggest that the benefits of leverage increase (decrease) with product market competition (concentration), lending support for Hypothesis 2.

These findings broadly provide support for a number of theoretical predictions (Bolton and Scharfstein, 1990; Chevalier and Scharfstein, 1996) and evidence that suggest that increase in financial leverage is associated with predatory behaviour in concentrated (uncompetitive) product markets (Chevalier, 1995a,b; Opler and Titman, 1994; Kovenock and Phillips, 1997).[18]

[17] The non-significance of the interaction term and squared term of lagged leverage may be due to high correlation between them. Correlation between these two variables ranges between 0.74 and 0.80.

[18] Opler and Titman (1994) and Kovenock and Phillips (1997), however, find a direct negative effect of leverage on firm performance. Also, as discussed earlier, their performance measures are different from the one used in this paper.

2.7.2 Relative leverage-performance relationship

In what follows, the paper seeks to substantiate the possibility that the marginal effect of leverage is, at least to some extent, competitor-driven. Employing relative leverage, which measures the difference between a firm's leverage and the mean industry leverage, may corroborate the existence of predatory behaviour as outlined in Chevalier and Scharfstein (1996) and Bolton and Scharfstein (1990). Additionally, this approach helps to check the robustness of the preceding results. Hence, equations (2.3) and (2.4) are revised such that leverage is replaced with relative leverage. The results are shown in Table 2.4.

Consistent with the previous findings, the coefficient of relative leverage is positive and significant; the interaction term involving the HHI is negative and significant; whilst the one involving the BI is positive but statistically insignificant.[19] Thus, the results show that firms that are more leveraged than their rivals have higher performance which increases (decreases) with product market competition (concentration), lending support for Hypothesis 3. The results are robust when taking possible non-monotonicity into account, and to alternative proxies for competition. Also, competition (the BI) is found to exert a statistically significant positive effect on firm performance. These results, coupled with the preceding findings, suggest that the disciplining effects of competition as argued by Hart (1983) and Aghion et al. (1997) outweigh the crowding-out effect of competition as indicated also in Aghion et al. (1997). Thus, competition has a net disciplining effect which reinforces the disciplining effect of leverage and results in higher performance.

[19] Although the coefficient of the interaction term between lagged leverage and BI is statistically insignificant, it is jointly significant with the coefficient on lagged leverage.

2.7.3 Marginal effect analysis

The natural progression at this stage is to probe the interaction terms between leverage and competition in order to analyse the moderating impact of competition on the leverage-performance relationship. The models are evaluated at the mean, low (one standard deviation below the mean) and high (one standard deviation above the mean) values of the Herfindahl-Hirschman Index (HHI) and the Boone indicator (BI).[20] Where the squared terms of (relative) leverage are involved, the marginal effects are evaluated at the mean of (relative) leverage.[21] Table 2.5 summarizes the marginal effect analysis. The first two columns show the marginal effects involving HHI whilst the last two show those involving the Boone indicator.

In Panel 1, attention is restricted to the models involving only the squared terms of leverage. This corresponds to models 2 and 6 in Tables 2.3 and 2.4. It shows that the marginal effects of leverage and relative leverage are positive and statistically significant. Similarly, in Panel 2, where the interaction and the squared terms of leverage and relative leverage are involved, the marginal effects on performance of leverage and relative leverage are positive over the relevant levels (mean, low and high) of HHI and the Boone indicator (BI). Surprisingly, the marginal effects of relative leverage with respect to HHI are significant only at high values of HHI. This might be due to the concern raised earlier about this specification. Panel 3 relates to models in which the squared terms of leverage and relative leverage are dropped. The results, again, indicate that the marginal effects of leverage and relative leverage are positive over the relevant levels of HHI and the

[20] The mean and standard deviation of Boone indicator are respectively 0.43 and 0.66. For the HHI, they are respectively 0.15 and 0.13.

[21] The mean of leverage and relative leverage are respectively 0.23 and 0.00.

BI, and vary directly (inversely) with product market competition (concentration).

The above findings suggest that, even though the performance effects of leverage and relative leverage depend, to a large extent, positively (negatively) on product market competition (concentration), which is consistent with the presence of significant predatory market behaviour, the overall effect is significantly positive.

2.7.4 GMM results

The 2-step Generalised Method of Moments estimation results for equation (2.4) are presented in Table 2.6. Leverage is instrumented with tangible assets as in Campello (2006), and non-debt tax shield (up to two lags). Competition proxies are instrumented with up to two lags of themselves, with appropriate modification of the interaction terms. Appropriate tests are conducted to verify the validity and relevance of the instruments.

The results are similar to those presented in previous sections. As before, financial leverage is shown to have a significant positive effect on firm performance and this effect increases (decreases) with product market competition (concentration). These findings are robust to alternative measures of leverage and competition. For instance, using HHI as the inverse measure of competition (models 1 and 2), the coefficients of leverage and relative leverage are positive and significant whilst the interaction effects are significantly negative. This is consistent with models 3 and 4 where leverage, relative leverage and their interactions with the Boone indicator are all significantly positive.

The marginal effects of leverage and relative leverage are probed, again, at mean, low and high levels of product market competition (concentration). The results are presented in Table 1 in Appendix A. First, the marginal effect of leverage on firm performance is positive over the relevant range of HHI. Using relative leverage instead of absolute leverage yields similar results. The results remain qualitatively unchanged when the Boone indicator is used as the proxy for competition.

2.7.4.1 Model diagnostics

To assess the extent to which the instruments satisfy the orthogonality condition, Hansen J-statistic is computed. The Hansen J-statistic follows a χ^2 distribution where the number of overidentifying restrictions gives the degrees of freedom. The null hypothesis is that the overidentifying restrictions are valid. Where the orthogonality condition is not satisfied, either because the instruments are not truly exogenous or the instruments are wrongly excluded from the model (see Baum et al., 2003), the null hypothesis is rejected. The p-values of the Hansen J-statistics are well above 0.1, meaning that we cannot reject the null hypothesis that the instruments are valid.

Although the instruments are valid, they could be weakly correlated with the endogenous regressors. Hence, a weak identification test is also performed by computing the Kleibergen-Paap rk Wald F statistic and comparing it with the Stock-Yogo IV critical values. The null hypothesis is that the instruments are weakly identified. As a rule of thumb, a Kleibergen-Paap Wald rk F statistic greater than 10 is required to reject the null hypothesis (Baum, 2006). As shown in Table 2.6, the Kleibergen-Paap Wald rk F statistics are all greater than 10. Hence, we can reject the null hypothesis and conclude that the instruments are not weakly correlated with the endogenous regressors.

2.7.5 Other robustness test

The study tests for the robustness of the results in various ways. Besides using different measures of leverage, and different proxies for competition, different measures of performance (return on equity and after-tax return on assets) were also used with qualitatively similar results. In addition, the sensitivity of the results to alternative and additional control variables, including volatility of returns on assets and dividend, are analysed. The results are not qualitatively different from the above; they are shown in Table 2 in Appendix A. In relation to outliers, fairly robust results are observed for models in which all variables are winsorised within 5% and 95%. The estimation results for the winsorised variables are presented in Table 3.

2.8 Conclusion

In this paper, the effects of leverage on firm performance are investigated. The study further investigates the extent to which the leverage-performance relationship is influenced by product market competition. Using a panel dataset of South African listed firms, it is found that financial leverage has a significant positive effect on firm performance. Also, using the Herfindahl-Hirschman Index and the Boone indicator as alternative measures of competition, it is found that firms in unconcentrated (competitive) industries significantly benefit from leverage whilst those in concentrated (uncompetitive) industries are likely to suffer adverse effects of leverage. This notwithstanding, the marginal effect of leverage is positive across the relevant range of product market concentration (competition). Accounting for nonlinearity in the leverage performance relationship does not qualitatively alter these findings. In addition, the results are robust to alternative measures of leverage, competition, and to different estimators.

The findings of this paper have two main policy implications. First, South African firms could significantly improve their performance if there is a shift from the current conservative use of debt. Second, whilst policies aimed at popularising debt-finance to firms could have significant positive effects on their performance, the benefits of such policies would be much better realised if matched with effective pro-competition product market regulations.

Table 2.1: Mean values of variables by industry

Industry	ROA	Lev	Size	Growth	MROA	Tang	NDTAX	HHI	BI
Oil and Gas	0.068	0.247	14.135	2.483	0.097	0.649	0.046	1.000	−0.272
Basic mat	−2.008	0.348	13.717	9.866	−1.262	0.429	0.038	0.098	0.494
Industrial goods	0.109	0.206	12.991	23.884	0.110	0.245	0.046	0.100	0.382
Consumer goods	0.124	0.166	13.500	0.177	0.127	0.304	0.031	0.126	0.773
Health care	0.160	0.303	14.391	0.440	0.168	0.359	0.026	0.410	0.510
Consumer service	0.115	0.143	13.471	1.384	0.122	0.263	0.041	0.097	0.335
Telecommunication	0.355	1.040	14.619	0.411	0.364	0.314	0.133	0.421	−0.825
Technology	0.143	0.119	11.788	0.378	0.145	0.108	0.052	0.373	0.529

This table presents the descriptive statistics for the data. The sample comprises 257 South African firms. *ROA* is measured as earning before interest, taxes, depreciation and amortisation (EBITDA) divided by total assets. *Lev* is the ratio of debt to total assets. *Size* is the natural logarithm of total assets. *Growth* is the one-year growth rate of sales. *MROA* is 2-year moving average of return on assets. *Tang* is the ratio of property, plant and equipment to total assets. *NDTAX* is non-debt tax shield, measured as depreciation and amortization divided by total assets). *HHI* is the Herfindahl-Hirschman Index. *BI* is the Boone indicator (coefficients estimated from equation (2.2) multiplied by -1 so that higher values reflect higher competition).

Table 2.2: Correlation matrix

Variables	$\text{ROA}_{i,t}$	$\text{Lev}_{i,t-1}$	$\text{Rlev}_{i,t-1}$	$\text{Size}_{i,t}$	$\text{Growth}_{i,t}$	$\text{MROA}_{i,t}$	$\text{BI}_{i,t}$	$\text{HHI}_{i,t}$
$\text{ROA}_{i,t}$	1.000							
$\text{Lev}_{i,t-1}$	-0.044^{**}	1.000						
$\text{Rlev}_{i,t-1}$	-0.052^{**}	0.863^{***}	1.000					
$\text{Size}_{i,t}$	0.159^{***}	-0.059^{***}	-0.101^{***}	1.000				
$\text{Growth}_{i,t}$	0.001	−0.004	−0.004	−0.014	1.000			
$\text{MROA}_{i,t}$	0.719^{***}	-0.340^{***}	-0.324^{***}	0.191^{***}	-0.047^{**}	1.000		
$\text{BI}_{i,t}$	0.127^{***}	−0.025	-0.072^{***}	−0.011	−0.000	0.095^{***}	1.000	
$\text{HHI}_{i,t}$	0.014	0.041^{*}	0.008	-0.078^{***}	−0.010	0.017	-0.124^{***}	1.000

This table presents the unconditional correlation coefficient between any pair of variables. *Lev* and *Rlev* are alternative measures of leverage, and therefore they do not simultaneously enter the same regression. The sample comprises 257 South African firms over the period 1998 to 2009. The subscripts i and t indices firm and time. *RLev* is relative-to-industry mean leverage measured as the deviation of each firm's leverage from the industry mean leverage. All other variables are as described in Table 2.1. ***, ** and * indicate significance at 1%, 5% and 10%, respectively

Table 2.3: Leverage-performance relationship

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)				Boone indicator (BI)			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Lev_{i,t-1}$	0.3688***	1.9436***	2.0245***	2.0412***	0.3651***	1.9398***	2.0538*	0.6063***
	(0.1026)	(0.6856)	(0.4104)	(0.4003)	(0.1067)	(0.6895)	(1.1526)	(0.1467)
$Size_{i,t}$	0.4335*	1.1812*	1.1138	0.9245**	0.4147**	1.1757*	1.2019	0.6757*
	(0.2269)	(0.6704)	(0.8064)	(0.4466)	(0.1869)	(0.6593)	(0.7356)	(0.3489)
$Size^2_{i,t}$	−0.0136*	−0.0404*	−0.0379	−0.0309**	−0.0133**	−0.0406*	−0.0416	−0.0224*
	(0.0074)	(0.0230)	(0.0282)	(0.0148)	(0.0064)	(0.0228)	(0.0256)	(0.0119)
$Growth_{i,t}$	0.0000	−0.0001	−0.0001	−0.0000	0.0000	−0.0001	−0.0001	0.0000
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
$MROA_{i,t}$	1.0567***	1.0024***	1.0105***	1.0302***	1.0515***	0.9965***	0.9992***	1.0100***
	(0.1069)	(0.1229)	(0.1545)	(0.1377)	(0.1007)	(0.1179)	(0.1115)	(0.1050)
$HHI_{j,t}$	1.0227	0.4867	1.0152	2.0470				
	(0.9273)	(1.0135)	(1.3529)	(1.4999)				
$BI_{j,t}$					0.1020	0.0906	0.1524	−0.2129
					(0.0953)	(0.0812)	(0.2455)	(0.1606)
$Lev^2_{i,t-1}$		−0.0349**	−0.0237			−0.0349**	−0.0385	
		(0.0150)	(0.0481)			(0.0151)	(0.0298)	
$Lev_{i,t-1}$*$HHI_{j,t}$			−1.5044	−4.3111***				
			(4.7344)	(1.0412)				
$Lev_{i,t-1}$*$BHH_{j,t}$							−0.2534	1.2675**
							(1.1366)	(0.5876)
Intercept	−3.5886**	−8.8624*	−8.4840	−7.3281**	−3.2778**	−8.7069*	−8.9004*	−5.1079**
	(1.7896)	(5.0066)	(5.7275)	(3.5419)	(1.3973)	(4.7800)	(5.3472)	(2.5248)
N	2030	2030	2030	2030	2024	2024	2024	2024
R^2	0.4739	0.5164	0.5168	0.5146	0.4753	0.5177	0.5178	0.4952

This table shows the fixed effect estimation results for the effects of leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. *ROA* is measured as earning before interest, taxes, depreciation and amortisation (EBITDA) divided by total assets. $Lev_{i,t-1}$ is the lagged ratio of debt to total assets. $Size_{i,t}$ is the natural logarithm of total assets. $Growth_{i,t}$ is the one-year growth rate of sales. $MROA_{i,t}$ is 2-year moving average of return on assets. $HHI_{j,t}$ is the $Herfindahl - Hirschman$ Index. $BI_{j,t}$ is the *Boone indicator* (coefficients estimated from equation (2.2)). Absolute measure of *leverage* is used in all models. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 2.4: Relative leverage-performance relationship

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)				Boone indicator (BI)			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Rlev_{i,t-1}$	0.3738***	0.3839***	2.4802	1.4971**	0.3785***	0.3890***	0.4161***	0.3970***
	(0.0999)	(0.1172)	(1.8414)	(0.6182)	(0.1017)	(0.1208)	(0.1334)	(0.1072)
$Size_{i,t}$	0.6184***	0.8046***	1.5665*	1.0598**	0.5809***	0.7609***	0.8701***	0.6678***
	(0.2321)	(0.2321)	(0.8437)	(0.4991)	(0.1841)	(0.1782)	(0.2455)	(0.2488)
$Size^2_{i,t}$	−0.0205***	−0.0270***	−0.0559*	−0.0365**	−0.0196***	−0.0261***	−0.0306***	−0.0231***
	(0.0076)	(0.0072)	(0.0312)	(0.0171)	(0.0062)	(0.0058)	(0.0087)	(0.0088)
$Growth_{i,t}$	−0.0001	−0.0002	−0.0004	−0.0003	−0.0001	−0.0002	−0.0002*	−0.0001
	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$MROA_{i,t}$	1.0185***	1.0083***	1.0309***	0.9828***	1.0136***	1.0051***	0.9886***	0.9963***
	(0.1022)	(0.0902)	(0.0427)	(0.1268)	(0.0946)	(0.0817)	(0.0791)	(0.0966)
$HHI_{j,t}$	1.1475	1.3473	0.7251	1.4397				
	(0.9932)	(0.9572)	(0.8944)	(1.3560)				
$BI_{j,t}$					0.1571*	0.1616*	0.2171**	0.2038*
					(0.0911)	(0.0866)	(0.1091)	(0.1122)
$Rlev^2_{i,t-1}$		−0.0007*	−0.0053			−0.0008*	−0.0010**	
		(0.0004)	(0.0050)			(0.0004)	(0.0005)	
$Rlev_{i,t-1}$*$HHI_{j,t}$			−5.4343	−3.0135*				
			(4.5489)	(1.5573)				
$Rlev_{i,t-1}$*$BI_{j,t}$							0.2440	0.1991
							(0.1944)	(0.1642)
Intercept	−4.7542**	−6.0788***	−10.8522*	−7.7388**	−4.2922***	−5.5117***	−6.1530***	−4.8310***
	(1.8449)	(1.9029)	(5.5845)	(3.7420)	(1.3814)	(1.3946)	(1.7535)	(1.7705)
N	2030	1759	1759	2030	2024	1754	1754	2024
R^2	0.4670	0.4664	0.5176	0.4921	0.4704	0.4698	0.4734	0.4730

This table shows the fixed effect estimation results for the effects of relative leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. The variables and table structure are as described in Table 2.3. *Relative − to − industry mean leverage* ($Rlev_{i,t-1}$) is used as the measure of leverage in all models. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 2.5: Marginal effect of leverage

	HHI		BI	
	Leverage	Relative leverage	leverage	Relative leverage
Panel 1				
Mean lev.	2.849***	0.384***	2.844***	0.389***
	(1.005)	(0.117)	(1.011)	(0.121)
Panel 2				
Mean HHI; mean BI and mean lev.	2.737**	1.649	2.902**	0.521**
	(1.256)	(1.146)	(0.240)	(0.204)
Low HHI; high BI and mean lev.	2.939***	2.377	2.735***	0.682**
	(0.675)	(1.755)	(0.657)	(0.325)
High HHI; low BI and mean lev.	2.536	0.921*	2.952**	0.359***
	(1.872)	(0.538)	(1.442)	(0.103)
Panel 3				
Mean HHI; mean BI	1.382***	1.036***	1.149***	0.482***
	(0.241)	(0.382)	(0.391)	(0.165)
Low HHI; high BI	1.959***	1.440**	1.985**	0.614**
	(0.380)	(0.589)	(0.776)	(0.267)
High HHI; low BI	0.804***	0.632***	0.311***	0.351***
	(0.102)	(0.181)	(0.037)	(0.084))

This table shows the marginal effect analysis of the results presented in Tables 2.3 and 2.4. Columns 1 and 2 respectively presents the marginal effect of leverage and relative leverage in models involving HHI whilst columns 3 and 4 present similar results for models involving BI. Panel 1 presents the results for models involving the squared terms of leverage and relative leverage without interaction terms. Panel 2 shows results for models involving the squared terms of leverage and relative leverage as well as the interaction terms. Panel 3 shows similar results for models involving the interaction terms without the squared terms. Marginal effects are evaluated at mean, low and high HHI or BI and, where relevant, at mean leverage or relative leverage. Standard errors are shown in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 2.6: Leverage-performance relationship - GMM approach

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)		Boone indicator (BI)	
	Model 1	Model 2	Model 3	Model 4
$Lev_{i,t-1}$	3.6170***		0.9102***	
	(1.2500)		(0.1953)	
$Rlev_{i,t-1}$		2.7851***		0.7775***
		(0.7880)		(0.1315)
$Size_{i,t}$	1.0661**	1.2689***	0.7271*	1.7228***
	(0.5135)	(0.4865)	(0.3880)	(0.6011)
$Size^2_{i,t}$	−0.0329*	−0.0470***	−0.0277**	−0.0686***
	(0.0185)	(0.0181)	(0.0134)	(0.0224)
$Growth_{i,t}$	−0.0001	−0.0002	0.0001	−0.0005**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$MROA_{i,t}$	1.0933***	1.0203***	0.9869***	1.1432***
	(0.0565)	(0.0572)	(0.0364)	(0.3110)
$HHI_{j,t}$	−0.5093	2.5468		
	(4.0577)	(4.9214)		
$BI_{j,t}$			−0.2670	1.3191***
			(0.4351)	(0.2259)
$Lev_{i,t-1}$*$HHI_{j,t}$	−7.7576***			
	(2.9041)			
$Rlev_{i,t-1}$*$HHI_{j,t}$		−6.5813***		
		(1.8485)		
$Lev_{i,t-1}$*$BI_{j,t}$			2.8172***	
			(0.8401)	
$Rlev_{i,t-1}$*$BI_{j,t}$				1.6438***
				(0.3068)
N	1748	1748	1741	1492
Hansen J P-value	0.2633	0.3359	0.4398	0.2453
K-P W. F-stat	16.2652	14.9901	23.2961	26.2316

This table shows the GMM estimation results for the effects of leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. The variables and table structure are as described in Table 2.3. Absolute measure of *leverage* is used in *columns* 1 and 3 whilst $relative-to-industry$ *mean leverage* is used in *columns* 2 and 4. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Chapter 3

Banking competition in Africa: Subregional comparative studies

3.1 Introduction

African banking sectors have witnessed significant reforms over the last three decades following a long period of underperformance. Recent reforms have led to the liberalisation of interest rates and credit markets. For instance, interest rate controls, particularly in Kenya, Ghana and Tanzania, and directed lending in Uganda, have been replaced with open market operations. Another area of development within each subregion is the significant privatisation of state-owned banks, predominantly in Kenya, Uganda, Rwanda, Tanzania and Zambia, as a step to minimising inefficiencies.[1] Also, by opening up the banking markets, the growth of foreign banks in each subregion has been significantly high, especially

[1]See Allen et al. (2011) for detailed review of the African financial system.

in East and West African subregions in recent times.[2] Moreover, in response to increased regional integration and advances in information technology, there has been a significant upward trend in cross-border banking particularly within the East African subregion, allowing customers to operate their accounts outside their home country. These developments have implications for banking sector competition.

Whilst the number of banks has undoubtedly increased across Africa, attempts to gain financial stability have also fostered recapitalisation programmes in a number of countries. Hence, African banking sectors remain highly concentrated even though the trend is generally downward. The downward trend in banking sector concentration may suggest an improvement in competition as, theoretically, banks' market power may have been diminishing in line with the structure-conduct-performance paradigm. However, this may not be the case if market concentration does not necessarily imply undesirable exercise of market power.

In view of the above, this study seeks to address the following questions: first, how competitive are African banks after years of banking sector reforms? Second, to what extent do competitive outcomes differ across subregional banking sectors in Africa? Finally, how does competition differ across interest-generating activities and overall banking activities? The answers to these questions are particularly significant as they help us compare banking sector competitiveness across Africa with other emerging markets. This should help ascertain the effectiveness and possible impact of continued reforms on African banking. The outcome may also shed light on the possible link between competition and concentration inferred

[2]For the purpose of this study Africa is divided into four subregions, namely, Southern Africa, West Africa, North Africa and East Africa. For a list of countries in each subregion see Table 3.1.

from the structural-conduct performance paradigm.

The study employs the Panzar-Rosse model to assess the degree of competition in African banking sectors at the subregional level, assuming common banking markets.[3] The Panzar-Rosse model has been extensively applied to the study of banking competition, particularly in respect of banking sectors in advanced countries (e.g., Bikker and Haaf, 2002; Coccorese, 2004; De Bandt and Davis, 2000; Molyneux et al., 1994, 1996; Nathan and Neave, 1989; Shaffer, 1982; Vesala, 1995), with recent interest in emerging markets' banking sectors (e.g., Al-Muharrami et al., 2006; Gunalp and Celik, 2006; Mamatzakis et al., 2005; Perera et al., 2006). However, less attention has been paid to banking competition in Africa. Selected African countries have often been considered as part of major studies where their competitive conditions are not highlighted (e.g., Bikker et al., 2009; Claessens and Laeven, 2004; Schaeck et al., 2009). Single country studies have been conducted by Biekpe (2011) and Simpasa (2011) in respect of Ghanaian and Tanzanian banking sectors, respectively. A critical assumption of the Panzar-Rosse model, which is often verified, is that banks are observed under long-run equilibrium. However, Goddard and Wilson (2009) convincingly highlight the fact that adjustment towards market equilibrium may be gradual rather than instantaneous, thus requiring a dynamic approach to the Panzar-Rosse model.

Employing both the static and dynamic versions of the Panzar-Rosse model, the findings of this paper show that banks in African subregional markets can be characterised as monopolistically competitive. In particular, the findings suggest that, with the exception of North Africa, African banks exhibit higher competition

[3]This assumption is consistent with the similarities of characteristics and increased regional integration among the relevant countries.

at interest-generating activities compared to total banking activities. Further, it is found that the degree of competition in African banking markets is comparable to that existing in other emerging markets. Finally, the paper finds consistent results for both the static and dynamic versions as it does for the scaled and unscaled versions of the Panzar-Rosse model, even though the static version is biased downwards, as documented in Goddard and Wilson (2009).

The paper contributes to the extant literature in banking competition in several ways. First, the paper attempts a broader empirical investigation of African banking competition. To the author's knowledge, this has not been previously addressed. Whilst banking competition has attracted much research interest in several countries and regions, little has been done to assess the competitive conditions in African banking markets. Second, the regional or common banking market approach adopted in this paper provides a useful way to assess the overall effectiveness of the recent wave of financial sector reforms in Africa. Third, by combining both static and dynamic estimation methods, the paper is less likely to misidentify the competitive nature of the African banking markets. In particular, a dynamic two-step system GMM estimator employed to estimate the dynamic Panzar-Rosse model in this paper is an improvement, in terms of efficiency, on the difference GMM estimator used in previous studies. The dynamic approach is profoundly important given the dramatic changing environment within banking markets. Finally, the paper provides first-hand evidence in support of Goddard and Wilson (2009) that the static H-statistic could be downward biased. The static H-statistic assumes that adjustment towards equilibrium is instantaneous whilst the dynamic H-statistic assumes a gradual adjustment toward equilibrium. Goddard and Wilson (2009) show that where adjustment towards equilibrium is gradual, the static

H-statistic is biased downwards. Consistent evidence is presented in this paper.

The rest of the paper is organised as follows: Section 3.2 presents some background information about African banking sectors. Section 3.3 outlines the Panzar-Rosse model and discusses the related literature. Section 3.4 details the econometric estimation methods; while Section 3.5 presents the empirical results. Finally, Section 3.6 summarises the findings and concludes the paper.

3.2 African banking sectors

The study of banking sector competition has attracted much empirical attention in recent times in response to the possible link between competition and banking stability. Whilst a significant amount of studies have been carried out in respect of developed countries, attention has just recently been drawn to African banking sectors. Recent structural changes across African financial sectors, particularly banking markets, and increased regional integration, which extends banking markets beyond geographic boundaries, underscore the need for a broader study of banking sector competition. In what follows, recent reforms and the response of banking sectors across Africa are discussed.

African banking sectors are generally well below the standards of developed countries, notwithstanding recent reforms across the continent. With domestic credit to the private sector averaging about 32% of GDP, financial intermediation remains relatively low in a number of African countries. This feature of the banking sectors is coupled with strong government ownership and traditional banking activities. The unfavourable performance, particularly record high levels of problem loans in the 1980s, led to significant financial sector reforms. As discussed in

Senbet and Otchere (2006), financial sector reforms in Africa have been aimed at deregulating the financial sector, opening it up to foreign entry, liberalising interest rates and exchange rates, removing credit ceilings, restructuring and privatising banks, and promoting the capital markets.

Whilst there is still a strong government presence in African banking sectors (e.g., Algeria and Tunisia), a significant amount of success has been achieved in privatising banks in a number of countries including Morocco, Kenya, Tanzania, Uganda, Rwanda and Zambia (Allen et al., 2011). These reforms have not only led to significant growth in the number of banks in many African countries but also to a noticeable increase in the degree of cross-border banking.[4]

As noted in Allen et al. (2011), banking sector reforms have led many banks to increase their capital base. The significant growth in the number of small banks with relatively less capital base, as a by-product of reforms, attracted recapitalisation programmes (e.g., Ghana, Sierra Leone and Nigeria) in order to address any possible threat to financial stability. Over the period under study, the subregional average of the ratio of equity to total assets was as high as approximately 15% in Southern and West Africa and 16% in North and East Africa.

Whilst some level of success has been recorded across all the African subregions, there is still more to be achieved. Savings mobilisation and credit allocation have generally not improved by as much as expected (Senbet and Otchere, 2006). The ratio of loans to total assets is just about 48% on average for the whole African region. At a subregional level, this ratio is approximately 45% and 46% in the Southern and West African subregions, respectively. Meanwhile, the Southern

[4]Recapitalisation programmes have, however, led to a significant decrease in the number of banks in Nigeria in particular.

African subregion boasts of the largest banks on the African continent (mainly in South Africa), with generally well-developed and sophisticated banking systems (e.g., South Africa, Botswana, Namibia, Seychelles and Malawi). There are many countries in this subregion with total banking sector assets exceeding US$500 million (e.g., South Africa, Angola, Mauritius, Namibia and Botswana) compared to the West African subregion (e.g., Nigeria and Togo). For example, over the period under study, the average total banking assets is approximately US$5.6 billion for the Southern African subregion. This compares favourably to an average of approximately US$667 million for the West African subregion. In the North and East African subregions, however, the ratio of loans to total assets are relatively higher; the North African subregion with average total banking assets of approximately US$2.6 billion commands 55%, whilst the East African subregion with average total banking assets of US$287 million boasts 50%.

Problem loans and investment in relatively riskless government securities still remain obstacles in African banking. Over the period under study, the average impaired loans are 7%, 12%, 18% and 19% of total loans in the Southern, North, West and East African subregions, respectively. This problem is worsened by poor credit information. The average depth of credit information index is approximately 1 in the West and East African subregions, 2 for the North African subregion, and 3 for the Southern African subregion.[5] Moreover, the degree of contract enforcement is very low; the average regulatory quality index in each subregion falls below the world average. As a result, many banks are compelled to invest disproportionately in liquid government assets.

[5]Depth of credit information is an index that measures the quality of credit information. It ranges between 0 and 6.

The ratio of liquid assets to total assets is approximately 34% in the Southern, West and East African subregions, and 26% in North Africa over the same period, with consequences for private sector credit. Worryingly, the credit to private sector as a percentage of gross domestic product (GDP) stands at 16% and 19% respectively in the West and East African subregions, whilst the Southern and North African subregions record approximately 55% and 45% respectively. This is unsurprising as the banking system remains the major constituent of the African financial system; debt markets are as yet generally under-developed (Allen et al., 2011).

Despite record levels of new entry and foreign penetration, very high levels of concentration characterise African banking sectors. Over the period under consideration, the average Herfindahl-Hirschman Index (HHI) is as high as 2059, whilst the five-bank concentration ratio stands at 77.29% for the whole African region.[6] On the positive side, concentration assumed a downward trend across all the subregions over the past few years, as can be seen in Figure 3.1. The Herfindahl-Hirschman Index (HHI) shows dramatic and consistent downward trend in all subregional banking sectors except West Africa, where the trend is moderate. A similar trend is indicated by five-bank concentration ratios,[7] as shown in Figure 3.2.

As indicated earlier, banking sector concentration may not necessarily suggest less competition. As argued by Boone et al. (2005), fierce competition may drive

[6]HHI is measured as the sum of the squared market share of each bank in a given country for each year. Market shares are measured in percentages. Hence, the HHI has an upper limit of 10,000 where one firm commands 100% market share (i.e., monopoly) and a lower bound of zero for perfect competition. HHI less than 1000 implies a highly competitive market. For a moderately concentrated market HHI ranges between 1000 and 1800, whilst a concentrated market has HHI above 1800.

[7]The only exception is West Africa where the trend is fairly upwards.

out of the market the less efficient banks, with a resultant increase in banking market concentration. Hence, a non-structural measure of competition such as the Panzar-Rosse model which is based on reduced form revenue equation may be a superior measure of competition.

3.3 Panzar and Rosse model and related literature

Measurement of competition can take two approaches: the structural and the non-structural. The structural approach to measuring competition, which underpins the structural-conduct-performance paradigm, associates market power with the degree of market concentration. The structural approach, thus, assumes lower competition in concentrated markets; more competition is associated with less concentrated markets. The Herfindahl-Hirschman Index (HHI) plays a major role here. Concentration-based measures of competition have been criticised on the grounds that concentration could be the outcome of greater efficiency, as proposed by the efficiency-structure hypothesis (Demsetz, 1973), or greater competition forcing out of the market inefficient firms, as noted earlier. The non-structural approach to measuring competition, on the other hand, infers product market competition from market behaviour. This latter approach is considered to be superior. The Panzar-Rosse model is a popular example of the non-structural approach to measuring competition.

The Panzar-Rosse model, popularised by Rosse and Panzar (1977) and Panzar and Rosse (1987), is an approach to measuring competition that is based on a reduced-form revenue equation. From this revenue equation, a measure of competition, H-statistic, is obtained by summing the elasticities of revenue with respect to input prices. This model assumes that banks have revenue and cost functions, respectively given as $R_i\left(y_i, n, z_i\right)$ and $C_i\left(y_i, w_i, t_i\right)$, where R_i and C_i are respectively the revenue and cost of bank i; y_i is the output of bank i; w_i is a vector of input prices for bank i ; n is the number of banks; and z_i and t_i are vectors of exogenous variables relevant respectively to the revenue and cost functions. Following a profit maximisation path requires that marginal revenue is equal to marginal cost. That is,

$$R_i^{'}\left(y_i, n, z_i\right) = C_i^{'}\left(y_i, w_i, t_i\right) \tag{3.1}$$

where $R_i^{'}$ and $C_i^{'}$ are respectively the marginal revenue and marginal costs of bank i. Long-run equilibrium in the product market imposes a zero profit constraint at the market level:

$$R_i^{*}\left(y_i^{*}, n^{*}, z_i\right) = C_i^{*}\left(y_i^{*}, w_i, t_i\right) \tag{3.2}$$

where the asterisked variables are the equilibrium values of the previously defined variables in equation (3.1).

The H-statistic is, then, derived as the sum of factor price elasticities. That is

$$H = \sum_{k=1}^{m} \frac{\partial R_i^{*}}{\partial w_{ki}} \frac{w_{ki}}{R_i^{*}} \tag{3.3}$$

where $\frac{\partial R_i^{*}}{\partial w_{ki}}$ is the derivative of total revenue with respect to the price of the kth input.

The H-statistics, derived as above, provides a test of three main market conditions: (i) the market is a monopoly; (ii) the market shows monopolistic competition with free entry; and (iii) the market is perfectly competitive.[8] The basic features of the alternative market conditions highlight the possible critical values of the H-statistics.

In a monopoly market, a rise in input prices leads to a rise in marginal costs, which results in a decrease in equilibrium output and a subsequent fall in revenue. Hence, the H-statistic is non-positive under monopoly (i.e., $H \leq 0$). In a perfectly competitive market, an increase in input prices leads to an increase in marginal and average cots; prices increase proportionally, which, in turn, leads to a proportional increase in revenue. Hence the H-statistic is one under perfect competition (i.e., $H = 1$). In a monopolistic competitive market, the rise in average and marginal costs resulting from an increase in input prices leads to the exit of loss-making firms and a subsequent rise in revenue. Hence, the H-statistic is between zero and one under monopolistic competition (i.e., $0 < H < 1$). Performing a Wald F-test will confirm if the H-statistics are statistically different from the critical values. It is worth noting that the magnitude of H could also be an indication of the level of the monopoly power (hence, competition) in the product market (see Vesala, 1995).

It must be emphasised that the Panzar-Rosse model relies on the assumption that banks are observed under long-run equilibrium.[9] Long-run equilibrium requires that (risk-adjusted) returns are not statistically significantly correlated with input prices (Shaffer, 1982). The application of the model to the banking sector further assumes that banks can be treated as single-product firms offering

[8]The assumption of contestable market is likely to apply to Africa given the several years of reforms. The banking sector reforms over the last two decades have liberalised the banking markets and encouraged entry by new and foreign banks. For detailed review, see Section 3.2.

[9]This assumption is crucial for perfect competition and monopolistic competition conclusions to be accurate (Panzar and Rosse, 1987).

intermediation services (De Bandt and Davis, 2000).

Starting from Shaffer (1982), the Panzar-Rosse model has been extensively applied to the study of banking competition. Using a sample of US banking data for the period 1979, Shaffer (1982) identifies a monopolistic competitive banking behaviour. Other earlier applications of the model are in respect of Canadian banks (Nathan and Neave, 1989), European banks (Molyneux et al., 1994; Vesala, 1995) and Japanese banks (Molyneux et al., 1996). Nathan and Neave (1989) find monopolistic competition in the Canadian banking sector for the period 1983 and 1984 but perfect competition in the period 1982.

For a sample of European countries over the period 1986 to 1989, Molyneux et al. (1994) find that banks in France, Germany, Spain and the United Kingdom (UK) behave as though operating under monopolistic competitive conditions whilst those in Italy are classed as though operating under monopoly. Also, Vesala (1995) examines the Finnish banking system over the period 1985 to 1992. He finds monopolistic competitive conditions for all years except 1989 and 1990 where the banking conditions are consistent with perfect competition. Finally, Molyneux et al. (1996) find conditions consistent with monopoly in 1986 and monopolistic competition in 1988 for the Japanese banking sector.

All the above studies employ a cross-sectional estimation procedure. In order to explore both time series and cross-sectional variations, recent applications of the Panzar-Rosse model employ a panel data estimation approach. These include Al-Muharrami et al. (2006) for the Arab Gulf Cooperation Council's (GCC) banking system; Bikker and Haaf (2002) for 23 European Union and non-European Union countries; Coccorese (2004) for the Italian banking system; De Bandt and Davis (2000) for a sample of French, German, Italian and US banks; Hondroyiannis et al.

(1999) for the Greek banking system; Mamatzakis et al. (2005) for a sample of South East European countries; and finally Perera et al. (2006) for South Asian banking sectors. The results of the above studies are generally consistent with monopolistic competition with the exception of a few submarkets.[10]

A recent development in the study of banking competition has been the gradual shift towards regionally classified common or single markets. The reasons behind such classification include similarity of banking market features (e.g., Al-Muharrami et al., 2006; Mamatzakis et al., 2005) and the introduction of a single banking licence (e.g., Casu and Girardone, 2006). Based on the similarities of characteristics within South Eastern European countries, Mamatzakis et al. (2005) class these countries' banking sectors as a single banking market and estimate the Panzar-Rosse H-statistic for the entire region over the period 1998 to 2002. Depending on the choice of dependent variable, H-statistics of 0.726 and 0.746 are documented.

In a similar fashion, Al-Muharrami et al. (2006) studied the Arab Gulf Cooperation Council's banking system as a single market over the period 1993 to 2002. They found H-statistics of 0.24 and 0.47, depending on the choice of estimation method - pooled or fixed effect - which imply that the entire regional banking market behaved as though operating in monopolistic competition.[11]

Moreover, following the introduction of the Single Banking Licence in the European Union (EU), Casu and Girardone (2006) apply the Panzar-Rosse model to the study of 15 major European countries' banking sectors, assuming a common

[10] E.g.,De Bandt and Davis (2000) find that small banks in France and Germany behave as though operating under monopoly conditions. Likewise, Bikker and Haaf (2002) find that competition is relatively less in small banks assumed to be operating in local markets.

[11] Their preferred estimation method, based on model specification test, is the fixed effect which gives a H-statistic of 0.47.

banking market. Their results show that, between the period 1997 and 2003, EU banks behaved as though operating under monopolistic competition. They find H-statistics of 0.362 and 0.364, based on the model specification.

A further development worth noting is the proposition by Goddard and Wilson (2009) in relation to modifying the static Panzar-Rosse model to allow for partial adjustment towards equilibrium. This disequilibrium approach, in their view, is justified because markets are not always in equilibrium. Hence, failure to take this dynamic adjustment into account may render the Panzar-Rosse model misspecified. Using both simulated and real data for the banking sectors in the Group Seven (G7) countries, they find that the static H-statistic is severely biased towards zero when the adjustment towards equilibrium is partial rather than instantaneous. Similarly, Bikker et al. (2009) suggest that the H-statistics could be biased when scaled rather than unscaled revenue equation is estimated. Scaling revenue by total assets makes the Panzar-Rosse model a price rather than a revenue equation. They further suggest that controlling for total assets in the revenue equation also biases the Panzar-Rosse model since this amounts to holding bank output fixed. In this study, these concerns are taken into consideration as part of robustness checks.

The present paper takes the view that increased regional integration coupled with advances in information technology and the banking sector reforms justify the assumption of single banking markets within African subregions. Besides, the paper embraces a recent development by applying a dynamic approach to the Panzar-Rosse model.

3.4 Estimation method and data

Following from equations (3.1) and (3.2) and consistent with Bikker and Haaf (2002), the Panzar-Rosse model is implemented by formulating the marginal cost and marginal revenue functions, imposing an equilibrium condition, and solving for the equilibrium output as a function of input prices and exogenous control variables. Assuming a Cobb-Douglas technology, the marginal cost and revenue functions can be written as:

$$MC_{it} = \alpha_0 + \alpha_1 lnOut_{it} + \sum_{k=1}^{m} \beta_k lnInp_{k,i,t} + \sum_{k=1}^{p} \gamma_k lnXc_{k,i,t} \tag{3.4}$$

and

$$MR_{it} = \phi_0 + \phi_1 lnOut_{it} + \sum_{h=1}^{q} \varphi_h Xr_{h,i,t}, \tag{3.5}$$

where MC_{it} and MR_{it} are respectively the marginal costs and marginal revenue of bank i at time t; $lnOut_{it}$ and $lnInp_{k,i,t}$ are respectively the natural logarithms of output and factor input k of bank i at time t; and $lnXc_{k,i,t}$ and $lnXr_{h,i,t}$ are respectively the natural logarithms of exogenous control variables k and h.

Setting marginal revenue (equation (3.5)) equals marginal costs (equation (3.4)) yields:

$$lnOut^*_{it} = \frac{(\alpha_0 - \phi_0 + \sum_{k=1}^{m} \beta_k lnInp_{k,i,t} + \gamma_k Xc_{k,i,t} - \varphi_h Xr_{h,i,t})}{\alpha_1 - \phi_1}. \tag{3.6}$$

Multiplying the equilibrium output (equation (3.6)) by a common price level gives the reduced form revenue equation. The common price level, derived from an inverse demand function, is expressed in logarithm as $lnP = \varepsilon + \lambda ln(\sum_i \sum_t Out^*_{it})$.

Building on this, as in Bikker and Haaf (2002) a reduced form revenue equation can be written as:

$$lnRev_{it} = \alpha + \sum_{j=1}^{J} \beta_j lnW_{j,i,t} + \sum_{k=1}^{K} \gamma_k lnX_{k,i,t} + \sum_{n=1}^{N} \xi_n lnZ_{n,t} + \varepsilon_{i,t}, \quad (3.7)$$

where subscripts i and t refer to bank i at time t; Rev is either total revenue or interest revenue or the ratios of these to total assets; W_j is a three-dimensional vector of input prices, namely, the unit price of fund (PF), unit price of labour (PL) and the unit price of capital (PC); X_k is a vector of bank-specific explanatory factors which may shift the revenue and cost functions; Z_n is a vector of macroeconomic variables; and ε_{it} is a composite error term including bank-fixed effects:

$$\varepsilon_{i,t} = \mu_i + \nu_{i,t} \quad (3.8)$$

where μ_i is bank-fixed effects and $\nu_{i,t}$, by assumption, is an independently and identically distributed component with zero mean and variance σ_v^2.

Following the extant literature, PF is measured as the ratio of total interest expenses to total deposits; PL is measured as the ratio of personnel expenses to total asset; and PC is proxied by the ratio of other operating expenses to fixed assets. Bank-specific explanatory factors popular in the literature include total assets (TA) to control for size;[12] the ratio of equity capital to total assets (EQTA), a proxy of banks' leverage; the ratio of loans to total assets (NLTA) to account for credit risk exposure; the ratio of loan loss provisions to total loans (LLPL), which controls for default risk; and the ratio of other operating income to total assets

[12]Following the literature (e.g., Mamatzakis et al., 2005) the natural log of total assets are excluded from the models with scaled dependent variable.

(OITA).[13]

The H-statistic is then obtained as the sum of the coefficients of factor prices as follows:

$$H = \sum_{i=1}^{3} \beta_i. \tag{3.9}$$

Consistent with the extant literature (e.g., Gunalp and Celik, 2006; Molyneux et al., 1996), a long-run equilibrium test is performed by replacing the dependent variable in equation (3.7) with the natural logarithm of return on assets ($lnROA$) as shown below:

$$lnROA_{it} = \alpha + \sum_{j=1}^{J} \beta_j lnW_{j,i,t} + \sum_{k=1}^{K} \gamma_k lnX_{k,i,t} + \sum_{n=1}^{N} \xi_n lnZ_{n,t} + \varepsilon_{i,t}. \tag{3.10}$$

The logic is that, if the zero-profit condition under long-run equilibrium holds, then the total elasticity of returns (i.e., ROA) to the input prices is identically zero. Hence, the test consists of estimating the elasticities of returns to each single factor price, summing them up, and testing whether the latter is significantly different from zero. Thus, the sum of the elasticity of returns with respect to input prices, henceforth called E-statistic, is obtained in a similar fashion as in equation (3.9).

Equations (3.7) and (3.10) are estimated using the panel fixed effect approach to control for heterogeneity across banks whilst controlling for country level factors such as GDP growth and inflation.

In view of the criticism raised against the static Panzar and Rosse (1987) H-statistic, equation (3.10) is modified to take the suggested dynamics into account.

[13]Other operating income is used as additional control variable only when interest income is used as the dependent variable.

Specifically, lagged dependent variable is included in the model as follows:

$$lnRev_{it} = \alpha lnRev_{i,t-1} + \sum_{j=1}^{J} \beta_j lnW_{j,i,t,} + \sum_{k=1}^{K} \gamma_k lnX_{k,i,t} + \sum_{n=1}^{N} \xi_n lnZ_{n,t} + \varepsilon_{it}. \quad (3.11)$$

In this regard, it is possible to wipe out the unobserved firm specific effect by first differencing equation (3.11) as follows:

$$\Delta lnRev_{it} = \alpha \Delta lnRev_{i,t-1} + \sum_{j=1}^{J} \beta_j \Delta lnW_{j,i,t} + \sum_{k=1}^{K} \gamma_k ln\Delta X_{k,i,t} + \sum_{n=1}^{N} \xi_n \Delta lnZ_{n,t} + \Delta\varepsilon_{i,t}, \quad (3.12)$$

in which case a dynamic H-statistic can then be obtained as:[14]

$$H = \frac{\sum_{i=1}^{3} \beta_i}{1-\alpha}. \quad (3.13)$$

A corresponding equilibrium test model will, then, be as in equation (3.14):

$$\Delta lnROA_{it} = \alpha \Delta lnROA_{i,t-1} + \sum_{j=1}^{J} \beta_j \Delta lnW_{j,i,t} + \sum_{k=1}^{K} \gamma_k ln\Delta X_{k,i,t} + \sum_{n=1}^{N} \xi_n \Delta lnZ_{n,t} + \Delta\varepsilon_{i,t}. \quad (3.14)$$

The E-statistic for equilibrium test is again obtained as previously described.

[14] The dynamic H-statistic is thus the long-run H-statistic. The main difference between the dynamic H-statistic and the static H-statistic is that, the former assumes that adjustments to the long run equilibrium are instantaneous, whilst the latter accounts for gradual adjustments.

The lagged dependent variables in equations (3.12) and (3.14) introduce endogeneity problem, as, by construction, they are correlated with the differenced error terms. In order to control for such endogeneity bias, Goddard and Wilson (2009) and Olivero et al. (2011) use the difference GMM estimator proposed by Arellano and Bond (1991), in which lagged levels of the endogenous variables are used as instruments in the differenced equation. Thus, under the assumptions that the original error term, $\varepsilon_{i,t}$, is serially uncorrelated and that the explanatory variables, W_j,X_k and Z_n, are weakly exogenous, the following moment conditions apply:

$$E\left(y_{i,t-s}\Delta\varepsilon_{i,t}\right) = 0; fors \geq 2; t = 3, ..., T \tag{3.15}$$

$$E\left(\mathbf{X}_{i,t-s}\Delta\varepsilon_{i,t}\right) = 0; fors \geq 2; t = 3, ..., T. \tag{3.16}$$

where $\mathbf{X}$ represents all the explanatory variables other than the lagged revenue and returns.

Blundell and Bond (1998) and Alonso-Borrego and Arellano (1999) show that lagged levels of independent variables can perform poorly as instruments for the first-differences of these variables, due possibly to persistence or measurement error. Hence, Arellano and Bover (1995) and Blundell and Bond (1998) recommend the addition of the equation in levels to the differenced equation to obtain a system of equations. The variables in levels are, then, instrumented with lagged first difference of the corresponding variables. This approach increases efficiency compared to the difference GMM. Thus, the following orthogonality restrictions are further imposed[15]:

$$E\left(\Delta y_{i,t-s}\varepsilon_{i,t}\right) = 0; for s = 1. \tag{3.17}$$

$$E\left(\Delta \mathbf{X}_{i,t-s}\varepsilon_{i,t}\right) = 0; for s = 1. \tag{3.18}$$

By construct, first order serial correlation is expected in the first differenced equation. Hence, in order to rule out first order serial correlation in levels, a test of second order serial correlation in the differenced equation is performed (Roodman, 2009). Next, a Hansen test of over-identifying restrictions is employed to test the validity of the over-identification restrictions. As a final step, standard errors are corrected for small sample bias based on the two-step covariance matrix attributed to Windmeijer (2005).

In view of the above, the study first estimates the static Panzar-Rosse model and the corresponding equilibrium test model (equations (3.7) and (3.10), respectively) using the panel fixed effect estimation method. This approach helps to control for unobserved heterogeneity. Second, the dynamic models (equations (3.11), (3.12) and (3.14)) are estimated using the dynamic system GMM estimator as robustness checks. Time dummies are included in all models to control for time-specific effects including the possibility of linear association between input prices and time (Perera et al., 2006). For all estimations, a Wald test is performed to ascertain whether the H-statistics are significantly different from zero and one.

[15]Lagged differences other than the most recent ones are not used because they result in redundant moment conditions (see Arellano and Bover, 1995).

Next, a similar test is conducted to verify if the E-statistics are significantly not different from zero - a necessary condition for long-run equilibrium.

Bank-level data over the period 2003 to 2009 is obtained from the BankScope database. A few data exclusion criteria are applied. First, all bank observations with negative values of equity are dropped from the data. Second, a few bank observations with interest expenses exceeding 100% of total deposits are dropped.[16] The final sample contains 845 observations of Southern African banks, 832 observations of West African banks, 484 observations of North African banks and 603 observations of East African banks. Full country-year observations and subregional totals are given in Table 3.1. Macroeconomic variables are sourced from World Bank (2011) World Development Indicators. Sample descriptive statistics and correlation matrix are shown in Tables 3.2 and 3.3, respectively.

3.5 Results

This section presents the estimations results of the static and dynamic Panzar-Rosse models for all the subregions. From these estimation results, the static and dynamic H-statistics and their corresponding E-statistics are computed. Alternative dependent variables (total revenue and interest revenue) are employed as robustness checks and a series of diagnostic tests carried out.

[16] The subsequent results, however, do not significantly change when these exclusion criteria are relaxed. The results involving the relaxed exclusion criteria are shown in appendix B

3.5.1 Static H-statistic

First, the static Panzar-Rosse model is estimated using the panel fixed effect estimation technique. Columns 1-4 of Table 3.4 show that the H-statistics are positive and statistically significant for all the subregional banking markets. North Africa has the highest H-statistic (0.534), followed by West Africa (0.509), East Africa (0.437) and Southern Africa (0.357). The Wald test confirms that the H-statistics are significantly different from both zero and unity for all subregions. The findings suggest that the subregional banking markets are characterised by monopolistic competitive behaviour. Thus, competition coexists with high levels of banking market concentration, suggesting contestable market behaviour.

Following Vesala (1995), the H-statistic can be employed as a continuous measure of competition. In this regard, banking sector competition in Africa in recent times is somehow comparable to that existing in other single banking markets in emerging economies. However, a fair amount of caution is recommended due to cross-market differences not captured by the model. With the exception of Southern Africa, the H-statistic is higher for all subregions compared to those documented in Al-Muharrami et al. (2006) for the GCC banking system (see Section 3.3). However, for all subregions, the H-statistic is significantly lower than that documented in Mamatzakis et al. (2005) for South Eastern European countries. The findings reported here are not directly comparable to Casu and Girardone (2006) due to significant differences in model specification.[17]

Given that most of the studies on banking competition (cited above) report

[17] Although the H-statistics reported here are larger than those reported in Casu and Girardone (2006) for 15 major European countries' banking market, their control variables somehow differ from those used in this paper.

results that are consistent with monopolistic competition, the findings of this study suggest that recent financial sector reforms in Africa may have had some beneficial effects in terms of market discipline.

In line with previous studies (e.g., Bikker and Haaf, 2002; Coccorese, 2004; Molyneux et al., 1994; Yeyati and Micco, 2007), the coefficient of unit price of funds is positive and statistically significant as expected for all subregions. Likewise, the unit price of labour is positive and statistically significant for all subregions except North Africa. Also, the unit price of capital (other operating expenses) is positive and statistically significant for all subregions. Price of funds seems to be the biggest contributor to the H-statistic for all subregions except Southern Africa, where the biggest contributor is the price of labour. This highlights the strong effect of interest rate liberalisation.

In relation to the control variables, it is observed that bank size (proxied by total assets) is positive and statistically significant for all subregions. The ratio of equity to total assets is mostly positive (the exception is East Africa) but significant only for Southern Africa. Consistent with Mamatzakis et al. (2005) and Bikker and Haaf (2002), the ratio of loans to total assets is always positive as expected and significant for all subregions except for North Africa. Also, in line with Mamatzakis et al. (2005) and Al-Muharrami et al. (2006), the ratio of loan loss provisions to total assets is positive for all subregions and statistically significant except for North Africa. This is consistent with the view that higher default risk is matched with higher reward (e.g., Al-Muharrami et al., 2006).

As regards the macroeconomic environment, the impact of GDP growth is mixed: it is negative for the Southern and North African subregions but positive for West and East Africa. However, it is statistically significant only for the North

African subregion. The coefficient of inflation is positive as in Mamatzakis et al. (2005), and significant only for the Southern and East African subregions.

As the validity of the H-statistics depends on the assumption of long-run equilibrium, Table 3.4 also provides the results of the equilibrium test in columns 4-8, obtained from equation (3.10) where ROA is the dependent variable. The Wald tests results show that the E-statistics (the total elasticities of returns to the input prices) are not statistically different from zero, suggesting that the banks are observed under long long-run equilibrium.

The results presented above are subjected to a series of robustness checks. First, given that a significant number of studies do scale revenue by total assets (e.g., Al-Muharrami et al., 2006; Claessens and Laeven, 2004; Hondroyiannis et al., 1999; Mamatzakis et al., 2005; Perera et al., 2006), whilst several others do not (e.g., Bikker and Haaf, 2002; Coccorese, 2004; Gunalp and Celik, 2006), and the concerns raised in Bikker et al. (2009) about possible bias arising from misspecification of the model, the paper compares the results above with the models using the ratio of revenue to total assets as the dependent variables. The results are presented in Table 3.5

As noted in Table 3.5, the main findings are qualitatively similar to those presented earlier, notwithstanding some apparent slight differences in the magnitude of the H-statistics; The H-statistics are all statistically significantly different from both zero and unity. In addition, similar results are obtained when total assets are dropped from the above estimations.[18] The existence of long-run equilibrium

[18]These estimations control for capacity indicators such as total fixed assets or equity (e.g., De Bandt and Davis, 2000; Gischer and Stiele, 2009; Murjan and Ruza, 2002; Vesala, 1995; Yildirim and Philippatos, 2007). Controlling for fixed assets rather than total assets does not hold banks' output constant, and it is therefore appropriate. The results are not presented here, for brevity, and are available upon request.

is also not rejected, as indicated in columns 4-8 of the table.

As interest-generating activities have been the tradition in African banking sectors for many years, results for interest income as a dependent variable are also provided in Table 3.6. The results show that the H-statistic is highest (0.638) for the West African subregional banking market, followed by North African (0.514), Southern African (0.490) and East African (0.444). Thus, the East African banking market is the least competitive in terms of interest income, while Southern Africa is the least competitive in terms of total banking activity. In comparison with Al-Muharrami et al. (2006) the estimates of the level of banking market competition are found to be higher for all African subregions, but lower when compared with Mamatzakis et al. (2005). Columns 4-8 of the table confirm that the banks are observed under long-run equilibrium.

As for input prices, unit prices of funds and labour are positive and significant for all subregions. However, the unit price of capital, though positive for all subregions, is significant only in the case of West Africa. Also, the coefficient of the unit price of funds is significantly higher in magnitude compared to the results for the total revenue equation and remains the biggest contributor to the H-statistic. This, coupled with the fact that the H-statistic is higher for all subregions except North Africa, suggests a higher degree of competition in interest-generating activities relative to total banking activities.

As far as the control variables are concerned, Table 3.6 shows that the ratio of equity to total assets, though always positive, is statistically insignificant for all subregions. Also, the coefficients of the ratio of loans to total assets are relatively higher in magnitude compared to the previous results. The ratio of other income to total assets has the expected negative sign for all subregions but is statistically significant only for Southern and West African banking markets. Thus, the engagement in other income-generating activities constrains banks' ability to generate interest income (Bikker and Haaf, 2002). The sign of the coefficient of GDP growth is again mixed but insignificant for all subregions, whilst inflation is positive and significant only for Southern Africa.

The E-statistics reported in columns 4-8 of Table 3.6 do not reject long-run equilibrium. As shown by the Wald test, the E-statistics are all not statistically different from zero.

The results presented so far suggest that banking competition in Africa is generally comparable to regional markets in other emerging economies. As in the total revenue model, the findings are robust to using the ratio of interest revenue to total assets as the dependent variable. Furthermore, the findings are robust to dropping total assets from the model.

3.5.2 Dynamic H-statistic

In this section, the dynamic version of the results presented above is discussed. The estimation results for the models using total revenue as the dependent variable are shown in Table 3.7. The maximum lag dependent variable is restricted to one in all models in order to restrain the number of moment conditions. The lag dependent variable is positive and significant; the Hansen test p-values are all well above 0.1, justifying the validity of the over-identification restriction; and, finally, the absence of second-order serial correlation is not rejected. Thus, the diagnostic tests justify the use of a dynamic model.

Table 3.7 shows that the H-statistic is positive and significantly different from both zero and one for all subregions, suggesting a monopolistic competitive market structure in all the banking markets. It is worth noting that the H-statistics are much larger in magnitude compared to the results in Table 3.4. This finding lends support to the view of Goddard and Wilson (2009) that the static H-statistic is downward biased if the adjustment towards equilibrium is partial rather than instantaneous. The results further show that, when dynamics are taken into account, H-statistic is highest (0.605) in East Africa; and it is least (0.517) in Southern Africa. The result for East Africa is not surprising given the extent of recent reforms and cross-border banking. Even after taking partial adjustment to equilibrium into account, the H-statistics for all subregions are slightly lower than those reported in Mamatzakis et al. (2005), except when interest revenue is considered.

Consistent with the previous results (Table 3.4), the price of funds is positive and significant for all subregions. Similarly, the price of labour is positive and significant for all subregions, whilst the price of capital is significantly positive for only the North and East African subregional banking markets. As in previous results, the price of funds seems to be the biggest contributor to the H-statistic.

As far as the control variables are concerned, the noticeable changes are that the ratio of net loans to total assets is now significant only for East Africa. GDP growth is positive and significant only for East Africa and inflation is significantly positive only for Southern Africa.[19] The ratio of loan loss provisions to total assets is now not significant for West Africa

[19]GDP growth rate is used instead of subregional growth rate or GDP level for comparability of the results with the previous literature, mainly Mamatzakis et al. (2005). Also, since the estimation is done at the subregional level, subregional growth variable would exhibit only within variations with very little or no explanatory power. Further, most of banking activities are within the domestic country, making country level growth rate more appropriate. Finally, GDP level summarises the overall institutional features which include competition.

The results of the equilibrium test (equation (3.14)) are also presented in columns 4-8 (Table 3.7). The diagnostic tests are satisfactory, and long-run equilibrium is not rejected.[20]

As in the estimation of the static models, the robustness of these results is assessed. First, similar results are obtained when total revenue is replaced with the ratio of total revenue to total assets as the dependent variable, as shown in Table 3.8. Also, ompared to the preceding results, the H-statistics are slightly larger. These notwithstanding, the main findings remain unchanged.

Finally, results of the dynamic models in which interest revenue is the dependent variable are also provided in Table 3.9. The results are not qualitatively different from the above except that the West and East African subregional banking markets now have higher H-statistics compared with the findings of Mamatzakis et al. (2005). All the diagnostic tests are, again, satisfactory. The H-statistics are, as before, higher in magnitude compared to those shown in Table 3.6. Consistent with the results in Table 3.6, the H-statistic is highest in West Africa (0.810). However, East Africa also has a high H-statistic of 0.780. Similar results are obtained when the dependent variable is the ratio of interest revenue to total assets.

3.6 Conclusion

This study examines banking competition across subregional banking markets in Africa. Assuming common markets within each subregion due to increased regional integration and cross-border banking, the non-structural approach to measuring competition, proposed by Rosse and Panzar (1977) and Panzar and Rosse (1987),

[20] The lagged dependent variable for the equilibrium test model is, however, not significant for North Africa. Thus, a fair amount of caution is to be exercised in interpreting the results.

is used to estimate the degree of competition in each of the subregional banking markets. The results suggest the existence of monopolistic competition across African subregional banking markets. These results are consistent with several recent studies for other parts of the world, particularly in emerging economies, suggesting that recent structural reforms within Africa may have had significant effects as far as banking sector competition is concerned.

The results are robust to alternative views of banking activities (i.e., interest-generating activities versus total banking activities) as well as alternative specifications and estimators. In particular, whilst the existence of long-run equilibrium, as a necessary condition, is verified for all model specifications, the robustness of the results in relation to the possibility of partial adjustment towards equilibrium is further assessed. In the empirical implementation, therefore, a dynamic approach is also used to estimate the Panzar-Rosse model to obtain a dynamic H-statistic for comparison with the static H-statistic. Whilst the results confirm the downwards bias of the static H-statistic, monopolistic competition cannot be ruled out.

The findings of this paper have policy significance because of the possible link between banking competition and efficient financial intermediation, bank profitability and stability. The results also offer a yardstick against which to measure the success of several years of regional integration and cross-border banking in Africa.

Figure 3.1: Evolution of banking sector concentration (HHI) by subregion.

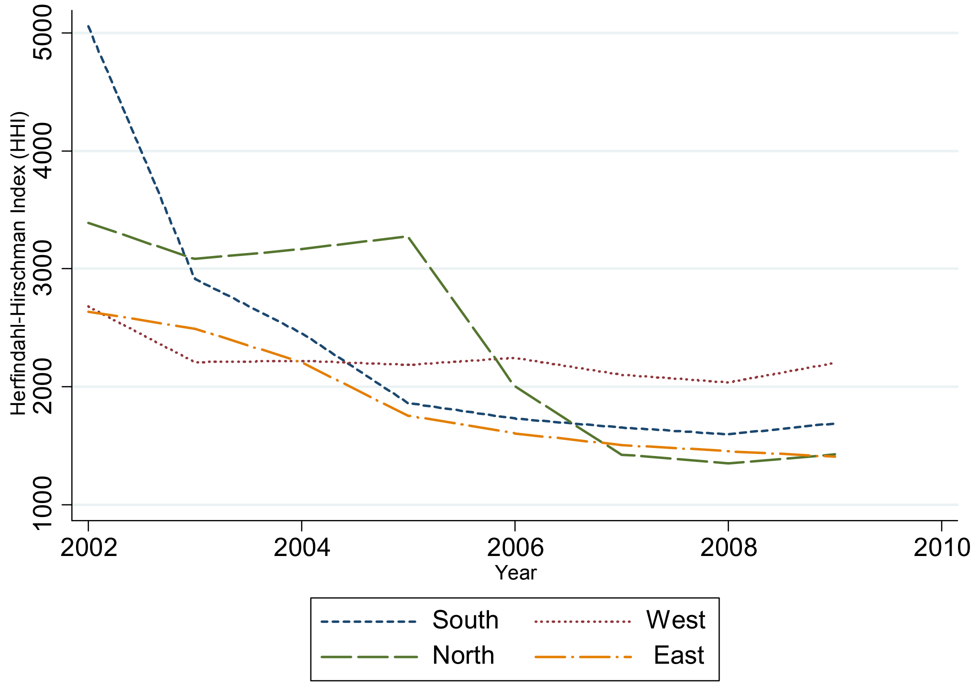

Figure 3.2: Evolution of banking sector concentration (CR5) by subregion.

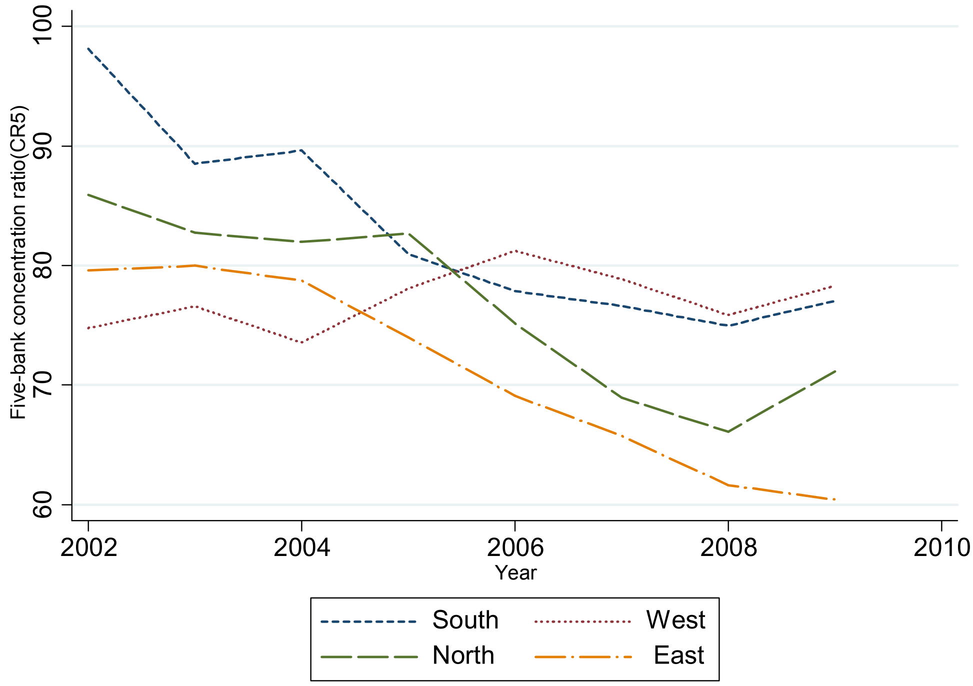

Table 3.1: Sample number of banks by country, year and subregion

Country	Year								
	2002	2003	2004	2005	2006	2007	2008	2009	*Total*
Panel 1: Southern Africa									
Angola	5	9	10	11	13	12	13	12	85
Botswana	1	4	6	7	9	9	11	10	57
Congo, D.R. OF	1	3	5	9	9	7	9	6	49
Lesotho	2	3	3	2	3	3	3	2	21
Madagascar	3	5	5	5	5	4	5	5	37
Malawi	7	10	10	9	9	8	11	11	75
Mauritius	2	11	13	13	14	15	16	12	96
Mozambique	2	4	4	6	6	9	11	11	53
Namibia	1	1	2	7	8	7	8	7	41
Seychelles	0	1	2	4	4	4	3	2	20
South Africa	2	3	11	25	30	34	41	37	183
Swaziland	2	5	6	6	5	5	5	5	39
Zambia	5	12	12	12	12	14	12	10	89
Regional total	33	71	89	116	127	131	148	130	845
Panel 2: West Africa									
Benin	4	6	4	6	6	6	6	5	43
Burkina Faso	3	5	7	7	8	7	6	5	48
Cameroon	5	9	10	11	12	9	6	5	67
Cape Verde	2	2	2	3	2	2	2	1	16
Gabon	1	1	1	2	2	2	2	2	13
Gambia	2	3	3	4	5	4	4	3	28
Ghana	4	4	5	9	9	21	23	22	97
Ivory Coast	8	11	11	13	12	11	10	6	82
Mali	5	5	6	6	7	7	7	6	49
Mauritania	5	7	7	8	6	5	4	5	47
Nigeria	22	28	36	26	22	23	19	17	193
Senegal	9	10	10	8	8	8	7	7	67
Sierra Leone	4	5	6	5	8	8	8	7	51
Togo	1	3	4	4	5	5	5	4	31
Regional total	75	99	112	112	112	118	109	95	832
Panel 3: North Africa									
Algeria	8	9	14	12	15	15	15	12	100
Morocco	3	5	7	7	10	17	17	15	81
Niger	1	3	4	4	5	5	4	4	30
Sudan	8	10	7	9	13	17	18	17	99
Tunisia	10	19	20	21	25	27	29	23	174
Regional total	30	46	52	53	68	81	83	71	484
Panel 4: East Africa									
Burundi	5	5	5	5	4	4	3	3	34
Ethiopia	1	8	8	9	9	10	8	9	62
Kenya	12	26	27	30	30	35	35	34	229
Rwanda	1	3	4	4	5	4	3	3	27
Tanzania	1	2	7	21	25	24	23	22	125
Uganda	9	15	16	16	17	16	18	19	126
Regional Regional total	29	59	67	85	90	93	90	90	603

Source: Fitch-IBCA's Bankscope database and own calculation

Table 3.2: Descriptive Statistics

Country	TA	TR	IR	ROA	PF	PL	PC	NLTA	EQTA	LLPL	GDPG	INFL
Panel 1: Southern Africa												
Angola	1329.54	135.80	81.87	1.25	2.13	1.79	67.61	29.17	14.70	8.37	13.02	32.51
Botswana	563.67	85.99	68.12	2.90	11.64	2.13	256.04	46.63	13.23	1.46	2.96	9.38
Congo D.R.	112.42	16.85	9.13	1.40	1.56	2.61	184.30	31.64	11.42	6.98	5.59	15.67
Lesotho	207.15	26.76	18.44	1.78	3.58	2.60	125.36	19.55	7.73	1.56	3.14	9.44
Madagascar	232.31	22.11	17.33	2.65	2.98	1.18	166.89	47.05	10.51	2.05	3.45	10.52
Malawi	91.77	18.72	11.49	2.23	6.34	5.36	107.43	35.42	16.74	1.37	5.86	11.06
Mauritius	1033.24	90.15	58.12	1.08	4.89	0.88	417.69	51.28	13.60	0.71	3.96	6.51
Mozambique	361.96	51.46	33.14	0.14	3.87	4.74	129.68	35.37	18.18	2.28	7.26	9.12
Namibia	996.50	139.79	110.87	1.95	8.21	2.30	142.55	81.21	19.08	0.98	4.25	6.58
Seychelles	222.13	20.83	11.81	1.90	1.22	0.67	250.53	28.81	6.22	0.58	3.62	10.45
South Africa	23689.37	2663.18	1961.88	2.54	11.78	2.87	779.36	57.95	17.38	2.05	3.49	6.85
Swaziland	158.46	22.56	15.36	2.88	8.36	3.34	223.75	64.11	19.38	0.14	2.60	7.37
Zambia	202.51	31.32	19.52	1.18	5.28	4.87	220.77	29.75	14.76	3.70	5.62	15.10
Average	5554.45	611.67	445.02	1.85	6.59	2.89	325.28	44.78	15.14	2.69	5.25	11.76
Panel 2: West Africa												
Benin	247.50	23.18	15.37	−0.27	2.55	1.86	133.12	56.19	9.21	2.37	4.02	3.34
Burkina Faso	221.78	23.30	15.65	0.68	2.60	1.96	94.34	60.29	8.17	2.63	5.17	3.18
Cameroon	377.24	39.45	22.22	1.14	3.25	1.93	104.39	50.77	11.47	1.82	3.23	2.41
Cape Verde	82.03	7.26	5.20	2.27	2.34	2.98	139.33	44.73	16.04	1.73	6.82	2.36
Gabon	93.63	11.13	8.60	1.28	6.92	4.44	91.62	56.45	41.44	−0.45	1.98	2.43
Gambia	61.87	11.25	6.82	2.95	3.93	2.77	91.77	29.55	14.28	2.60	5.42	6.91
Ghana	283.61	48.45	35.59	1.79	8.70	4.34	134.55	42.12	15.37	3.11	6.28	15.38
Ivory Coast	378.25	43.73	24.66	−0.17	3.91	3.77	184.08	59.58	10.23	0.84	0.95	3.02
Mali	271.70	23.27	15.21	1.23	1.55	1.91	69.12	57.25	10.77	1.95	4.79	2.78
Mauritania	119.69	11.64	6.58	1.87	2.58	1.89	117.39	50.87	23.87	4.12	4.72	7.22
Nigeria	1893.19	243.76	160.79	2.03	7.70	2.72	160.02	32.49	17.08	1.42	6.93	12.44
Senegal	336.09	34.61	25.61	0.88	2.30	1.62	138.29	57.79	8.98	1.38	4.10	2.02
Sierra Leone	37.85	7.37	4.33	2.62	3.60	3.93	105.32	22.94	20.23	8.71	8.22	12.03
Togo	1180.05	148.49	91.78	2.00	2.23	2.67	94.32	52.59	14.19	−1.84	2.49	3.10
Average	666.71	85.27	56.49	1.42	4.74	2.78	130.91	46.06	14.54	2.18	5.02	7.27
Panel 3: North Africa												
Algeria	4125.85	215.04	148.45	1.06	2.82	0.80	69.59	41.87	14.03	3.36	3.70	3.31
Morocco	7261.77	466.90	382.00	1.74	3.83	1.85	87.67	67.83	12.11	1.06	4.80	2.19
Niger	119.53	12.49	7.69	0.45	1.71	2.01	118.18	56.70	9.62	0.49	4.16	3.10
Sudan	953.37	78.07	45.10	1.84	5.09	2.25	84.86	31.40	17.15	4.10	7.34	9.67
Tunisia	1012.05	73.54	53.06	0.88	12.07	1.37	90.78	68.58	20.28	2.51	4.86	3.58
Average	2634.00	162.72	123.26	1.23	6.71	1.54	86.41	54.73	16.32	2.52	5.07	4.50
Panel 4: East Africa												
Bunrundi	52.75	7.28	4.84	2.02	4.80	2.62	66.47	54.63	13.72	4.14	3.05	8.93
Ethiopia	721.89	47.33	26.90	2.45	2.20	1.02	89.32	54.03	12.32	1.39	9.29	15.95
Kenya	340.55	45.70	30.66	1.51	4.77	3.11	127.49	53.47	18.99	2.37	4.26	12.71
Rwanda	90.11	10.42	7.54	1.27	4.74	2.60	116.47	43.01	10.09	3.14	7.34	9.91
Tanzania	202.11	25.34	18.15	1.50	4.69	3.46	318.81	45.85	13.11	1.88	6.99	8.07
Uganda	167.06	26.24	21.03	2.53	5.03	6.08	241.20	47.46	16.44	2.08	7.90	8.02
Average	287.37	34.65	23.31	1.83	4.54	3.22	182.66	50.26	15.86	2.23	6.17	10.76

Values are in millions of US$ for TA, TR and IR and percentages for all other variables. TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation.

Table 3.3: Correlation Matrix

Variables	ln TR	ln IR	ln ROA	lnPF	ln PL	ln PC	ln TA	ln NLTA	ln EQTA	ln LLPL	ln GDPG	ln INFL
Panel 1: Southern Africa												
ln TRr	1.000											
ln IR	0.978	1.000										
ln ROA	0.033	−0.012	1.000									
ln PF	0.206	0.241	0.116	1.000								
ln PL	−0.155	−0.216	0.215	0.133	1.000							
l PC	0.105	0.068	0.046	0.126	−0.036	1.000						
ln TA	0.967	0.965	−0.053	0.152	−0.345	0.109	1.000					
ln NLTA	0.317	0.381	−0.033	0.344	−0.089	−0.015	0.279	1.000				
ln EQTA	−0.243	−0.279	0.389	0.190	0.323	−0.044	−0.322	−0.015	1.000			
ln LLPL	−0.092	−0.133	0.069	−0.193	0.331	−0.079	−0.188	−0.361	0.170	1.000		
ln GDPG	−0.015	−0.031	0.001	−0.234	0.085	−0.096	−0.037	−0.134	−0.040	0.176	1.000	
ln INFL	−0.184	−0.203	0.122	−0.262	0.147	−0.154	−0.237	−0.303	0.050	0.433	0.192	1.000
Panel 2: West Africa												
ln TR	1.000											
ln IR	0.959	1.000										
ln ROA	0.056	0.053	1.000									
ln PF	0.034	0.116	0.145	1.000								
ln PL	−0.211	−0.218	0.104	0.245	1.000							
ln PC	−0.088	−0.020	0.072	0.189	0.035	1.000						
ln TA	0.966	0.927	−0.047	−0.098	−0.382	−0.086	1.000					
ln NLTA	0.162	0.147	−0.183	−0.148	−0.138	−0.031	0.238	1.000				
ln EQTAa	−0.117	−0.086	0.222	0.246	0.316	0.040	−0.241	−0.218	1.000			
ln LLPL	−0.086	−0.059	−0.086	0.212	0.137	−0.081	−0.133	−0.316	0.066	1.000		
ln GSPG	0.036	0.072	0.177	0.153	0.062	−0.005	−0.014	−0.207	0.156	0.183	1.000	
ln INFL	0.124	0.162	0.192	0.410	0.212	0.182	0.043	−0.310	0.230	0.176	0.374	1.000
Panel 3: North Africa												
ln TR	1.000											
ln IR	0.980	1.000										
ln ROAa	−0.208	−0.231	1.000									
ln PF	−0.097	−0.003	−0.033	1.000								
ln PL	−0.281	−0.343	0.244	−0.040	1.000							
ln PC	−0.236	−0.244	0.187	−0.042	0.345	1.000						
ln TA	0.975	0.957	−0.281	−0.138	−0.397	−0.312	1.000					
ln NLTA	0.128	0.193	−0.058	0.404	0.066	0.039	0.133	1.000				
ln EQTA	−0.365	−0.367	0.521	0.078	0.247	0.091	−0.430	−0.097	1.000			
ln LLPL	−0.102	−0.135	−0.169	−0.066	−0.039	−0.085	−0.116	−0.262	0.011	1.000		
ln GDPG	0.013	−0.009	0.018	0.119	0.153	−0.018	−0.036	−0.083	0.003	−0.049	1.000	
ln INFL	−0.046	−0.114	0.130	0.019	0.122	−0.061	−0.065	−0.227	0.144	0.031	0.331	1.000
Panel 4: East Africa												
ln TR	1.000											
ln IR	0.988	1.000										
ln ROA	0.208	0.214	1.000									
ln PF	−0.324	−0.276	−0.042	1.000								
ln PL	−0.163	−0.143	−0.073	0.282	1.000							
ln PC	−0.061	−0.021	0.051	−0.026	0.120	1.000						
ln TA	0.960	0.940	0.140	−0.402	−0.406	−0.137	1.000					
ln NLTA	−0.017	0.007	−0.092	0.329	0.147	−0.106	−0.075	1.000				
ln EQTA	−0.409	−0.390	0.131	0.389	0.249	−0.084	−0.432	0.201	1.000			
ln LLPL	−0.147	−0.179	−0.249	0.081	0.221	0.000	−0.234	0.013	0.057	1.000		
ln GDPG	0.051	0.046	0.167	−0.163	−0.167	0.182	0.053	−0.101	−0.175	−0.171	1.000	
ln INFL	0.209	0.186	−0.050	−0.060	−0.081	−0.212	0.262	0.096	0.046	−0.113	−0.036	1.000

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation.

Table 3.4: Panzar-Rosse H-statistic using total revenue: panel fixed effect estimation

	Dependent variable: lnTR				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
ln PF	0.148***	0.238***	0.271***	0.210***	0.009	0.234**	−0.055	0.226
	(0.036)	(0.024)	(0.062)	(0.039)	(0.110)	(0.110)	(0.104)	(0.174)
ln PL	0.163***	0.210***	0.138	0.171**	−0.106	−0.556*	0.131	−0.254
	(0.057)	(0.045)	(0.103)	(0.066)	(0.141)	(0.327)	(0.470)	(0.384)
ln PC	0.047**	0.062***	0.125*	0.056*	−0.041	0.199*	−0.138	0.023
	(0.023)	(0.022)	(0.064)	(0.029)	(0.107)	(0.106)	(0.130)	(0.104)
ln TA	1.130***	0.921***	0.925***	0.956***	0.210	−0.380**	−0.196**	0.134
	(0.063)	(0.027)	(0.056)	(0.085)	(0.161)	(0.182)	(0.094)	(0.332)
ln EQTA	0.148***	0.001	0.049	−0.020	1.020***	0.196	0.412	0.919***
	(0.043)	(0.025)	(0.046)	(0.053)	(0.214)	(0.151)	(0.377)	(0.273)
ln NLTA	0.176***	0.200***	0.013	0.122***	−0.193	0.076	−0.562**	−0.334**
	(0.042)	(0.046)	(0.080)	(0.035)	(0.167)	(0.244)	(0.241)	(0.142)
ln LLPL	0.050***	0.017**	0.023	0.024***	−0.026	−0.195***	−0.200**	−0.070
	(0.010)	(0.007)	(0.017)	(0.008)	(0.044)	(0.047)	(0.078)	(0.055)
ln GDPG	−0.022	0.003	−0.027*	0.008	0.015	0.111	−0.065	−0.000
	(0.019)	(0.015)	(0.016)	(0.023)	(0.064)	(0.186)	(0.084)	(0.115)
ln INFL	0.072**	0.004	0.010	0.035*	0.022	−0.158*	−0.033	−0.048
	(0.030)	(0.011)	(0.014)	(0.019)	(0.098)	(0.083)	(0.042)	(0.114)
Constant	−2.218***	0.789**	0.194	−0.098	−5.004**	−0.889	−2.500	−4.499
	(0.788)	(0.345)	(0.619)	(0.711)	(2.211)	(1.861)	(2.492)	(3.287)
H-stat / E-stat	0.357[a]	0.509[a]	0.534[a]	0.437[a]	−0.137[e]	−0.124[e]	0.063[e]	−0.005[e]
	(0.069)	(0.053)	(0.105)	(0.085)	(0.241)	(0.346)	(0.509)	(0.438)
Wald F stat. H = 0 / E = 0	27.19***	91.88***	26.05***	26.43***	0.33	0.13	0.02	0.00
Wald F stat. H = 1	88.30***	85.30***	19.77***	43.88***				
Adj. R^2	0.908	0.962	0.859	0.932	0.126	0.132	0.191	0.150
N	487	427	286	375	479	413	292	384

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Heteroskedasticity-robust standard errors are given in parentheses. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Table 3.5: Panzar-Rosse H-statistic using the ratio of total revenue to total assets: panel fixed effect estimation

	Dependent variable: ln(TR/TA)				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
ln PF	0.159***	0.253***	0.272***	0.209***	0.025	0.265**	−0.061	0.234
	(0.033)	(0.026)	(0.064)	(0.039)	(0.107)	(0.124)	(0.107)	(0.165)
ln PL	0.116**	0.238***	0.190**	0.185***	−0.154	−0.387	0.285	−0.305
	(0.046)	(0.044)	(0.075)	(0.050)	(0.144)	(0.279)	(0.469)	(0.349)
ln PC	0.037	0.069***	0.127*	0.061**	−0.055	0.250**	−0.149	0.007
	(0.025)	(0.020)	(0.066)	(0.024)	(0.110)	(0.105)	(0.128)	(0.109)
ln EQTA	0.121***	−0.005	0.057	−0.004	0.945***	0.176	0.424	0.863***
	(0.044)	(0.026)	(0.046)	(0.055)	(0.205)	(0.144)	(0.377)	(0.199)
ln NLTA	0.186***	0.197***	0.001	0.123***	−0.153	0.074	−0.592**	−0.346**
	(0.044)	(0.048)	(0.079)	(0.033)	(0.158)	(0.252)	(0.265)	(0.141)
ln LLPL	0.048***	0.015**	0.023	0.025***	−0.031	−0.202***	−0.200**	−0.070
	(0.011)	(0.007)	(0.017)	(0.007)	(0.045)	(0.046)	(0.079)	(0.054)
ln GDPG	−0.033	0.009	−0.024	0.005	−0.004	0.142	−0.040	0.009
	(0.022)	(0.016)	(0.015)	(0.021)	(0.066)	(0.199)	(0.087)	(0.115)
ln INFL	0.044	0.012	0.007	0.031*	−0.019	−0.115	−0.042	−0.037
	(0.036)	(0.012)	(0.013)	(0.018)	(0.097)	(0.076)	(0.039)	(0.105)
Contant	−0.760**	−0.021	−0.519	−0.507	−2.551***	−4.785***	−4.405*	−3.292**
	(0.325)	(0.192)	(0.389)	(0.247)	(0.946)	(1.038)	(2.431)	(1.608)
N	487	427	286	375	479	413	292	384
H-stat / E-stat	0.312[a]	0.561[a]	0.590[a]	0.455[a]	−0.183[e]	0.128[e]	0.076[e]	−0.064[e]
	(0.069)	(0.050)	(0.105)	(0.067)	(0.249)	(0.285)	(0.503)	(0.424)
Wald F stat. H = 0 / E = 0	20.24 * **	123.91 * **	31.73 * **	28.43 * **	0.54	0.20	0.02	0.02
Wald F stat. H = 1	98.85 * **	75.85 * **	15.28 * **	43.83 * **				
Adj. R^2	0.304	0.622	0.389	0.396	0.123	0.114	0.186	0.151
N	487	427	286	375	479	413	292	384

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Heteroskedasticity-robust standard errors are given in parentheses. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Table 3.6: Panzar-Rosse H-statistic using interest revenue: : panel fixed effect estimation

	Dependent variable: lnIR				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
ln PF	0.323***	0.300***	0.345***	0.235***	0.055	0.219*	−0.016	0.181
	(0.041)	(0.032)	(0.078)	(0.030)	(0.108)	(0.132)	(0.127)	(0.162)
ln PL	0.130*	0.287***	0.148*	0.160***	−0.092	−0.553*	−0.449	−0.488
	(0.066)	(0.057)	(0.086)	(0.055)	(0.147)	(0.325)	(0.399)	(0.418)
ln PC	0.037	0.051**	0.022	0.049	0.040	0.227**	−0.160	−0.036
	(0.033)	(0.023)	(0.042)	(0.030)	(0.111)	(0.107)	(0.125)	(0.109)
ln TA	1.146***	0.950***	0.942***	0.986***	0.137	−0.232	−0.196***	0.136
	(0.069)	(0.031)	(0.041)	(0.082)	(0.169)	(0.190)	(0.071)	(0.347)
ln EQTA	0.089	0.012	0.033	0.036	0.946***	0.215	0.347	0.934***
	(0.066)	(0.028)	(0.049)	(0.055)	(0.218)	(0.146)	(0.359)	(0.291)
ln NLTA	0.390***	0.271***	0.038	0.234***	−0.242	0.007	−0.453*	−0.248*
	(0.067)	(0.059)	(0.099)	(0.044)	(0.163)	(0.235)	(0.249)	(0.144)
ln LLPL	0.063***	0.019**	0.001	0.022**	−0.053	−0.217***	−0.209***	−0.094
	(0.012)	(0.008)	(0.014)	(0.010)	(0.045)	(0.045)	(0.070)	(0.058)
ln OITA	−0.132***	−0.139***	−0.051	0.028	0.238*	0.424**	0.390**	0.617**
	(0.049)	(0.036)	(0.037)	(0.047)	(0.130)	(0.212)	(0.176)	(0.282)
ln GDPG	0.020	0.012	−0.022	−0.021	0.012	0.142	−0.004	−0.027
	(0.024)	(0.022)	(0.022)	(0.035)	(0.065)	(0.181)	(0.081)	(0.117)
ln INFL	0.101**	−0.007	0.004	0.035	−0.047	−0.172**	−0.036	−0.045
	(0.047)	(0.015)	(0.014)	(0.023)	(0.101)	(0.083)	(0.034)	(0.114)
_cons	−2.914***	0.138	−0.512	−0.395	−3.075	−1.348	−2.956	−3.485
	(0.958)	(0.370)	(0.473)	(0.705)	(2.284)	(1.821)	(2.050)	(3.556)
H-stat / E-stat	0.490[a]	0.638[a]	0.514[a]	0.444[a]	0.002[e]	−0.107[e]	−0.626[e]	−0.344[e]
	(0.091)	(0.068)	(0.100)	(0.088)	(0.241)	(0.371)	(0.508)	(0.470)
Wald F stat. H = 0 / E = 0	29.02***	88.33***	26.32***	25.53***	0.00	0.08	0.1.52	0.53
Wald F stat. H = 1	31.44***	28.54***	23.45***	39.95***				
Adj. R^2	0.897	0.947	0.870	0.924	0.148	0.178	0.230	0.184
N	476	426	271	375	468	408	272	381

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Heteroskedasticity-robust standard errors are given in parentheses. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Table 3.7: Dynamic Panzar-Rosse H-statistic using total revenue: dynamic panel estimation, two-step system GMM

	Dependent variable: lnTR				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
Lagged dep. var.	0.189**	0.323**	0.439*	0.418***	0.350**	0.400*	0.170	0.646***
	(0.086)	(0.124)	(0.251)	(0.085)	(0.176)	(0.205)	(0.133)	(0.227)
ln PF	0.126***	0.162***	0.079*	0.096**	−0.027	0.071	−0.020	0.001
	(0.026)	(0.031)	(0.047)	(0.044)	(0.075)	(0.075)	(0.059)	(0.088)
ln PL	0.259***	0.218***	0.134**	0.205***	0.043	0.025	0.136	−0.036
	(0.037)	(0.042)	(0.065)	(0.038)	(0.055)	(0.096)	(0.143)	(0.071)
ln PC	0.034	0.024	0.100**	0.051***	−0.012	0.097	0.152	0.020
	(0.021)	(0.017)	(0.038)	(0.016)	(0.034)	(0.081)	(0.122)	(0.048)
ln TA	0.801***	0.672***	0.532**	0.585***	0.037***	0.051	−0.058	0.072
	(0.084)	(0.117)	(0.246)	(0.089)	(0.014)	(0.036)	(0.040)	(0.077)
ln EQTA	0.087***	0.056*	−0.022	−0.013	0.402***	0.171	0.523***	0.363
	(0.027)	(0.034)	(0.030)	(0.043)	(0.100)	(0.107)	(0.195)	(0.232)
ln NLTA	−0.009	0.015	0.043	0.150***	−0.110	0.089	−0.282***	−0.176
	(0.039)	(0.033)	(0.039)	(0.036)	(0.094)	(0.104)	(0.100)	(0.122)
ln LLPL	0.039***	0.006	0.027	0.020*	0.005	−0.148***	−0.200***	−0.080**
	(0.009)	(0.011)	(0.017)	(0.010)	(0.030)	(0.052)	(0.060)	(0.034)
ln GDPG	−0.004	0.025	−0.024	0.041**	−0.015	0.151*	−0.009	0.113
	(0.018)	(0.017)	(0.029)	(0.018)	(0.049)	(0.086)	(0.080)	(0.080)
ln INFL	0.080***	0.016	0.005	−0.008	0.175***	−0.006	−0.061**	−0.061
	(0.017)	(0.012)	(0.019)	(0.016)	(0.065)	(0.080)	(0.030)	(0.104)
Constant	0.085	0.141	0.043	0.008	−2.440***	−3.421***	−2.031***	−2.375*
	(0.159)	(0.151)	(0.345)	(0.117)	(0.485)	(1.153)	(0.449)	(1.307)
H-stat / E-stat	0.517[a]	0.596[a]	0.557[a]	0.605[a]	0.004[e]	0.193[e]	0.269[e]	−0.0152[e]
	(0.043)	(0.071)	(0.124)	(0.066)	(0.111)	(0.149)	(0.203)	(0.130)
Wald F stat. H = 0 / E = 0	232.19***	71.51***	20.06***	83.11***	0.00	1.68	1.75	0.01
Wald F stat. H = 1	203.07***	32.81***	12.68***	35.49***				
Hansen (p-values)	12.135(0.52)	15.317(0.29)	10.498(0.84)	24.343(0.18)	11.646(0.90)	28.170(0.35)	20.342(0.78)	10.088(0.86)
2^{nd} order ser. cor. test(p-values	1.178(0.24)	0.726(0.47)	−1.135(0.56)	0.228(0.82)	1.418(0.16)	−0.949(0.34)	1.448(0.15)	−0.641(0.52)
N	383	334	215	296	364	313	225	304

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Table 3.8: Dynamic Panzar-Rosse H-statistic using the ratio of total revenue to total assets: dynamic panel estimation, two-step system GMM

	Dependent variable: ln(TR/TA)				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
Lagged dep. var.	0.543**	0.515**	0.465*	0.425***	0.330**	0.417**	0.879***	0.649**
	(0.222)	(0.253)	(0.246)	(0.110)	(0.147)	(0.210)	(0.175)	(0.248)
ln PF	0.086***	0.132***	0.103***	0.073***	−0.007	0.081	−0.057	−0.052
	(0.029)	(0.043)	(0.033)	(0.025)	(0.075)	(0.073)	(0.083)	(0.094)
ln PL	0.161*	0.189***	0.137*	0.219***	0.033	−0.029	−0.060	−0.069
	(0.086)	(0.065)	(0.074)	(0.051)	(0.054)	(0.084)	(0.120)	(0.090)
ln PC	0.025	0.017	0.114***	0.061***	−0.014	0.083	−0.084	−0.002
	(0.019)	(0.017)	(0.035)	(0.018)	(0.035)	(0.077)	(0.097)	(0.050)
ln EQTA	0.074**	0.048	0.019	−0.009	0.366***	0.170	0.149	0.290
	(0.036)	(0.034)	(0.028)	(0.028)	(0.087)	(0.109)	(0.151)	(0.185)
ln NLTA	0.044	0.131**	0.019	0.160***	−0.075	0.065	−0.126	−0.170
	(0.032)	(0.057)	(0.043)	(0.035)	(0.088)	(0.104)	(0.101)	(0.119)
ln LLPL	0.040***	0.013	0.043***	0.028***	0.015	−0.151***	−0.125*	−0.080**
	(0.011)	(0.010)	(0.015)	(0.008)	(0.031)	(0.052)	(0.071)	(0.038)
ln GDPG	−0.023	0.032*	−0.031	0.044**	−0.011	0.152*	0.218	0.106
	(0.017)	(0.017)	(0.021)	(0.018)	(0.050)	(0.086)	(0.226)	(0.085)
ln INFL	0.082***	0.009	0.001	0.001	0.172***	−0.005	−0.107	−0.034
	(0.024)	(0.014)	(0.012)	(0.018)	(0.064)	(0.084)	(0.070)	(0.096)
Constant	0.206*	0.352**	−0.063	−0.002	−2.010***	−2.890***	−1.426**	−1.956*
	(0.108)	(0.175)	(0.251)	(0.113)	(0.359)	(1.038)	(0.640)	(1.049)
H-stat / E-stat	0.595[a]	0.695[a]	0.661[a]	0.615[a]	0.012[e]	0.135[e]	−0.202[e]	−0.122[e]
	(0.043)	(0.162)	(0.130)	(0.047)	(0.111)	(0.131)	(0.232)	(0.166)
Wald F stat. H = 0 / E = 0	57.05***	18.29***	25.95***	172.18***	0.01	1.06	0.75	0.54
Wald F stat. H = 1	26.42***	3.52*	6.80**	67.43***				
Hansen J test (p-values)	16.584(0.22)	12.226(0.51)	0.115(0.73)	0.081(0.78)	11.669(0.90)	28.236(0.35)	0.136(0.71)	11.059(0.81)
2^{nd} order ser. cor. test(p-values)	0.936(0.35)	1.458(0.15)	−0.438(0.66)	0.335(0.74)	1.418(0.16)	−1.002(0.32)	1.558(0.12)	−0.537(0.59)
N	383	334	215	296	364	313	225	304

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Table 3.9: Dynamic Panzar-Rosse H-statistic using total revenue: dynamic panel estimation, two-step system GMM

	Dependent variable: lnIR				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
Lagged dep. var.	0.237**	0.325***	0.581***	0.561***	0.362	0.423**	0.303*	0.558**
	(0.102)	(0.099)	(0.192)	(0.178)	(0.222)	(0.170)	(0.162)	(0.238)
ln PF	0.220***	0.267***	0.068	0.133***	0.003	0.101	0.021	0.070
	(0.037)	(0.029)	(0.050)	(0.044)	(0.082)	(0.062)	(0.041)	(0.106)
ln PL	0.205***	0.243***	0.143*	0.160**	−0.137*	−0.055	−0.077	−0.100
	(0.039)	(0.044)	(0.076)	(0.079)	(0.080)	(0.117)	(0.137)	(0.107)
ln PC	−0.006	0.037***	0.012	0.049**	−0.001	0.179**	−0.041	0.030
	(0.025)	(0.013)	(0.038)	(0.020)	(0.035)	(0.079)	(0.080)	(0.055)
ln TA	0.751***	0.680***	0.383**	0.450***	0.022	0.040	−0.090**	0.121
	(0.101)	(0.089)	(0.189)	(0.171)	(0.015)	(0.036)	(0.037)	(0.078)
ln EQTA	0.048	0.023	−0.054	−0.027	0.397***	0.151	0.378***	0.471*
	(0.042)	(0.024)	(0.043)	(0.048)	(0.110)	(0.092)	(0.130)	(0.250)
ln NLTA	0.012	0.087	0.042	0.224***	−0.055	0.098	−0.143*	−0.167
	(0.053)	(0.064)	(0.053)	(0.043)	(0.074)	(0.104)	(0.073)	(0.144)
ln LLPL	0.016	0.005	0.005	0.008	−0.008	−0.107**	−0.161***	−0.102**
	(0.012)	(0.012)	(0.018)	(0.014)	(0.037)	(0.046)	(0.044)	(0.042)
ln OITA	−0.051*	−0.079*	−0.045*	−0.046	0.199*	0.353**	0.060	0.143
	(0.029)	(0.040)	(0.025)	(0.030)	(0.100)	(0.171)	(0.044)	(0.141)
ln GDPG	0.051*	0.086***	−0.024	0.042	0.023	0.122	−0.015	0.087
	(0.026)	(0.024)	(0.022)	(0.028)	(0.055)	(0.096)	(0.074)	(0.086)
ln INFL	0.099***	0.014	−0.007	−0.018	0.150*	−0.039	−0.046	−0.042
	(0.029)	(0.014)	(0.014)	(0.025)	(0.076)	(0.069)	(0.030)	(0.089)
Constant	−0.423**	−0.141	−0.043	−0.118	−2.146***	−2.080*	−1.729***	−2.650*
	(0.188)	(0.260)	(0.430)	(0.162)	(0.461)	(1.148)	(0.559)	(1.341)
H-stat / E-stat	0.550[a]	0.810[a]	0.534[a]	0.780[a]	−0.135[e]	0.225[e]	−0.097[e]	0.001[e]
	(0.058)	(0.078)	(0.193)	(0.100)	(0.120)	(0.142)	(0.168)	(0.157)
Wald F stat. H = 0 / E = 0	90.91***	108.83***	7.67***	61.23***	1.25	2.49	0.33	0.00
Wald F stat. H = 1	60.72***	5.95**	5.85**	4.88**				
Hansen test (p-values)	21.586(0.16)	12.295(0.50)	32.098(0.19)	27.607(0.12)	7.726(0.86)	16.315(0.43	9.274(0.90)	19.534(0.48)
Second order ser. cor. test (p-values)	0.193(0.85)	0.561(0.58)	1.373(0.17)	0.254(0.80)	0.971(0.33)	−0.677(0.50)	1.256(0.21)	−0.541(0.59)
N	374	334	206	297	354	311	212	301

TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Chapter 4

Credit information, consolidation and credit market performance: Bank-level evidence from developing countries

4.1 Introduction

Information asymmetry and poor contract enforcement lead to suboptimal credit market equilibrium (Stiglitz and Weiss, 1981). To the extent that these problems are endemic in underdeveloped countries, financial sector underdevelopment in these countries could be attributed to poor credit information about borrowers. Credit information sharing is therefore expected to facilitate lending decisions (Bennardo et al., 2010; Pagano and Jappelli, 1993), reduce loan default by increasing borrowers' incentive to repay (Padilla and Pagano, 1997, 2000), and increase competition which in turn leads to higher lending (Pagano and Jappelli, 1993). The benefits of information sharing are hypothesised to be particularly helpful in less consolidated or more competitive banking markets, where borrower credit information is dispersed (Marquez, 2002). Although recent empirical interest has been drawn to the potential benefits of credit information sharing on lending decisions, the moderating effect of banking sector consolidation has been largely ignored.

In this paper I examine the effect of credit information sharing on bank lending in African countries. I further condition this effect on the extent of banking sector consolidation. This paper focuses on African countries for a number of reasons. The region exhibits record high levels of default. This, coupled with inadequate credit information and poor creditor rights protection, makes lending decisions within African banking markets a difficult task. Unsurprisingly, therefore, African banking markets remain dramatically underdeveloped, even compared to other developing countries (Honohan and Beck, 2007; Mylenko, 2007). Bank credit to the private sector in the region lags behind that of other regions. The region records the lowest credit penetration in the world (Mylenko, 2007) with less than 20% of households having access to formal banking services (Beck et al., 2009).

A key feature to which Africa's financial sector under-development may be attributed is weak contract enforcement. With rule of law, regulatory quality, and control of corruption well below the world average, it is unsurprising that it takes an extremely lengthy process to recover bad loans (Sacerdoti, 2005). The high credit risk translates into high interest spreads and margins (Beck et al., 2009).

With low banking depth and breadth, as well as high credit risk, the potential benefits of credit information have been appreciated in a few African countries. A few years ago, public credit registries and private credit bureaus were virtually non-existent. In recent times, significant efforts have been made to have operational information sharing systems in a number of African countries. In many of these countries, however, information sharing systems are in their infancy (e.g., Zambia, Nigeria and Ethiopia).

The effort to establish functional credit information sharing schemes in Africa is consistent with several years of financial sector reforms that have promoted banking competition in the region. With significant reforms across the African financial sectors over the past two decades,[1] the region has witnessed significant financial deepening and broadening in recent times (see Allen et al., 2012; Beck et al., 2009). Compared to developing countries in other regions, however, the pace of improvement is much slower (Allen et al., 2012). The years of reforms have also led to a downward trend in banking sector concentration, which has been characteristically high for the region (as shown in Chapter 3). This suggests that banking markets are becoming more competitive, and credit information more dispersed as the pool of borrowers per bank becomes smaller.

In view of the above-mentioned features, this paper seeks to answer the following questions: first, how does credit information sharing affect lending in developing countries? Second, to what extent does the depth (or the characteristics) of credit information affect lending decisions? Third, to what extent is the effect of credit information sharing conditional on the degree of banking market concentration?

The results suggest that credit information sharing improves bank lending. It is

[1] Financial sector reforms are in the form of interest rate liberalisation, removal of credit ceilings, and privatisation of financial institutions, among others (see Allen et al., 2012).

also found that the depth of credit information is similarly important in increasing bank lending. Furthermore, it is found that the effect of credit information sharing is higher in less concentrated banking markets. The findings are robust to controlling for several measures of institutional quality and their possible interactions with credit information.

The paper contributes to the existing literature in several ways: first, the paper provides the first bank-level evidence of the effect of credit information on credit allocation. Bank-level data ensures that individual banks' reactions to credit information sharing are not confounded by aggregate variation in credit allocation. In particular, bank-level data helps to isolate variations in credit allocation arising from (unobserved) heterogeneity of banks. Using aggregated credit data makes it impossible to isolate lending behaviour of specialised banks, especially those that are there to serve government motives. Second, this paper is the first to provide empirical evidence about the moderating effect of banking sector consolidation on the benefits of credit information sharing. Third, the paper further investigates the extent to which a wider range of institutional factors interact with credit information sharing to impact on credit allocation. Finally, this is the first paper to attempt a comprehensive study of credit information sharing and bank lending in African countries.

The rest of this paper is organised as follows. Section 4.2 provides a review of the theoretical literature and empirical evidence that motivates this study. Section 4.3 outlines the research hypotheses. The data and variables used for the study are described in Section 4.4, whilst the empirical estimation methods are provided in Section 4.5. The findings of the study are discussed in Section 4.6. Section 4.7 concludes the study.

4.2 Literature review

This section provides a review of the theoretical and empirical literature that motivates this study. A strand of literature motivating the relationship between credit information sharing and credit market outcome (e.g., Behr and Sonnekalb, 2012; Bennardo et al., 2010; Brown et al., 2009; Djankov et al., 2007; Love and Mylenko, 2003; Padilla and Pagano, 1997, 2000; Pagano and Jappelli, 1993) is reviewed first. This is then followed by a body of literature that suggests that banking market concentration or competition is of importance in the relationship between credit information sharing and bank lending decisions (e.g., Cetorelli and Peretto, 2000; Jappelli and Pagano, 2002; Marquez, 2002; Pagano and Jappelli, 1993; Petersen and Rajan, 1995).

4.2.1 Theory of credit information sharing and bank lending

Theory shows that credit information sharing impacts on credit market performance by reducing adverse selection in lending (Pagano and Jappelli, 1993), reducing moral hazard on the part of borrowers, thereby increasing borrower efforts (Padilla and Pagano, 1997, 2000), and reducing credit rationing in multiple bank lending (Bennardo et al., 2010).

Pagano and Jappelli (1993) show that credit information sharing reduces adverse selection in bank lending. In their model, credit information sharing helps increase the bankable population and possibly expand lending. In the absence of credit information, banks cannot distinguish between a new pool of potential borrowers who are likely to repay and those who are likely to default. The authors show that in such a situation, since the new loan applicants might have borrowed from other banks in the past, information sharing can help the bank in question make the right decision to lend safely to credible new applicants. The overall impact on lending, however, depends on the extent to which increased lending to safe borrowers compensates for the reduced lending to risky borrowers. As information sharing also reduces informational rent in contestable banking markets, the resulting increase in competition can increase lending.

Information sharing may also induce more bank lending by reducing borrower hold-up problems. Credit information acquired by a bank today confers informational advantage which permits it to extract higher interest rates from borrowers in the future. Padilla and Pagano (1997) show that, when banks commit to sharing credit information, the extraction of informational rent is restrained. This increases borrower effort and makes repayment more likely. With reduced default risk, interest rates decrease and lending, in turn, increases.

It is also argued that sharing default information may serve as a disciplinary device to encourage borrowers to repay their debt. Among other moral hazard situations, borrowers may prioritise potential returns from risky investments over incentives to repay (Myers, 1977). It is shown in Klein (1992), Vercammen (1995) and Padilla and Pagano (2000) that sharing default information encourages repayment. This is because sharing credit information allows borrowers who default to be blacklisted. As blacklisted borrowers may have difficulty getting credit in future, borrowers thus have an incentive to avoid default. The resulting reduction in default rates could reduce borrowing cost and increase lending. Padilla and Pagano (2000), however, argue that sharing only default information has the potential to increase lending; sharing information about borrower quality cannot increase lending since borrowing cost cannot be reduced any further due to the elimination of informational rent.

Moreover, credit information sharing may help reduce over-borrowing and its associated credit rationing in multiple bank lending (Bennardo et al., 2010). Aside from the higher implicit cost in multiple bank lending (Petersen and Rajan, 1994), borrowing from multiple banks induces opportunistic behaviour among borrowers, causing them to over-borrow. This behaviour can be costly to lenders. Hence, their natural response to this opportunistic behaviour is to ration credit, raise interest rates or deny credit. Bennardo et al. (2010) show that credit information sharing permits lenders to assess the outstanding debts of each borrower and lend safely. This mitigates the need for credit rationing and higher interest charges. Therefore, bank lending is expected to be higher in the presence of credit information sharing.

The above review shows that credit information can have a positive effect on bank lending, although borrower composition (Pagano and Jappelli, 1993) and the type of information shared (Padilla and Pagano, 2000) may also have a role to play. In the following sections, the literature that links the banking market concentration to the relationship is reviewed.

4.2.1.1 Interaction of competition and credit information sharing

Theory explains that, by reducing adverse selection, borrower hold-up problems and moral hazard, credit information sharing may help reduce default rate and increase lending. However, there is a strand of literature that suggests that the overall impact of credit information sharing depends to some extent on the degree of banking market concentration. This literature further suggests that banking market concentration may not always restrain access to credit in informationally asymmetric banking markets.

Literature on banking competition suggests that imperfect competition is associated with higher interest rate spread (Pagano, 1993) and also leads to a higher tendency to ration credit (Guzman, 2000), resulting in sub-optimal credit market performance. This conclusion is without regard to the fact that some level of banking market concentration may help to reduce the degree of information asymmetry in credit markets. In fact, Petersen and Rajan (1995) suggest that banking market concentration encourages long term relationships in banking, due to the potential for intertemporal surplus sharing. These relationships help banks acquire important credit information about borrowers, suggesting that information asymmetry is less of a problem in more concentrated or less competitive banking markets.

Another reason to suggest that credit information sharing may not be as beneficial in concentrated markets as in competitive markets is given by Cetorelli and Peretto (2000). They show that banks in concentrated markets are more likely to screen borrowers and lend efficiently than banks in competitive markets. This view is consistent with Marquez (2002). They argue that competitive banking markets have a small pool of borrowers per bank, suggesting that these markets have more dispersed credit information. Hence, the risk of adverse selection is much higher in competitive banking markets. In contrast, banks in consolidated banking markets have a large pool of borrowers and face a relatively low risk of adverse selection.

The points highlighted above suggest that, whilst credit information sharing may affect bank lending, banking market concentration may play a crucial role. The information needs of banks in highly concentrated banking markets should be very different from banks in less concentrated markets. Thus, it is important for empirical works to address this concern.

4.2.2 Empirical evidence

The relationship between credit information sharing and credit market performance has attracted some empirical attention, starting with Jappelli and Pagano (2002), who, in a cross-sectional study of 43 countries, show that credit information sharing increases bank lending to the private sector (as a ratio of gross domestic product). Given that the quality of institutional factors such as legal enforcement, which protects the rights of creditors, could possibly substitute for the availability of credit information, they further control for these factors and find that the effect of information sharing is stronger in poorer countries. Behr and Sonnekalb (2012), however, show that, whilst credit information sharing reduces default rates, it has no effect on the probability of a loan application's approval. This suggests that the channels through which credit information sharing impacts on overall lending need further attention.

Using firm-level data, Love and Mylenko (2003) show that firms' perceived financial constraint is lower and the share of bank financing higher in countries where private credit bureaus exist. The effect of public credit registries, however, is found to be statistically insignificant. Their findings further suggest that small and medium-sized firms have improved access to bank financing in the presence of private credit bureaus. Similar evidence is presented in Brown et al. (2009). Using a sample of 24 transitions countries in Eastern Europe and the former Soviet Union, they find that credit information sharing improves firms' access to credit and reduces the cost of borrowing. Again, their findings suggest that credit information may be more beneficial to informationally asymmetric firms and firms in countries with weak legal enforcement.

Given the theoretical prediction that credit information is relatively less asymmetric in highly concentrated banking markets, one would equally expect credit information sharing to have less effect on lending in more concentrated banking markets. Empirical evidence is, however, lacking in this respect. The informational advantage of concentrated banking markets is empirically weak given that some studies (e.g., Black and Strahan, 2002; Hannan, 1991) suggest a negative effect of concentration on financing, whilst others show a positive effect (e.g., Cetorelli and Gambera, 2001; Petersen and Rajan, 1995). It is worth noting, however, that the negative effect of concentration on access to finance is ameliorated by the presence of credit information sharing. This is empirically shown by Beck et al. (2004). This evidence suggests some degree of interaction between credit information sharing and banking market concentration. Nevertheless, it does not provide evidence on the direct effect of credit information sharing and how it is moderated by banking market concentration. Related evidence presented in Barth et al. (2009) suggest that, both information sharing and banking market competition reduce corruption in bank lending, and that the effect of competition is mitigated by credit information sharing. This current paper seeks to investigate the direct and the interaction effects of credit information sharing on bank lending. Also, by using bank-level data, this paper adds a new dimension to the literature.

To conclude this section, it is emphasised that, even though micro-level evidence provides an additional dimension to the literature, as it helps to control for heterogeneity at the firm level, the literature could be extended by analysing the relationship between credit information sharing and the supply of credit at the bank level. This approach helps to control for (unobserved) heterogeneity of banks, which otherwise could be confounded. Additionally, even though theory predicts that the information needs of banks may be less of a problem in concentrated banking markets, the existing empirical studies have not considered the possibility that the effect of credit information sharing may be moderated by banking market concentration. This study seeks to fill in these gaps.

4.3 Research hypotheses

Based on the theoretical predictions and empirical evidence about credit information sharing and credit market outcomes, two main testable hypotheses are formulated.

Given that the problems that credit information sharing is meant to address are endemic in the African banking market, one could expect its effect to be particularly high in the region. For instance, a high level of adverse selection problems are reflected in the record levels of default in African banking markets. Also, moral hazard problems should be particularly high given the weak legal enforcement in the region. Hence, by reducing the risk of adverse selection (Pagano and Jappelli, 1993) and moral hazard (Bennardo et al., 2010; Padilla and Pagano, 2000; Pagano and Jappelli, 1993), credit information sharing is expected to reduce default rates and the cost of borrowing and, at the same time, reduce credit rationing. This leads to the first hypothesis:

H1: *Credit information sharing has a positive effect on bank lending in African banking markets.*

Also, given that banks in concentrated markets face relatively less information asymmetries due to the incentives of long term customer relations (Petersen and Rajan, 1995), more efficient screening (Cetorelli and Peretto, 2000) and less dispersed credit information (Marquez, 2002), credit information sharing is expected to have less effect on lending in concentrated banking markets. Hence, a second hypothesis is formulated as follows:

H2: *The effect of credit information sharing on bank lending decreases with banking market concentration.*

4.4 Data

Bank-level data over the period 2004 to 2009 is obtained from the BankScope database, which accounts for about 90% of all banks in each country. The sample consists of all active banks with three or more years of consecutive observations.[2] Banks with negative values of equity and for which the dependent variable, the ratio of loans to total assets, is missing are dropped. Country-year observations with less than three banks are also excluded from the sample. The final sample contains about 2000 bank-year observations.

Credit information sharing data and macroeconomic data are obtained from the World Bank (2011) World Development Indicators (WDI). Governance data, including rule of law, regulatory quality and control of corruption, are obtained from Worldwide Governance Indicators (WGI), details of which are discussed in Kaufmann et al. (2011).

[2]The subsequent results, however, do not significantly change when non-active banks are included in the sample.

4.4.1 Bank-specific Variables

The choice of variables and proxies is guided by the literature. Credit market performance is measured as the ratio of loans to total assets, as in Demetriades and Fielding (2012), Kaufman (1966) and Weill (2011), as it captures banks' tendency to grant loans. Following the literature, the paper controls for other bank level variables, particularly profitability, deposit mix and the government share in ownership of each bank.

Profitability is measured as net income as a percentage of total assets; it controls for managerial efficiency. Deposit mix is demand deposits as a percentage of total deposits. This variable controls for the extent to which banks are reliant on demand deposits; banks with a very high deposit mix may be less competitive at generating time and savings deposits (Heggestad and Mingo, 1976). Government share is the percentage of ownership share in each bank that is held by the government. This variable controls for the credit stabilisation function of government-owned banks (e.g., Micco and Panizza, 2006) and the possible distortion of optimal market outcomes (e.g., Cecchetti and Krause, 2001; Barth et al., 2001; La Porta et al., 2002). Output price variable is not included in the regression because this is not readily available. However inflation rate is included to capture the general price levels in each country.

4.4.2 Information sharing variables

Credit information sharing is measured in either of the following ways: first, as a dummy variable equal to one for countries (and years) in which either a public credit registry or private credit bureau operates.[3] The second measure of credit information sharing utilises a credit information index, which goes beyond the mere existence of credit registries and examines the depth of information sharing.

The depth of information index ranges from zero to six (0-6), where higher figures indicate the availability of more credit information to help make lending decisions. The index is zero if the credit registry or private credit bureau is non-operational or its coverage is below 1% of the adult population. Otherwise, one point is given for each of the following features: public credit registry or private credit bureau distributes data on both firms and individuals; both positive and negative credit information are shared; data from retailers, utility companies and financial institutions are shared; at least two years of historical data are distributed; data are collected and distributed for loan amounts below 1% of income per capita; and the law permits borrowers to inspect their own data.

4.4.3 Banking market concentration

Banking market concentration is mainly the three-bank concentration ratio, measured as the share of assets of the largest three banks as a percentage of total banking assets. This measure of concentration is preferred over other alternative measures (five-bank concentration ratio and the Herfindahl-Hirschman Index). This is because the sample size changes over the sample period, which could result in measurement bias when the number of banks goes beyond the top three banks (see, Beck et al., 2006). For robustness checks, however, the findings are verified against the five-bank concentration ratio and the Herfindahl-Hirschman

[3] As explained in World Banks "Doing Business" database, these countries are those that have zero percentage coverage of adult population.

Index (HHI) as alternative concentration measures.

4.4.4 Macroeconomic and governance variables

To ensure that the relationship between lending and credit information sharing is not driven by some variations in the macroeconomic and institutional environment, the paper controls for the growth rate of gross domestic product (GDP), inflation rate, and governance indicators, specifically, rule of law, regulatory quality and control of corruption. Growth rate of real gross domestic product (GDP) is measured as the annual percentage change in real GDP. GDP growth rate controls for possible changes in the demand for credit within a country (Altunbas et al., 2009). Inflation rate is the annual percentage change in the GDP deflator. It controls for uncertainty in the credit market.

Rule of law is an index that captures "the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann et al., 2011, p. 223). This index ranges from -2.5 to 2.5. The world average of this index for the base year is 0. Hence, a positive value of the index for any country suggests that country's performance is above the world average. Thus, higher values of the index suggest a higher regard for the rule of law. Regulatory quality is an index that proxies for the "the perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (Kaufmann et al., 2011, p. 223). Again, the world average for this index is 0, and higher values suggest better regulatory environments. Control of corruption is an index "that captures the perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' by elites and private interests" (Kaufmann et al., 2011, p. 223). As is the case with the first two indices, the world average is 0, and higher values suggest firmer controls on corruption.

4.4.5 Summary statistic

Descriptive statistics for the main variables are presented in Table 4.1. The average of lending is about 49.4%, indicating that bank credit is less than 50% of bank assets. By international standards, this is relatively low. On average, profitability of African banks as a percentage of assets is about 1.7%. Deposit mix averages about 85.8%, indicating that African banks are funded predominantly by demand deposits. This suggests that most banks face higher funding risks. In terms of ownership, on average, about 11.3% of total banking assets in Africa are owned by governments. All the above-mentioned variables exhibit a significant amount of variations, as indicated by their large standard deviations.

The three-bank concentration ratio is substantially high, given that this figure amounts to 58% of total banking assets. It is also clear that a significant number of countries have information sharing institutions, but the credit information sharing has substantially low depth, as shown by an average depth of credit information index of 2.

The mean governance variables are all negative, indicating that the quality of governance in Africa is substantially below the world average. These variables also exhibit substantial variations, as indicated by their standard deviations.

Table 4.2 presents the correlation matrix of the main variable. The alternate measures of credit information sharing are strongly correlated, but this correlation poses no concern as they do not enter the regression at the same time. Likewise, the governance indicators enter the regression one at a time as they exhibit a very strong correlation with one another. With regard to the remaining variables, there is no evidence of multicollinearity.

4.5 Empirical model

In this section, empirical models are formulated to help address the main questions raised in this paper. In order to explore variations in bank lending over time, the paper adopts a panel data approach which permits bank and country level variables to vary over time. Also, to allow for the possibility that bank lending may not have been observed under long-run equilibrium for any given year, a dynamic estimation approach is adopted to accommodate the possibility of partial adjustment towards equilibrium. Thus, the following baseline model is formulated:

$$\begin{aligned} Lending_{i,t} &= \alpha + \beta_1 Lending_{i,t-1} + \beta_2 Info_{j,t} + \beta_3 CR_{j,t} + \gamma' X_{i,t} \\ &\quad + \xi' Z_{j,t} + \varepsilon_{i,t}, \end{aligned} \tag{4.1}$$

where $i \in j$ indicates the ith bank in country j; *Lending* is the credit market performance measure; CR is the concentration ratio of banking markets in each country; $Info$ is the information sharing index, which is alternately the credit information sharing dummy and the depth of credit information index; X is a set of other bank control variables; whilst Z represents a set of macroeconomic variables and governance indicators; α, β, γ and ξ are parameters; and ε_{it} is a composite error term including bank-fixed effects:

$$\varepsilon_{i,t} = \mu_i + \nu_{i,t}$$

where μ_i is bank-fixed effects and $\nu_{i,t}$, by assumption, is an independently and identically distributed component with zero mean and variance σ_v^2. All variables are as defined in Subsection 4.4. Growth and profitability are treated as predetermined, rather than as strictly exogenous variables, due to possible feedback from past shocks.

Equation (4.1) permits a direct test of the first research hypothesis. In order to test the second research hypothesis, equation (4.1) is modified to include an interaction term between information sharing index and concentration ratio as follows:

$$\begin{aligned} Lending_{i,t} &= \alpha + \beta_1 Lending_{i,t-1} + \beta_2 Info_{j,t} + \beta_3 CR_{j,t} + \beta_4 Info_{j,t} \times CR_{j,t} \\ &\quad + \gamma' X_{i,t} + \xi' Z_{j,t} + \varepsilon_{i,t} \end{aligned} \tag{4.2}$$

The total (or marginal) effect of credit information is obtained by differentiating equation (4.1) with respect to the information sharing variable, as follows:

$$\frac{\partial\left(Lending_{i,t}\right)}{\partial\left(Info_{i,t}\right)} = \beta_2 + \beta_4 CR_{j,t} \tag{4.3}$$

Here, β_4 reflects the extent to which banking market concentration moderates the effect of credit information sharing.

Due to the presence of the interaction term, the effect of banking market concentration on bank lending also needs to be interpreted with caution; it is now given by

$$\frac{\partial\left(Lending_{i,t}\right)}{\partial\left(CR_{i,t}\right)} = \beta_3 + \beta_4 Info_{j,t} \tag{4.4}$$

The estimation of equations (4.1) and (4.2) requires special attention to avoid endogeneity problems. First, the bank-fixed effects need to be wiped out. This can be achieved by first-differencing the equations. Next, the lagged dependent variables, by construction, are correlated with the differenced error terms. To circumvent this setback, Arellano and Bond (1991) propose the difference GMM estimator, which uses the lagged levels of the endogenous variables as instruments in the differenced equation. Assuming that the original error term, $\varepsilon_{i,t}$, is serially uncorrelated, and that the explanatory variables are weakly exogenous, the following moment conditions apply:

$$E\left(y_{i,t-s}\Delta\varepsilon_{i,t}\right) = 0; for s \geq 2; t = 3, ..., T \tag{4.5}$$

$$E\left(\mathbf{X}_{i,t-s}\Delta\varepsilon_{i,t}\right) = 0; for s \geq 2; t = 3, ..., T. \tag{4.6}$$

where $\mathbf{X}$ represents all the explanatory variables other than lagged lending.

As shown in Alonso-Borrego and Arellano (1999) and Blundell and Bond

(1998), lagged levels of the explanatory variables can perform poorly as instruments for their first-differences, due possibly to persistence or measurement error. Hence, to improve efficiency, the equation in levels may be combined with the differenced equation to obtain a system of equations (Arellano and Bover, 1995; Blundell and Bond, 1998). In the system GMM, the variables in levels have as instruments the lagged first-difference of the corresponding variables. Additional orthogonality restrictions apply as follows[4]:

$$E\left(\Delta y_{i,t-s}\varepsilon_{i,t}\right) = 0; for s = 1. \tag{4.7}$$

$$E\left(\Delta \mathbf{X}_{i,t-s}\varepsilon_{i,t}\right) = 0; for s = 1. \tag{4.8}$$

Theoretically, the first-differenced equation may have first order serial correlation. Second order serial correlation in the differenced equation is, however, a cause for concern as it indicates possible first order serial correlation in the levels equation (Roodman, 2009). Hence, a formal test for this is performed. Next, a Hansen test of over-identifying restrictions is employed to test the validity of the over-identification restrictions. As a final step, standard errors are corrected for small sample bias based on the two-step covariance matrix attributed to Windmeijer (2005).

[4]Lagged differences other that the most recent ones are not used because they result in redundant moment conditions (see Arellano and Bover, 1995).

4.6 Empirical results

This section presents the estimation results for equations (4.1) and (4.2), which permit us to test the main research hypotheses. In order to ascertain the sensitivity of the main results, a series of robustness checks is also carried out.

4.6.1 Main results

The main results of this paper are presented in Tables 4.3 and 4.5. The corresponding marginal effect analyses which help substantiate the test of the research hypothesis are presented in Tables 4.4 and 4.6, respectively. In Table 4.3, the information sharing dummy variable is used as a measure of the availability of credit information through information sharing, whilst in Table 4.5 the depth of credit information index is used. In all the results presented here and in subsequent sections, the maximum lag dependent variables are restricted to one in order to restrain the number of moment conditions. Lags up to order five are used as instruments for the lag dependent variable, profitability and growth. The lag dependent variables are positive and significant; the Hansen test p-values are all well above 0.1, justifying the validity of the over-identification restriction; and, finally, the absence of second-order serial correlation is not rejected. Thus, the use of a dynamic model is appropriate.

4.6.1.1 Results using the credit information sharing dummy

The results presented in Table 4.3 show that credit information increases bank lending in developing countries. Starting from Model 1 (relating to equation (4.1) without controlling for governance), it can be seen that the coefficient on

Information sharing is positive and highly significant. It suggests that banks in countries that share credit information lend approximately 4.72% more than their counterparts in countries without credit information sharing. In other words, countries that switch to an information sharing regime can expect to increase bank lending by about 4.72%. This finding provides support for the first research hypothesis (Hypothesis 1). The finding here is largely consistent with macro- and firm-level evidence provided in Brown et al. (2009), Djankov et al. (2007), Jappelli and Pagano (2002) and Love and Mylenko (2003).

As regards the control variables, the results in Model 1 of Table 4.3 also suggest that banking market concentration, generally, significantly impedes bank lending. This evidence is broadly consistent with Black and Strahan (2002) and Hannan (1991). Also, profitable banks lend more than less profitable banks. This may be attributed to the notion that more profitable banks have more efficient management. Consistent with Weill (2011), it is also seen that banks that depend more on demand deposits lend less. It is possible that, being less competitive in generating funds from other sources increases bank risk aversion. The effect of government share in the ownership of banks does not significantly affect bank lending. Whilst its coefficient is negative, it is statistically insignificant. This could possibly be because government banks are becoming less active in credit markets in developing countries as many of these countries experience high growth rates (see Micco and Panizza, 2006). Growth rate of GDP is positively associated with more bank lending. This can be attributed to the possibility that higher growth rate induces confidence in credit markets. High rates of inflation, on the other hand, decrease bank lending.

Model 2 of Table 4.3 shows the results for the estimation involving the interaction term between information sharing and concentration (i.e., equation (4.2)). The control variables retain their signs and significance. Banking market concentration is significant only through its interaction with information sharing. Thus, the effect of concentration on bank lending is insignificant when there is no credit information sharing, but significantly negative when credit information is shared. Impliedly, barring the information advantage of concentrated banking markets, concentration can have a detrimental effect on bank lending. Stated differently, banking concentration may be less harmful in an informationally asymmetric banking environment. This finding is more or less inconsistent with Beck et al. (2004).

As before, credit information sharing is seen to impact positively and significantly on bank lending, as the coefficient on $Information\ sharing$ remains positive. However, due to the presence of the interaction term, the results need to be interpreted carefully. The coefficient on the interaction term, $Informationsharing \times Concentration$, is negative and statistically significant, suggesting that the positive effect of credit information sharing is a decreasing function of banking market concentration. Thus, the findings suggest that information asymmetry is less of a problem in concentrated banking markets, making credit information sharing less effective at increasing lending. This finding provides support for the second research hypothesis (Hypothesis 2), but the detailed marginal effect analysis that follows shortly will help corroborate this. Models 3–9 extend the analysis by controlling for governance indicators of $rule\ of\ law$ (Models 3–4), $regulatory\ quality$ (Models 5–6) and $control\ of\ corruption$ (Models 7–8). The results remain unchanged, whilst the governance indicators appear significant with the expected sign.

Evaluating the moderating effect of concentration on the relationship between credit information sharing and bank lending, Table 4.4 suggests that credit information sharing can increase bank lending by between 2.60% and 5.07%, depending on the degree of banking market concentration. This translates to an average increase of between US $1.21 billion and US $2.36 billion in overall bank lending at the country level. Applying equation 4.3 to Model 2 of Table 4.3, where no governance indicator is controlled for, a switch to an information sharing regime is associated with a 5.06% increase in bank lending when the banking market concentration is at the 25th percentile. This effect decreases to 4.27% and 2.64% when concentration is at the 50th and 75th percentiles, respectively. The marginal effect analysis yields similar results when applied to the models in which governance indicators are controlled for (i.e., Models 4, 6, and 8), as shown in the table. In fact, the difference between the effect of credit information sharing at the 25th percentiles, on the one hand, and at the 75th percentiles, on the other hand, is at least 2.32%. Hence, it can be concluded safely that the benefit of credit information sharing decreases with banking market concentration. This evidence strengthens the support for Hypothesis 2.

The next set of results focuses on the depth of credit information index, rather than the mere presence of information sharing. This is an important addition in view of the fact that the depth of information sharing differs considerably across countries.

4.6.1.2 Results using the depth of credit information index

Table 4.5 presents the results in which the depth of credit information index is used in place of the information sharing dummy. Since the characteristics of credit information sharing differ between countries and time periods, the depth of credit information index is likely to capture more information than the information sharing dummy variable.

The findings are consistent with those presented in Subsection 4.6.1.1. In Model 1 of Table 4.5 it can be seen that a one-unit increase in the depth of credit information index increases bank lending by about 0.86%. The effect is highly statistically significant (at the 1% level). Hence, switching from a regime without credit information sharing to a regime with fully-fledged credit information sharing can increase bank lending by up to 5.16%. The finding is consistent with the models that control for governance indicators (Models 3, 5 and 7). This finding, again, provides support for Hypothesis 1.

The models that incorporate the interaction term between the depth of credit information index and banking market concentration (Models 2, 4, 6 and 8) give similar results to those presented earlier. Again, the depth of credit information index remains positive and statistically significant, whilst the interaction term is significantly negative. Thus, the results further suggest that a higher depth of credit information is associated with higher bank lending, but the increased lending may not be by as much in concentrated banking markets as in less concentrated banking markets. Again, this finding is robust across different model specifications. The negative coefficients of the interaction terms also suggest that the overall effect of banking market concentration on bank lending is negative.

As in the preceding section, in order to measure the moderating effect of concentration on credit information sharing, the interaction term is evaluated at the 25th, 50th and 75th percentiles of concentration. Table 4.6 presents this marginal effect analysis. In the model that does not control for any governance indicator (Model 2 of Table 4.3), a one-unit increase in the depth of credit information index increases bank lending by 0.95%, 0.656% and 0.062% at the 25th 50th and 75th percentiles, respectively. This clearly shows that the lending-enhancing effect of credit information sharing decreases with banking market concentration, thus providing support for Hypothesis 2. Similar results are reported for the models controlling for governance indicators.

4.6.2 Robustness checks

A natural progression, at this stage, is to assess the robustness of the above findings. In particular, the possibility of further interactions between information sharing and governance is investigated. This is followed by addressing the possibility of endogeneity problems. Next, the effects of using alternative estimation methods, on the one hand, and alternative measures of concentration, on the other hand, are analysed.

4.6.2.1 Extensions - interactions with governance indicators

It may be argued that good quality governance may be a substitute for credit information sharing. For instance, credit information sharing may be more useful in banking markets with less legal enforcement (Jappelli and Pagano, 2000, 2002). Hence, the models above are extended to include interactions with governance indicators of rule of law, regulatory quality and control of corruption. The results are presented in Table 4.7; they are similar to those presented earlier in Subsection 4.6.1.

The effects of governance on bank lending now need to be equally interpreted with caution, given the presence of their interaction with information sharing.

The models employing the information sharing dummy suggest that a one-unit (corresponding to one standard deviation in the worldwide sample) increase in governance increases bank lending by between 3.24% and 4.63% when there is no information sharing scheme, depending on the governance indicator used. When credit information sharing exists, the effect is up to 1.86%. Similarly, when the depth of credit information index is employed, a one-unit increase in governance will improve bank lending by up to 3.88% when the depth of credit information index is 0. However, at the median depth of credit information index, a one-unit increase in governance will improve bank lending by up to 1.93%.

Table 4.7 shows that credit information sharing impacts positively on bank lending. The coefficients of the interaction term between the credit information sharing and concentration (Models 1, 3 and 5) remain significantly negative. Also, the additional interactions between credit information sharing and governance indicators are negative and statistically significant. The findings are consistent when the depth of credit information index is employed as the measure of information sharing. In Models 2, 4 and 6, the depth of credit information index has a statistically significant coefficient, whilst the interaction terms all have statistically significant negative coefficients. Thus, whilst providing support for the findings that credit information sharing impacts positively on bank lending and that this effect decreases with concentration, the results further show that the benefits of credit information sharing are less in countries with robust governance compared with countries with more lax governance.

The marginal effect analysis presented in Table 4.8 shows that, by holding rule of law at the 25th percentile, a switch to an information sharing regime will increase bank lending by about 5.95% if concentration is at the 25th percentile, but by 3.90% if concentration is at the 75th percentile. However, at the 75th percentile of rule of law, the effect of information sharing will be a 3.41% and 1.36% increase in bank lending if concentration is at the 25th and 75th percentiles, respectively.[5] This analysis confirms that sharing credit information can help boost bank lending, and that the effect is not as great in more concentrated banking markets as it is in less concentrated banking markets.

4.6.2.2 Endogenous credit information

The next robustness check performed in this paper is in respect of possible reverse causality between credit information sharing and bank lending. This endogeneity problem is less likely to apply in this study since it is conducted at individual bank level whilst credit information sharing decisions are at the country level. It is unlikely that an individual bank's lending decision influences the information sharing policy at the national level. Besides, over the sample period, only five countries switched information sharing regime.

The above notwithstanding, an attempt is made to re-estimate the model assuming information sharing is endogenous. The following are employed as external instruments for the credit information variables: religious composition, ethnocentric fractionalisation, legal origin and urbanisation.[6] Urbanisation, measured as percentage of urban population to total population, is obtained from the World Bank (2011).[7] Ethnocentric fractionalisation, legal origin and religious composi-

[5]A separate marginal effect analysis table for the depth of credit information index is not presented here for brevity of this paper.

[6] Religious composition (the percentages of Protestant, Catholic and Muslim populations to total population), ethnocentric fractionalisation (a measures the extent of ethnic diversity) and legal origin (an indicator of the origin of a country's legal system) are obtained from La Porta et al. (1999).

[7]There are concerns that urbanisation may have a direct impact on lending, rendering it

tions are shown to be significant determinants of the establishment of information sharing schemes (see Djankov et al., 2007), and have been used as instruments for information sharing in recent papers (Barth et al., 2009; Houston et al., 2010). Urbanisation has also been used in Buyukkarabacak and Valev (2012) as an instrument for information sharing on the grounds that information travels less effectively in urban areas, making credit information sharing more likely in more urbanised countries.

The findings presented in Tables 4.9 and 4.10 are consistent with those presented earlier. Table 4.9 presents the results for the credit information sharing dummy. Despite the apparent differences in the magnitudes of the coefficients, information sharing has a significantly positive coefficient whilst the interaction term remains significantly negative across all models. In fact, the marginal effect analysis shows that, at the 25th percentile of concentration, sharing credit information can increase bank lending by up to 6.69%, about 1.63% higher than the case where information sharing is treated as exogenous. At the 50th percentile, bank lending is 4.36% higher when credit information is shared. This compares to 4.27% in the case where information sharing is treated as exogenous.[8] Thus, the findings are consistent at the relevant levels of banking market concentration.

Table 4.10 reports the results for the case where the depth of credit information index is treated as endogenous. The findings are highly consistent. The depth of credit information index has a positive coefficient and it is statistically significant. The interaction between this variable and concentration is significantly negative,

invalid as an instrument. To address this issue I drop urbanisation from the instrument set, and the results remain mostly unchanged. Additionally, when including urbanisation in the main estimations as an explanatory variable, it enters insignificantly. In the first stage of the regression all the instruments significantly affect credit information sharing.

[8] A separate marginal effect analysis is not reported for brevity of this paper.

as before. This corroborates the earlier findings that credit information sharing increases bank lending, and that the rise in bank lending resulting from credit information sharing decreases with banking market concentration. In fact, marginal effect analysis yields predictions very close to those presented earlier.

4.6.2.3 Alternative estimation methods

The robustness of the findings to alternative estimation methods is assessed in this section. Specifically, ordinary least square (OLS) method is employed.[9] It is noteworthy that the inclusion of the lagged dependent variable makes this alternative estimation method inefficient. The results are presented in Tables 4.11 and 4.12. The adjusted R^2 shown in the results tables suggests that about 80% of the variations in bank lending are explained by the explanatory variables. The lagged dependent variable is also significant, justifying the use of a dynamic estimation method. Its coefficients are also relatively larger in magnitude than those presented in the main results (Tables 4.3 and 4.5).

Table 4.11 presents the OLS results for the models using the information sharing dummy. The results are qualitatively similar to those obtained under the dynamic system GMM estimation. The coefficient of information sharing is positive across all the models. It is also significant across all models without interaction terms except when the governance indicator is the regulatory quality. When the interaction term is included, information sharing remains positive and significant, whilst the interaction term is consistently negative across all models.

Highly consistent results are found when the depth of credit information index

[9] Given that the information sharing variables exhibit little within variation, fixed effect (within) estimation would yield particularly inflated variance, rendering the explanatory power of the variables weak.

is employed. Table 4.12 shows that the depth of credit information index is positive and highly significant under all models. The interaction term is also consistently negative and highly significant across all models. These findings lend support to the research hypotheses.

4.6.2.4 Other sensitivity checks

Additional sensitivity checks are also carried out. The robustness of the findings to alternative measures of competition is also assessed. First, the three-bank concentration ratio is replaced with the five-bank concentration ratio, and, second, the Herfindahl-Hirschman Index (HHI) is used as the alternative measure of concentration. Both yield consistent results. Third, controlling for log of total assets as an endogenous variable yields consistent results, but the log of assets appears statistically insignificant. Additionally, controlling for liquid assets as a percentage of total assets, a proxy of risk aversion, does not change the findings.

Moreover, the sensitivity of the findings is assessed against the possibility that some types of banks have different lending behaviour than others. As a step to assessing this possibility, specialised government credit institutions and multilateral government banks, as well as investment banks are (alternately and jointly) dropped from the sample. The results are highly consistent with the findings reported above.

Finally, a subsample containing only countries that share credit information is obtained, and the depth of credit information index used as the measure of credit information. This is to help identify the true effect of having a robust credit information sharing scheme, rather than merely having such a scheme. The estimations from this subsample yield consistent results.

4.7 Conclusion

Using bank-level data, the results from this paper suggest that credit information sharing increases bank lending. Moreover, this study finds that the increases in bank lending arising from credit information sharing decrease with banking market concentration. The results are robust to alternative measures of credit information sharing and banking market concentration.

Whilst banking market concentration may signal less dispersion of credit information, the evidence in this paper suggests that this informational advantage does not outweigh the distortion of optimal credit market performance caused by banking market concentration. Given the wave of pro-competitive policies across many banking markets in developing countries, the evidence suggests that embracing or deepening credit information sharing will help boost financial development in these countries.

The evidence further suggests that policy makers cannot necessarily view quality governance as a perfect substitute for ensuring better access to credit information. Even though the benefits of credit information sharing decrease with the quality of governance, some positive benefits still accrue from information sharing even at very high levels of governance. This is consistent with the fact that, even in developed countries where rule of law, for example, is robust, credit information sharing is advanced. Hence, the findings of this paper implore developing countries to strive to achieve effective and efficient credit information sharing schemes alongside the promotion of competition and quality governance.

Table 4.1: Descriptive statistics

Variable	Mean	Std. Dev.	25th percentile	50th percentile	75th percentile	N
Lending	49.389	21.218	34.252	49.377	63.745	2296
Profitability	1.748	3.469	0.716	1.630	2.835	2288
Deposit mix	85.788	22.696	84.272	94.644	99.352	2113
Government share	11.266	26.764	0	0	0.17	1949
GDP growth	5.214	3.943	3.279	5.609	6.899	1785
Inflation	8.467	6.238	3.892	7.448	11.536	2271
Concentration	0.584	0.164	0.449	0.536	0.7118	2296
Credit information sharing	0.709	0.454	0	1	1	2296
Depth of credit information	2.041	1.978	0	2	4	2296
Rule of law	−0.43	0.586	−0.882	−0.374	0.029	2296
Regulatory quality	−0.335	0.519	−0.632	−0.320	−0.057	2296
Control of corruption	−0.465	0.554	−0.891	−0.530	−0.091	2296

This table presents the descriptive statistics for the data. The sample comprises 471 banks over the period 2004 to 2009. *Lending* is the percentage of loans to total assets; *Profitability* is the percentage of net income to total assets; *Deposit mix* is the percentage of demand deposits to total deposits; *Government share* is the percentage of ownership share in each bank that is held by the government; *GDP growth* is the annual percentage change in real GDP; *Inflation* is the annual percentage change in the GDP deflator; *Concentration* is the three-bank concentration ratio, measured as the share of assets of the largest three banks as a percentage of total banking assets; *Credit information sharing* is a dummy variable equal to one for countries (and years) in which either public credit registry or private credit bureaus operate; *Depth of credit information* is an index that captures the depth of credit information. *Rule of law*, *Regulatory quality* and *Control of corruption* are indicators capturing the quality of governance defined in detail in Subsection 4.4.4.

Table 4.2: Correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1 Lending	1.000											
2 Profitability	−0.003	1.000										
3 Deposit mix	−0.295	0.035	1.000									
4 Government share	−0.003	−0.010	−0.019	1.000								
5 GDP growth	−0.154	−0.014	−0.003	−0.002	1.000							
6 Inflation	−0.251	0.018	0.143	−0.002	0.198	1.000						
7 Concentration	−0.168	−0.044	0.134	0.007	0.106	−0.070	1.000					
8 Credit information sharing	0.319	−0.024	−0.144	0.070	−0.215	−0.246	−0.084	1.000				
9 Depth of credit information	0.260	0.056	−0.132	0.099	−0.246	−0.035	−0.381	0.660	1.000			
10 Rule of law	0.299	0.044	−0.180	0.052	−0.190	−0.207	−0.192	0.246	0.410	1.000		
11 Regulatory quality	0.340	0.092	−0.149	0.019	−0.253	−0.202	−0.394	0.352	0.573	0.851	1.000	
12 Control of corruption	0.304	0.079	−0.131	0.053	−0.244	−0.221	−0.138	0.274	0.449	0.898	0.847	1.000

This table presents the unconditional correlation coefficient between any pair of variables. *Credit information sharing* and *Depth of credit information* are alternative measures of the availability of credit information, and therefore they do not simultaneously enter the same regression. Likewise, *Rule of law*, *Regulatory quality* and *Control of corruption* are alternative measures of governance and do not simultaneously enter the same. All variables are as described in Table 4.1 and Subsection 4.4.4.

Table 4.3: Credit information sharing, concentration and bank lending: dynamic two-step system GMM estimation

Dependent variable: Lending

	Governance indicator							
	None		*Rule of law*		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Lending_{-1}$	0.626***	0.656***	0.608***	0.635***	0.613***	0.593***	0.648***	0.642***
	(0.065)	(0.065)	(0.063)	(0.062)	(0.065)	(0.066)	(0.064)	(0.063)
Profitability	0.548***	0.488***	0.528***	0.528***	0.438***	0.474***	0.278**	0.483***
	(0.175)	(0.158)	(0.181)	(0.184)	(0.156)	(0.169)	(0.134)	(0.153)
Deposit mix	−0.061***	−0.052**	−0.060**	−0.049**	−0.056**	−0.061**	−0.054***	−0.051**
	(0.023)	(0.022)	(0.024)	(0.022)	(0.022)	(0.024)	(0.021)	(0.022)
Government share	−0.015	−0.019	−0.016	−0.017	−0.017	−0.015	−0.019	−0.017
	(0.014)	(0.014)	(0.016)	(0.015)	(0.015)	(0.016)	(0.014)	(0.015)
Inflation	−0.235***	−0.266***	−0.243***	−0.259***	−0.269***	−0.241***	−0.228***	−0.238***
	(0.059)	(0.059)	(0.058)	(0.056)	(0.057)	(0.059)	(0.055)	(0.057)
GDP growth	0.199*	0.271**	0.218*	0.319***	0.300***	0.262**	0.222**	0.261**
	(0.112)	(0.114)	(0.116)	(0.111)	(0.110)	(0.117)	(0.112)	(0.116)
Concentration	−7.933***	0.013	−7.849***	−0.405	−4.906**	0.996	−6.375***	0.081
	(2.597)	(3.742)	(2.538)	(3.964)	(2.388)	(4.136)	(2.330)	(3.976)
Information sharing	4.720***	9.220***	4.683***	9.910***	3.628***	9.109***	3.727***	9.250***
	(1.207)	(2.833)	(1.167)	(2.788)	(1.084)	(2.761)	(1.081)	(2.765)
Information sharing x Concentration		−9.238**		−9.866**		−8.849*		−9.346**
		(4.387)		(4.523)		(4.659)		(4.487)
Governance			1.266*	1.095*	2.859***	2.676***	1.352*	1.522**
			(0.680)	(0.657)	(0.900)	(0.956)	(0.699)	(0.695)
Constant	24.784***	18.721***	26.086***	19.675***	25.191***	22.456***	23.930***	19.823***
	(5.129)	(5.217)	(5.023)	(5.348)	(4.920)	(5.653)	(4.962)	(5.393)
No. of observations	1421	1421	1421	1421	1421	1421	1421	1421
Hansen test p-value	0.286	0.465	0.338	0.655	0.667	0.423	0.714	0.476
Resid. AR(1) test p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resid. AR(2) test p-value	0.721	0.776	0.740	0.807	0.856	0.766	0.781	0.760

This table shows the dynamic system GMM estimation results for the effect of credit information on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 4.4: Effect of credit information sharing at specified levels of concentration

Concentration at:	25% (0.449)	50% (0.536)	75% (0.712)	Change between 25% and 75%	Based on regression
Governance indicator:					
None	5.069***	4.265***	2.644**	2.424**	Table 4.3, column 2
	(1.302)	(1.170)	(1.263)	(1.151)	
Rule of law	5.476***	4.618***	2.887**	2.589**	Table 4.3, column 4
	(1.205)	(1.088)	(1.258)	(1.187)	
Regulatory quality	5.132***	4.363***	2.810**	2.322*	Table 4.3, column 6
	(1.187)	(1.104)	(1.355)	(1.223)	
Control of corruption	5.050***	4.237***	2.597**	2.453**	Table 4.3,column 8
	(1.226)	(1.120)	(1.294)	(1.177)	

This table shows the marginal effect analysis of the results presented in Tables 4.3. Marginal effects are evaluated at the 25th, 50th and 75th percentiles of concentration. Standard errors are in parenthesis.
* Indicates significance at 10%.
** Indicates significance at 5%.
*** Indicates significance at 1%.

Table 4.5: Depth of credit information, concentration and bank lending: dynamic two-step system GMM estimation

Dependent variable: Lending

	Governance indicator							
	None		*Rule of law*		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Lending_{-1}	0.664***	0.681***	0.651***	0.678***	0.641***	0.671***	0.650***	0.677***
	(0.061)	(0.061)	(0.060)	(0.056)	(0.061)	(0.056)	(0.061)	(0.056)
Profitability	0.422***	0.403***	0.408***	0.419***	0.373***	0.391***	0.390**	0.397***
	(0.152)	(0.142)	(0.155)	(0.140)	(0.142)	(0.131)	(0.153)	(0.135)
Deposit mix	−0.052**	−0.048**	−0.052**	−0.047**	−0.055**	−0.050**	−0.053**	−0.048**
	(0.022)	(0.022)	(0.022)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)
Government share	−0.020	−0.021	−0.020	−0.020	−0.019	−0.019	−0.020	−0.020
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Inflation	−0.323***	−0.307***	−0.322***	−0.301***	−0.313***	−0.290***	−0.317***	−0.293***
	(0.064)	(0.063)	(0.062)	(0.060)	(0.063)	(0.060)	(0.062)	(0.059)
GDP growth	0.292**	0.307***	0.297***	0.307***	0.308***	0.316***	0.299***	0.312***
	(0.115)	(0.118)	(0.114)	(0.116)	(0.114)	(0.115)	(0.115)	(0.116)
Concentration	−3.510	3.151	−3.734*	2.926	−2.233	4.148	−3.912*	3.248
	(2.158)	(2.732)	(2.185)	(2.762)	(2.200)	(2.768)	(2.219)	(2.768)
Depth of information	0.856***	2.471***	0.807***	2.437***	0.610***	2.253***	0.762***	2.501***
	(0.205)	(0.656)	(0.209)	(0.658)	(0.208)	(0.663)	(0.203)	(0.654)
Depth of information x Concentration		−3.386***		−3.421***		−3.393***		−3.667***
		(1.236)		(1.243)		(1.261)		(1.245)
Governance			0.754	0.587	2.384**	1.967**	1.125	1.064
			(0.694)	(0.655)	(0.992)	(0.931)	(0.714)	(0.663)
Constant	21.566***	16.651***	22.736***	17.203***	23.534***	17.870***	23.314***	17.486***
	(4.902)	(4.898)	(4.935)	(4.773)	(4.942)	(4.794)	(5.015)	(4.787)
No. of observations	1421	1421	1421	1421	1421	1421	1421	1421
Hansen test p-value	0.396	0.341	0.447	0.575	0.506	0.637	0.438	0.583
Resid. AR(1) test p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resid. AR(2) test p-value	0.911	0.894	0.920	0.895	0.959	0.920	0.912	0.886

This table shows the dynamic system GMM estimation results for the effect of credit information on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 4.6: Effect of depth of credit information sharing at specified levels of concentration

Concentration at:	25% (0.449)	50% (0.536)	75% (0.712)	Change between 25% and 75%	Based on regression
Governance indicator:					
None	0.950*** (0.210)	0.656*** (0.201)	0.062 (0.322)	0.888*** (0.324)	Table 4.5, column 2
Rule of law	0.900*** (0.207)	0.602*** (0.199)	0.002 (0.323)	0.898*** (0.326)	Table 4.5, column 4
Regulatory quality	0.728*** (0.209)	0.433** (0.202)	−0.162 (0.330)	0.890*** (0.331)	Table 4.5, column 6
Control of corruption	0.853*** (0.199)	0.534*** (0.192)	−0.111 (0.321)	0.962*** (0.327)	Table 4.5,column 8

This table shows the marginal effect analysis of the results presented in Table 4.5. Marginal effects are evaluated at the 25th, 50th and 75th percentiles of concentration. Standard errors are in parenthesis.
** Indicates significance at 5%.
*** Indicates significance at 1%.

Table 4.7: Credit information, concentration and bank lending - extensions: dynamic two-step system GMM estimation

Dependent variable: Lending	Governance indicator					
	Rule of law		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$Lending_{-1}$	0.626***	0.666***	0.609***	0.662***	0.644***	0.668***
	(0.068)	(0.065)	(0.063)	(0.068)	(0.061)	(0.065)
Profitability	0.476***	0.422***	0.474***	0.405***	0.491***	0.403***
	(0.162)	(0.136)	(0.169)	(0.129)	(0.160)	(0.142)
Deposit mix	−0.052**	−0.045**	−0.054**	−0.045**	−0.052**	−0.045**
	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)	(0.022)
Government share	−0.018	−0.020	−0.017	−0.019	−0.020	−0.021
	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.015)
Inflation	−0.258***	−0.311***	−0.269***	−0.296***	−0.263***	−0.302***
	(0.059)	(0.067)	(0.056)	(0.066)	(0.056)	(0.065)
GDP growth	0.230**	0.264**	0.329***	0.272**	0.286**	0.278**
	(0.116)	(0.121)	(0.114)	(0.121)	(0.113)	(0.121)
Concentration	−2.131	2.898	1.317	5.281*	−1.567	3.072
	(4.298)	(2.897)	(3.862)	(2.870)	(3.942)	(2.960)
Information sharing	7.006**		8.261***		6.804**	
	(3.012)		(2.752)		(2.907)	
Information sharing x Concentration	−7.815*		−10.373**		−7.851*	
	(4.636)		(4.485)		(4.413)	
Information sharing x Governance	−2.780**		−2.762*		−2.294*	
	(1.379)		(1.650)		(1.367)	
Depth of information		2.431***		2.749***		2.345***
		(0.677)		(0.731)		(0.696)
Depth of information x Concentration		−3.805***		−4.622***		−3.827***
		(1.279)		(1.406)		(1.320)
Depth of information x Governance		−0.870**		−0.975**		−0.695**
		(0.398)		(0.461)		(0.346)
Governance	3.244***	2.443**	4.630***	3.879***	3.324***	2.991**
	(1.238)	(1.123)	(1.473)	(1.428)	(1.254)	(1.166)
Constant	23.124***	18.584***	22.497***	17.997***	22.265***	18.896***
	(6.042)	(5.450)	(5.527)	(5.395)	(5.485)	(5.422)
No. of observations	1421	1421	1421	1421	1421	1421
Hansen test p-value	0.366	0.209	0.757	0.195	0.716	0.171
Resid. AR(1) test p-value	0.000	0.000	0.000	0.000	0.000	0.000
Resid. AR(2) test p-value	0.740	0.890	0.812	0.892	0.766	0.882

This table shows the dynamic system GMM estimation results for the effect of credit information on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 4.8: Effect of credit information sharing at specified levels of concentration and governance

Concentration at:	25% (0.449)	50% (0.536)	75% (0.712)	Change between 25% and 75%	Based on regression
Rule of law at:					
25% (-0.882)	5.946*** (1.387)	5.267*** (1.328)	3.896** (1.560)	2.051* (1.217)	Table 4.7, column 1
50% (-0.364)	4.534*** (1.258)	3.855*** (1.141)	2.484* (1.132)	2.051* (1.217)	Table 4.7, column 1
75% (0.029)	3.412** (1.419)	2.733** (1.278)	1.362 (1.363)	2.051* (1.217)	Table 4.7, column 1
Regulatory quality at:					
25% (-0.631)	5.345*** (1.225)	4.444*** (1.105)	2.624** (1.259)	2.722** (1.177)	Table 4.7, column 3
50% (-0.320)	4.483*** (1.138)	3.581*** (1.025)	1.760 (1.217)	2.722** (1.177)	Table 4.7, column 3
75% (-0.057)	3.757**** (1.239)	2.855** (1.148)	1.035 (1.344)	2.722** (1.177)	Table 4.7, column 3
Control of corruption at:					
25% (-0.894)	5.320*** (1.274)	4.637*** (1.189)	3.260** (1.374)	2.060* (1.158)	Table 4.7, column 5
50% (-0.521)	4.490*** (1.171)	3.808*** (1.049)	2.430** (1.204)	2.060* (1.158)	Table 4.7, column 5
75% (-0.091)	3.489*** (1.313)	2.800** (1.174)	1.423 (1.250)	2.060* (1.158)	Table 4.7, column 5

This table shows the marginal effect analysis of the results presented in Table 4.7. Marginal effects are evaluated at the 25th, 50th and 75th percentiles of concentration and governance indicators. Standard errors are in parenthesis.
* Indicates significance at 10%.
** Indicates significance at 5%.
*** Indicates significance at 1%.

Table 4.9: Endogenous credit information sharing, concentration and bank lending: dynamic two-step system GMM estimation

Dependent variable: Lending

	Governance indicator							
	None		*Rule of law*		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Lending_{-1}$	0.779***	0.754***	0.769***	0.750***	0.753***	0.705***	0.764***	0.744***
	(0.061)	(0.056)	(0.061)	(0.057)	(0.062)	(0.060)	(0.060)	(0.055)
Profitability	0.536***	0.453**	0.514**	0.447**	0.460**	0.412***	0.478**	0.417**
	(0.203)	(0.186)	(0.205)	(0.189)	(0.202)	(0.139)	(0.201)	(0.188)
Deposit mix	−0.029	−0.030*	−0.029	−0.030*	−0.033*	−0.041**	−0.030*	−0.029*
	(0.018)	(0.017)	(0.018)	(0.017)	(0.018)	(0.019)	(0.018)	(0.018)
Government share	−0.012	−0.017	−0.013	−0.017	−0.013	−0.018	−0.013	−0.017
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.012)
Inflation	−0.160***	−0.176***	−0.162***	−0.179***	−0.169***	−0.216***	−0.164***	−0.181***
	(0.055)	(0.056)	(0.055)	(0.056)	(0.055)	(0.061)	(0.055)	(0.056)
GDP growth	0.216*	0.237**	0.235**	0.231**	0.276**	0.319***	0.254**	0.258**
	(0.118)	(0.112)	(0.119)	(0.112)	(0.121)	(0.112)	(0.120)	(0.112)
Concentration	−4.016**	17.234*	−4.039**	15.024	−2.286	12.314	−4.083**	15.831*
	(1.955)	(9.013)	(1.924)	(9.515)	(1.949)	(7.484)	(1.951)	(9.313)
Information sharing	3.437***	18.697***	3.412***	17.255**	3.087***	14.591**	3.252***	17.742**
	(1.223)	(6.918)	(1.144)	(7.281)	(1.154)	(6.240)	(1.139)	(7.129)
Information sharing x Concentration		−26.716**		−24.110**		−20.140**		−25.118**
		(11.421)		(12.028)		(10.085)		(11.785)
Governance			0.590	0.013	1.864**	1.795*	1.054*	0.625
			(0.568)	(0.628)	(0.811)	(0.948)	(0.619)	(0.638)
Constant	12.512***	1.993	13.355***	3.526	14.145***	9.343	14.051***	3.584
	(4.786)	(6.284)	(4.858)	(6.871)	(4.774)	(6.263)	(4.828)	(6.670)
No. of observations	1402	1402	1402	1402	1402	1402	1402	1402
Hansen test p-value	0.162	0.430	0.193	0.412	0.269	0.532	0.156	0.430
Resid. AR(1) test p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resid. AR(2) test p-value	0.862	0.795	0.876	0.800	0.910	0.842	0.881	0.809

This table shows the dynamic system GMM estimation results for the effect of credit information on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 4.10: Endogenous depth of credit information, concentration and bank lending: dynamic two-step system GMM estimation

Dependent variable: Lending

	Governance indicator							
	None		*Rule of law*		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Lending_{-1}	0.777***	0.822***	0.752***	0.874***	0.748***	0.883***	0.743***	0.892***
	(0.052)	(0.048)	(0.052)	(0.055)	(0.052)	(0.076)	(0.054)	(0.078)
Profitability	0.380***	0.367***	0.386***	0.506**	0.356***	0.500**	0.342***	0.526**
	(0.117)	(0.105)	(0.116)	(0.241)	(0.109)	(0.242)	(0.121)	(0.248)
Deposit mix	−0.032*	−0.030*	−0.040**	−0.017	−0.040**	−0.013	−0.041**	−0.012
	(0.019)	(0.018)	(0.018)	(0.017)	(0.018)	(0.019)	(0.018)	(0.019)
Government share	−0.018	−0.015	−0.017	−0.010	−0.016	−0.010	−0.018	−0.009
	(0.011)	(0.009)	(0.011)	(0.008)	(0.011)	(0.009)	(0.011)	(0.008)
Inflation	−0.229***	−0.177***	−0.241***	−0.162***	−0.234***	−0.149**	−0.240***	−0.144**
	(0.063)	(0.056)	(0.060)	(0.049)	(0.061)	(0.062)	(0.061)	(0.061)
GDP growth	0.371***	0.310***	0.379***	0.308***	0.390***	0.334***	0.399***	0.345***
	(0.132)	(0.118)	(0.134)	(0.118)	(0.131)	(0.123)	(0.133)	(0.128)
Concentration	−0.495	9.314	−1.397	13.241*	−0.390	13.026**	−1.252	15.073**
	(1.927)	(6.287)	(1.934)	(7.058)	(1.932)	(6.552)	(1.960)	(7.514)
Depth of information	0.921***	3.316**	0.995***	4.019**	0.850***	4.005**	0.961***	4.372**
	(0.274)	(1.679)	(0.303)	(1.915)	(0.319)	(1.803)	(0.308)	(1.994)
Depth of information x Concentration		−5.463*		−6.813*		−6.847**		−7.633**
		(3.166)		(3.561)		(3.321)		(3.774)
Governance			0.083	−0.840	1.235	−0.481	0.602	−0.328
			(0.647)	(0.579)	(0.994)	(0.791)	(0.737)	(0.596)
Constant	11.470***	4.145	13.793***	−2.587	14.105***	−3.078	14.557***	−4.868
	(4.249)	(4.726)	(4.259)	(4.583)	(4.259)	(6.006)	(4.519)	(6.547)
No. of observations	1402	1402	1402	1402	1402	1402	1402	1402
Hansen test p-value	0.182	0.475	0.324	0.461	0.358	0.249	0.192	0.261
Resid. AR(1) test p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Resid. AR(2) test p-value	0.977	0.898	0.973	0.912	0.997	0.927	0.988	0.925

This table shows the dynamic system GMM estimation results for the effect of credit information on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis.

* Indicates significance at 10%.

** Indicates significance at 5%.

*** Indicates significance at 1%.

Table 4.11: Credit information, concentration and bank lending: pooled OLS estimation

Dependent variable: Lending

	Governance indicator							
	None		*Rule of law*		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Lending_{-1}$	0.822***	0.821***	0.822***	0.822***	0.819***	0.819***	0.821***	0.820***
	(0.023)	(0.023)	(0.022)	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)
Profitability	0.171**	0.163*	0.171**	0.163*	0.165*	0.160*	0.168**	0.161*
	(0.083)	(0.085)	(0.083)	(0.085)	(0.084)	(0.086)	(0.082)	(0.084)
Deposit mix	−0.036**	−0.035**	−0.036**	−0.035**	−0.036**	−0.035**	−0.036**	−0.035**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Government share	−0.011	−0.011	−0.011	−0.011	−0.010	−0.011	−0.011	−0.011
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.008)
Inflation	−0.130**	−0.140**	−0.131**	−0.143**	−0.128*	−0.136**	−0.127*	−0.137**
	(0.062)	(0.060)	(0.060)	(0.057)	(0.065)	(0.063)	(0.064)	(0.061)
GDP growth	0.046	0.063	0.045	0.059	0.069	0.081	0.057	0.071
	(0.073)	(0.075)	(0.080)	(0.080)	(0.075)	(0.075)	(0.079)	(0.079)
Concentration	−2.185	2.838	−2.218	3.014	−1.181	3.009	−2.122	2.690
	(1.894)	(2.787)	(1.937)	(2.787)	(2.321)	(2.646)	(1.991)	(2.677)
Information sharing	1.790*	5.267**	1.803*	5.494**	1.511	4.536*	1.735*	5.087*
	(1.029)	(2.520)	(0.993)	(2.431)	(0.980)	(2.440)	(1.023)	(2.547)
Information sharing x Concentration		−6.198*		−6.537*		−5.328		−5.955*
		(3.356)		(3.332)		(3.318)		(3.412)
Governance			−0.069	−0.202	0.918	0.801	0.347	0.273
			(0.672)	(0.629)	(0.788)	(0.745)	(0.650)	(0.602)
Constant	12.798***	9.867***	12.792***	9.691***	12.703***	10.195***	12.924***	10.082***
	(2.139)	(2.943)	(2.130)	(2.876)	(2.086)	(2.652)	(1.987)	(2.748)
No. of observations	1421	1421	1421	1421	1421	1421	1421	1421
Adj. R^2	0.799	0.800	0.799	0.799	0.800	0.800	0.799	0.799

This table shows the OLS estimation results for the effect of credit information on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Heteroskedasticity-robust standard errors, corrected for clustering at the country level, are in parentheses.
* Indicates significance at 10%.
** Indicates significance at 5%.
*** Indicates significance at 1%.

Table 4.12: Depth of credit information, concentration and bank lending: pooled OLS estimation

Dependent variable: Lending

	Governance indicator							
	None		*Rule of law*		*Regulatory quality*		*Control of corruption*	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
$Lending_{-1}$	0.824***	0.823***	0.825***	0.824***	0.822***	0.821***	0.824***	0.822***
	(0.021)	(0.022)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)
Profitability	0.152*	0.138	0.151*	0.138	0.150*	0.137	0.152*	0.138
	(0.086)	(0.088)	(0.086)	(0.088)	(0.087)	(0.089)	(0.085)	(0.087)
Deposit mix	−0.036**	−0.034**	−0.036**	−0.035**	−0.036**	−0.034**	−0.036**	−0.034**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Government share	−0.011	−0.012	−0.011	−0.012	−0.011	−0.011	−0.011	−0.012
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Inflation	−0.161**	−0.165**	−0.167***	−0.171***	−0.156**	−0.160**	−0.161**	−0.164***
	(0.062)	(0.061)	(0.056)	(0.054)	(0.065)	(0.062)	(0.060)	(0.059)
GDP growth	0.051	0.087	0.044	0.079	0.065	0.097	0.052	0.089
	(0.074)	(0.072)	(0.081)	(0.079)	(0.074)	(0.072)	(0.080)	(0.077)
Concentration	−0.585	3.838*	−0.634	3.852*	−0.149	4.054*	−0.587	3.842*
	(1.778)	(1.985)	(1.764)	(2.006)	(2.158)	(2.125)	(1.693)	(2.005)
Depth of information	0.418**	1.556***	0.457**	1.616***	0.346*	1.458***	0.417*	1.553***
	(0.199)	(0.454)	(0.182)	(0.430)	(0.202)	(0.469)	(0.211)	(0.459)
Depth of information x Concentration		−2.257***		−2.292***		−2.183***		−2.266***
		(0.749)		(0.705)		(0.788)		(0.760)
Governance			−0.388	−0.426	0.643	0.532	0.010	0.073
			(0.656)	(0.599)	(0.885)	(0.807)	(0.683)	(0.611)
Constant	12.773***	10.076***	12.644***	9.894***	12.867***	10.243***	12.779***	10.114***
	(2.233)	(2.233)	(2.181)	(2.220)	(2.107)	(2.024)	(1.962)	(2.038)
No. of observations	1421	1421	1421	1421	1421	1421	1421	1421
Adj. R^2	0.800	0.800	0.799	0.800	0.800	0.800	0.799	0.800

This table shows the OLS estimation results for the effect of credit information sharing on bank lending. Time fixed dummies are included in all estimations. All variables are as described in Table 4.1 and Subsection 4.4.4. Heteroskedasticity-robust standard errors, corrected for clustering at the country level, are in parentheses.
* Indicates significance at 10%.
** Indicates significance at 5%.
*** Indicates significance at 1%.

Chapter 5

Conclusions

This thesis examined three distinct topics with a common theme, competition. First, paying particular attention to the degree of product market competition, the leverage-performance relationship is re-examined in chapter 2. Second, given the several years of financial and banking sector reforms within Africa and the associated implications for competitive behaviour, a comparative study of banking competition within African subregional banking markets is conducted in chapter 3. Finally, given the coexistence of severe information asymmetry, poor legal enforcement and worryingly low levels of financial development in Africa, an examination of the effects of credit information sharing on bank lending is presented in chapter 4; further, particular attention is paid to the ameliorating effect of banking sector concentration on the impact of credit information sharing.

Using a panel dataset of South African listed firms, the results in chapter 2 suggests that financial leverage has a significant positive effect on firm performance. The results further suggest that firms in unconcentrated (competitive) industries significantly benefit from leverage whilst those in concentrated (uncompetitive) industries are likely to suffer adverse effects of leverage. However, marginal effect analysis suggests that the effect of leverage on firm performance is positive across the relevant range of product market concentration (competition). The results are found to be robust to alternative measures of competition: the Herfindahl-Hirschman Index and the Boone indicator. In addition, controlling for nonlinearity in the leverage-performance relationship does not qualitatively alter the findings. Finally, similar results are obtained when alternative measures of leverage and different estimators are employed. The findings of this chapter have two main policy implications. First, a gradual shift from the conservative use of debt, which is a key feature of South African firms, could significantly improve their performance. Second, effective pro-competition product market regulations are essential to realise the performance-enhancing effects of leverage.

Assuming common markets within each subregion due to increased regional integration and cross-border banking, and applying the static and dynamic versions of the Panzar-Rosse model (Rosse and Panzar, 1977; Panzar and Rosse, 1987), the findings in Chapter 3 suggest that African subregional banking markets exhibit monopolistic competition behaviour. The findings reported in this chapter are consistent with those reported for other parts of the world, particularly in emerging economies, suggesting that recent structural reforms within Africa may have had significant effects as far as banking sector competition is concerned. It is worth emphasising that the monopolistic competition behaviour cuts across alternative views of banking activities: interest-generating activities versus total banking activities. In addition, the findings are robust to alternative specifications and estimators. Even though downwards bias of the static H-statistic, as argued in Goddard and Wilson (2009), is confirmed, the findings remain robust to alternative estimators. Some policy implications could be drawn from this paper for African countries because of the possible link between banking competition and efficient financial intermediation, bank profitability and stability. The findings from this chapter may serve as a benchmark against which to measure the success of several years of regional integration and cross-border banking in Africa.

Finally, motivated by the severity of the information asymmetry, poor contract enforcement and woefully underdeveloped financial markets within African countries, Chapter 4 models bank lending as a function of credit information sharing. The results from this chapter suggest that credit information sharing increases bank lending. The chapter, however, notes that the increases in bank lending arising from credit information sharing decrease with banking market concentration. It is also implied from this chapter that the informational advantage of concentrated banking markets does not compensate for its distortionary effects on optimal credit market performance. The results further suggest that countries with relatively weak governance gain most from information sharing. In view of the fact that countries sharing credit information do so at varying depths, the chapter verifies the robustness of the findings to alternative credit information sharing proxies. Also, the results are robust to alternative measures of banking market concentration. Policy makers could draw some implications from this findings: first, in view of the pro-competitive policies across many banking markets in developing countries, deepening credit information sharing will help boost financial development in African countries. Second, policy makers cannot necessarily view quality governance as a perfect substitute to credit information sharing since some benefits accrue from the latter even at relatively high levels of governance.

Appendix A

Table 1: Marginal effect of leverage – GMM models

	HHI		BI	
	Leverage	Relative leverage	leverage	Relative leverage
Mean HHI; mean BI	2.4301***	1.778***	2.091***	1.458***
	(0.835)	(0.512)	(0.547)	(0.217)
Low HHI; high BI	3.470***	2.660***	3.922***	2.520***
	(1.197)	(0.753)	(1.096)	(0.400)
High HHI; low BI	1.391***	0.896***	0.257***	0.395***
	(0.513)	(0.282)	(0.010)	(0.118))

This table shows the marginal effect analysis of the results presented in Tables 2.6. Columns 1 and 2 respectively presents the marginal effect of leverage and relative leverage in models involving HHI whilst columns 3 and 4 present similar results for models involving BI. Marginal effects are evaluated at mean, low and high HHI or BI. Standard errors are shown in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 2: Leverage-performance relationship: extensions

	Dependent variable					
	ROA		After Tax ROA		ROE	
	Model_1	Model_2	Model_3	Model_4	Model_5	Model_6
$Lev_{i,t-1}$	0.5932***	0.3783***	1.1144***	0.4484***	4.5142	0.7973
	(0.1523)	(0.0563)	(0.4030)	(0.0667)	(3.6404)	(0.5579)
$Size_{i,t}$	1.3066	1.2640**	1.0986*	1.0759**	−8.6016	−9.0590
	(0.8236)	(0.5759)	(0.5656)	(0.4276)	(7.7941)	(8.2675)
$Size^2_{i,t}$	−0.0440	−0.0443**	−0.0373*	−0.0380**	0.2957	0.3140
	(0.0274)	(0.0201)	(0.0193)	(0.0152)	(0.2685)	(0.2868)
$Growth_{i,t}$	−0.0003	−0.0002	−0.0002	−0.0002	−0.0137***	−0.0139***
	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0024)	(0.0023)
$MROA_{i,t}$	0.6337***	0.4095***	0.6339***	0.3996***	2.3580	2.7453
	(0.0590)	(0.1501)	(0.0471)	(0.1305)	(1.6180)	(1.8962)
$Volatility_{i,t}$	−0.0987***	−0.1192***	−0.2930***	−0.2304***	−0.1381	−0.1906
	(0.0044)	(0.0075)	(0.1036)	(0.0563)	(0.1621)	(0.2083)
$Dividend_{i,t}$	0.0903***	0.0935***	−0.0726***	−0.0683***	0.0029	0.0191
	(0.0345)	(0.0312)	(0.0210)	(0.0219)	(0.3001)	(0.2887)
$HHI_{j,t}$	−2.5746		−2.1834		2.0316	
	(2.0531)		(1.7692)		(2.5674)	
$BI_{j,t}$		0.0314		−0.0155		−0.0954
		(0.0589)		(0.0526)		(0.1321)
$Rlev_{i,t-1}*HHI_{j,t}$	−0.8538**		−2.0032**		−9.6237	
	(0.4204)		(0.9613)		(8.1705)	
$Lev_{i,t-1}*BI_{j,t}$		0.8784**		1.0354***		0.4279
		(0.4041)		(0.3833)		(0.6465)
Intercept	−9.1938	−8.9000**	−7.7557**	−7.5472**	60.2766	63.6202
	(5.8160)	(4.0681)	(3.8930)	(2.9656)	(54.7785)	(58.0317)
N	1508	1505	1495	1493	1486	
R^2	0.9656	0.9750	0.7472	0.8079	0.2706	

This table shows the fixed effect estimation results for the effects of relative leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. The variables are as described in Table 2.3. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 3: Leverage-performance relationship: winsorised variables

Dep. var.: ROA	Herfindahl-Hirschman Index (HHI)		Boone indicator (BI)	
	Model 1	Model 2	Model 3	Model 4
$\text{Lev}_{i,t-1}$	0.0570***		0.0450***	
	(0.0205)		(0.0173)	
$\text{Rlev}_{i,t-1}$		0.0657***		0.0473**
		(0.0215)		(0.0187)
$\text{Size}_{i,t}$	−0.0000	−0.0011	−0.0023	−0.0031
	(0.0162)	(0.0160)	(0.0160)	(0.0158)
$\text{Size}^2_{i,t}$	−0.0004	−0.0003	−0.0003	−0.0003
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
$\text{Growth}_{i,t}$	0.0526***	0.0526***	0.0533***	0.0532***
	(0.0053)	(0.0053)	(0.0053)	(0.0053)
$\text{MROA}_{i,t}$	1.0552***	1.0535***	1.0554***	1.0542***
	(0.0172)	(0.0172)	(0.0170)	(0.0169)
$\text{HHI}_{j,t}\text{hi}$	0.0567	0.0720		
	(0.0649)	(0.0601)		
$\text{BI}_{j,t}$			−0.0060	−0.0013
			(0.0072)	(0.0051)
$\text{Lev}_{i,t-1}*\text{HHI}_{j,t}$	−0.0087			
	(0.1214)			
$\text{Rlev}_{i,t-1}*\text{HHI}_{j,t}$		−0.0863		
		(0.1389)		
$\text{Lev}_{i,t-1}*\text{BI}_{j,t}$			0.0243	
			(0.0314)	
$\text{Rlev}_{i,t-1}*\text{BI}_{j,t}$				0.0147
				(0.0336)
Intercept	0.0387	0.0525	0.0619	0.0734
	(0.1114)	(0.1104)	(0.1093)	(0.1073)
N	2030	2030	2024	2024
R^2	0.7021	0.7018	0.7025	0.7021

This table shows the fixed effect estimation results for the effects of relative leverage on firm performance. The sample comprises 257 South African firms over the period 1998 to 2009. The variables and table structure are as described in Table 2.3. bsolute measure of *leverage* is used in *columns* 1 and 3 whilst *relative−to−industry mean leverage* is used in *columns* 2 and 4. Cluster and heteroskedasticity robust standard errors are shown in parenthesis. Each model includes year dummies which are not reported. ***, ** and * indicate significance at 1%, 5% and 10%, respectively. All variables are winsorised at within 5% and 95%.

Appendix B

Table 4: Panzar-Rosse H-statistic using total revenue Data exclusion criterial relaxed: panel fixed effect estimation

	Dependent variable: lnTR				Dependent variable: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
ln PF	0.145***	0.239***	0.354***	0.209***	0.029	0.106	−0.038	0.220
	(0.035)	(0.024)	(0.031)	(0.039)	(0.108)	(0.084)	(0.051)	(0.174)
ln PL	0.160***	0.211***	0.137	0.172**	−0.114	−0.514	−0.008	−0.251
	(0.056)	(0.044)	(0.106)	(0.066)	(0.141)	(0.326)	(0.451)	(0.384)
ln PC	0.046**	0.061***	0.127**	0.056*	−0.044	0.180*	−0.127	0.022
	(0.023)	(0.022)	(0.053)	(0.029)	(0.107)	(0.099)	(0.129)	(0.104)
ln TA	1.126***	0.920***	0.988***	0.955***	0.156	−0.394**	−0.217**	0.125
	(0.063)	(0.027)	(0.063)	(0.085)	(0.164)	(0.181)	(0.088)	(0.331)
ln EQTA	0.149***	0.002	0.075	−0.022	1.019***	0.207	0.395	0.902***
	(0.043)	(0.025)	(0.057)	(0.052)	(0.213)	(0.151)	(0.372)	(0.270)
ln NLTA	0.174***	0.200***	−0.120**	0.124***	−0.192	0.071	−0.392**	−0.325**
	(0.043)	(0.046)	(0.053)	(0.035)	(0.168)	(0.240)	(0.150)	(0.142)
ln LLPL	0.049***	0.016**	0.038**	0.024***	−0.033	−0.190***	−0.201***	−0.072
	(0.010)	(0.007)	(0.017)	(0.008)	(0.044)	(0.046)	(0.075)	(0.054)
ln GDPG	−0.023	0.004	−0.019	0.006	0.000	0.106	−0.079	−0.011
	(0.019)	(0.015)	(0.021)	(0.023)	(0.065)	(0.187)	(0.086)	(0.112)
ln INFL	0.071**	0.004	0.011	0.035*	−0.000	−0.146*	−0.028	−0.048
	(0.029)	(0.011)	(0.015)	(0.019)	(0.098)	(0.082)	(0.044)	(0.114)
Constant	−2.185***	0.802**	−0.268	−0.098	−4.267*	−0.947	−2.592	−4.456
	(0.780)	(0.343)	(0.627)	(0.710)	(2.233)	(1.857)	(2.394)	(3.268)
H-stat / E-stat	0.352[a]	0.511[a]	0.618[a]	0.436[a]	−0.129[e]	−0.228[e]	−o.173[e]	−0.009[e]
	(0.067)	(0.053)	(0.103)	(0.085)	(0.236)	(0.343)	(0.467)	(0.438)
Wald F stat. H = 0 / E = 0	27.44***	93.66***	35.79***	26.36***	0.30	0.44	0.14	−0.00
Wald F stat. H = 1	93.18***	85.57***	1.70***	43.98***				
Adj. R^2	0.909	0.962	0.798	0.932	0.128	0.129	0.203	0.149
N	490	429	316	378	483	418	317	389

Data exclusion criteria are relaxed in these estimations. TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Heteroskedasticity-robust standard errors are given in parentheses. ***, ** and * indicate significant at 1%, 5% and 10%, respectively.

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

Table 5: Panzar-Rosse H-statistic using total revenue Data exclusion criterial relaxed: dynamic panel estimation, two-step system GMM

	Dependent variable: lnTR				Dependent variable Data exclusion criterial relaxed: lnROA			
Variables	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	NORTH	EAST
Lagged dep. var.	0.224**	0.303**	0.429**	0.399***	0.308*	0.391*	0.217	0.671***
	(0.086)	(0.133)	(0.209)	(0.080)	(0.167)	(0.200)	(0.162)	(0.234)
ln PF	0.113***	0.165***	0.164**	0.062	−0.014	0.005	0.003	−0.021
	(0.024)	(0.033)	(0.069)	(0.051)	(0.069)	(0.039)	(0.028)	(0.061)
ln PL	0.249***	0.219***	0.114	0.221***	0.058	0.022	0.108	−0.036
	(0.039)	(0.045)	(0.082)	(0.033)	(0.059)	(0.091)	(0.179)	(0.072)
ln PC	0.033	0.032*	0.114**	0.048***	−0.020	0.090	0.137	0.019
	(0.021)	(0.019)	(0.056)	(0.016)	(0.035)	(0.071)	(0.116)	(0.049)
ln TA	0.767***	0.691***	0.557***	0.599***	0.034**	0.053	−0.038	0.062
	(0.085)	(0.125)	(0.195)	(0.081)	(0.014)	(0.034)	(0.044)	(0.075)
ln EQTA	0.078***	0.054	−0.049	−0.014	0.393***	0.178*	0.485***	0.316
	(0.028)	(0.036)	(0.043)	(0.038)	(0.089)	(0.100)	(0.177)	(0.223)
ln NLTA	−0.010	0.017	−0.034	0.148***	−0.096	0.096	−0.223**	−0.163
	(0.039)	(0.036)	(0.074)	(0.038)	(0.088)	(0.103)	(0.087)	(0.120)
ln LLPL	0.038***	0.008	0.042**	0.022*	0.009	−0.151***	−0.159***	−0.078**
	(0.009)	(0.011)	(0.020)	(0.012)	(0.030)	(0.051)	(0.058)	(0.035)
ln GDPG	−0.000	0.026	−0.027	0.036*	−0.015	0.156*	0.032	0.101
	(0.018)	(0.018)	(0.034)	(0.019)	(0.051)	(0.092)	(0.049)	(0.082)
ln INFL	0.077***	0.017	−0.003	−0.013	0.159**	0.021	−0.074*	−0.065
	(0.018)	(0.013)	(0.021)	(0.017)	(0.068)	(0.071)	(0.037)	(0.103)
Constant	0.054	0.138	−0.027	−0.011	−2.441***	−3.752***	−2.064***	−2.281*
	(0.155)	(0.164)	(0.323)	(0.135)	(0.439)	(1.033)	(0.604)	(1.356)
H-stat / E-stat	0.508[a]	0.598[a]	0.685[a]	0.551[a]	0.025[e]	0.118[e]	0.247[e]	−0.038[e]
	(0.035)	(0.073)	(0.175)	(0.096)	(0.105)	(0.136)	(0.245)	(0.115)
Wald F stat. H = 0 / E = 0	216.33 * **	66.57 * **	15.38 * **	32.83 * **	0.06	0.75	1.01	0.11
Wald F stat. H = 1	202.72 * **	30.00 * **	3.24*	21.72 * **				
Hansen J test (p-values)	14.102(0.367)	16.682(0.214)	28.806(0.272)	26.354(0.121)	11.257(0.915)	28.236(0.354)	23.723(0.592)	10.766(0.824)
2^{nd} order ser. cor. test(p-values)	1.249(0.212)	0.867(0.386)	−1.189(0.234)	0.309(0.757)	1.371(0.170)	−0.958(0.338)	1.341(0.180)	−0.566(0.571)
N	387	336	246	298	369	317	249	307

Data exclusion criteria are relaxed in these estimations. TA: total assets, TR: total revenue, IR: interest revenue, ROA: return on assets, PF: price of funds, PL: price of labour, PC: price of capital, NLTA: the ratio of net loans to total assets, EQTA: The ratio of equity to total assets, LLPL: the ratio of loan loss provisions to total loans, GDPG: GDP growth rate, INFL: inflation. Time dummies are included in all models. Robust Windmeijer (2005) finite-sample corrected standard errors are in parenthesis. ***, ** and * indicate significant at 1%, 5% and 10%, respectively

[a] Significantly different from both zero and unity on Wald test (i.e. monopolistic competition)

[e] Long run equilibrium not rejected

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