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Competition and Banking Sector Stability in Kenya

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Abstract

Financial liberalization and globalization have enhanced competition in the banking sector with profound implications for stability. Positively, competition has had obvious benefits including increased efficiencies, continuous financial innovations and accelerated financial inclusion. However, to certain levels, competition may increase risk taking by banks where charter value is threatened. To this end, the assumption that efficiency and competition consideration may have eclipsed financial stability concerns in the run up to the global financial crisis has raised questions on the actual linkage between stability and competition, with increased calls for more nuanced approach to the assessment. This paper analyses the competition-stability nexus within the Kenyan context using quarterly data from 23 banks operating in the country between 2006 and 2018. The empirical estimation follows a three-step model. First, we construct a composite Bank Stability Index, building on the Uniform Financial Rating System Model that incorporates capital adequacy, asset quality, earnings and liquidity measures in the Bank stability estimate. Secondly, a proxy for bank competition is computed using the Panzar-Rosse H-statistic. Finally, we regress the Bank Stability Index against competition as measured by the H-Statistic, controlling for business cycles and some bank specific features including efficiency. The empirical results show a negative relationship between competition and bank stability. However, the relationship is not statistically significant. This underlines the need for an effective regulatory and supervisory environment that ensures stability even as the banking landscape grows increasingly competitive. This may include proactive policy measures that can counter the adverse effects of changes in banking competition on the sector's stability.

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1.0 Introduction

The competition landscape in the global financial sector has evolved considerably over the years, with profound implications for efficiency and stability for the banking sector. This has in part been driven by financial liberalization in the pre-financial crisis period as well as globalization (Andries, 2013) which enhanced cross border operations by banks. Even then, the debate on whether competition enhances stability or exacerbates fragility remains inconclusive (Kasman and Carvallo (2014).

Undoubtedly, competition has had some obvious benefits of increasing efficiencies, motivating innovations and accelerating financial inclusion across the globe. However, the ambiguity in empirical and theoretical finding has necessitated continuous and more nuanced assessment of the competition-stability nexus in the post crisis era. Whereas the connection between bank competition and financial stability has historically been weak (Shijaku, 2016), the assumption that efficiency and competition consideration overshadowed financial stability concerns in the run up to the crisis (Vives 2016), reinforced the need for a review of this relationship.

To be sure, the Global Financial Crisis (GFC) raised questions on some key underlying assumptions about financial markets mechanisms and their inferences for stability. The belief that increased competition among banks would lead to a more efficient banking sector, had been the biggest incentive for the unprecedented levels of deregulation in the four decades prior to the crisis (Beck et al 2013). However, following the crisis, this was now up for debate.

In spite of rich literature, consensus on the impact of competition on banking sector stability has remained elusive. That said, the issue of

competition-stability is more nuanced, depending on the sample, period and assumptions used. Thus far, two schools of thoughts have emerged. First, the charter value also known as competition-fragility supports a negative relationship between competition and stability. Keeley (1990) argues that excessive competition erodes market power and bank profit margins driving them to take on higher risks, which leads to failures and instability. Beck (2008) also posits that very high levels of bank competition can endanger financial stability by increasing their risk taking in order to compensate for the loss of revenue through weaker market share. Second, the parallel strand – competition stability, propagated by Boyd and Nicolo (2005) argue that excessive competition within the banking sector drives banks to lower their lending rate, which reduces moral hazard and effectively default risk, bolstering stability. Kasman and Carvallo (2014) postulates that more competition is conducive for greater financial stability as banks achieve market power through better efficiency, leverage and earnings ability.

However, as size and complexity increase, agency problems and increased risk taking might start gaining momentum, generating inefficiency and fragility (Kunt 2012). This non-linear relationship was propagated by Miera and Repullo (2010) who argued that both the competition-fragility view of Keely (1990) and the competition-stability view of Boyd and Nicolo (2005) could coexist and that the relationship between competition and financial stability is non-linear and U-Shaped.

1.1 Competition in the Banking Sector

Competition in banking has two fundamental connotations; it can drive social welfare by pushing down prices (i.e. interest rates, transactions costs) through efficiency gains and improving services for consumers and enterprises (Cetorelli, 2001). Likewise, as the bank lending channel, competition in banks is pivotal for monetary policy transmission. Habib et. Al., (2016) show that the effect of monetary policy on bank loans reduces as the level of competition decrease.

Competition in banking has increased remarkably over the years; arising from both traditional and non-conventional sources including non-bank financial intermediaries, market-based financers and most recently from fin-tech companies. Today, borrowers have direct access to funding from the market, shadow banks are providing alternative credit channels and technology has also reduced switching costs between banks and other credit sources, with the resultant multi-banking relationships significantly altering the competition landscape.

However, the standard competition paradigm in favour of cost minimization and allocative efficiency may not be entirely valid for banking given that its crucial role in the economy makes it prone to tighter regulations, supervision and public intervention (Danisman, 2018). The structure of banks has also considerably evolved. Following the liberalisation and deregulation in the 1970s, bank functions have expanded beyond

the traditional intermediation role to include payment services, asset management, equity underwriting and debt issues, securitization and insurance, adding some complexities to bank wide assessment of the competitive landscape (Vives, 2016).

That said the biggest disruption to banking today, with considerable implications for market structure and competition is from the non-traditional banks. Entry of Fintechs in the financial payments systems has seen unprecedented innovations, with immense transformative potential compared to traditional banks. This could worsen in the next digital era where the combination of new telecommunication systems, predictive algorithms, cryptography and machine learning will potentially change the industry in faster and more disruptive ways.

To this end, Fintech credit has grown rapidly around the world although with varying volumes and transactions, across countries, depending on the degree of economic development and the structure of the financial market (Stijn et., al, 2018). According to a report by the Bank of International Settlement (BIS), Fintech credit market in an economy is positively correlated to its income level and negatively linked to the competitiveness of its banking system and the stringency of its banking sector.

As technology promise better and cheaper ways to compete for core banking business, banks' dominant positions will therefore continue to be challenged (Yves Mersch ECB, 2019). In the first half of 2018, global investment in Fintechs reached $ 57.9Bn compared to $38.1Bn for the whole of 2017. The life span of adopting new banking innovation such as online and mobile banking is getting shorter and shorter.

1.2 The Case of Kenya

The banking sector in Kenya is composed of 42 commercial banks, 1 mortgage finance company, 9 representative offices of foreign banks, 13 licenced microfinance banks, 3 credit reference bureaus, 19 money remittance providers, 8 non-operating bank holding companies and 73 foreign exchange bureaus. Of the 43 banking institutions, 40 are privately owned. Of these, 25 banks have a local majority holding and are domiciled in Kenya while 15 are foreign owned. The sector is regulated by the Central Bank of Kenya.

Whereas the composition of the sector has changed considerably over the last 30 years, the last 10 have seen minimum alterations to the structure. Following a wave of bank failures in the 90s, the sector has witnessed a series of mergers and acquisitions motivated by the need to build scale in the fast-changing operating and regulatory environment. To be sure, in the last three decades, 33 mergers and 9 acquisitions have taken place. Of this, however, only 3 mergers (Savings and Loans (K) Limited Vs. Kenya Commercial Bank, City Finance Bank Vs. Jamii Bora Kenya Limited and Equatorial Commercial Bank Vs. Southern Credit Banking Corporation Ltd) and 5 acquisitions have happened in the last decade.

Even then, the collapse of three banks; Dubai, Imperial and Chase bank within a span of 9-months between 2015-2016 has altered the structure somewhat and may trigger more Merger & Acquisition (M&A) activities in coming years. The failures considerably altered the banking landscape with notable fragmentation of the interbank market as depositors and investors' perception of the smaller banks changed, unfavourably. This compounded fragility that was already evident in the local interbank market. Sichei et. al (2012) at al posits that, the Kenya interbank market is incomplete and fragmented by size; small Vs. big and that large banks tend to discriminate against small banks in extending credit with potential for liquidity strains in small banks.

This may be aggravated by the lending rate ceiling set at CBR+4%. This has restricted ability of banks to price risk at a time when funding costs for smaller banks are on the rise due to the aforementioned discrimination. Already, strains are evident as bank's profitability has slowed partly reflecting changes in the balance sheet structures with a bias towards lower-yielding, risk-free government securities. In fact, credit growth has slowed and stagnated within single digits since 2016. The central bank of Kenya partially attributed the 9.0% decline pre-tax profit for the banking industry and the 5.0% decline in lending in 2017 to the impact of the interest rate caps (Bank Supervision Annual Report, 2017). The pace of merger and acquisition activities in the sector may therefore depend on the durability of this environment as banks seek to enhance their competitive edge through scale.

Even with the ambiguity in the findings, literature on the link between competition and stability in Kenya is limited. Many studies in the country and across Sub-Saharan Africa have overly focused on determinants of banking competition, profitability and stability as well as the effects of competition on efficiency and financial access. Available literature suggests that competition has remained fairly low in the sector. Ogola 2016, concluded that the level of competition among commercial banks in Kenya is low, characterized by 96.1 per cent persistence in profitability, which increases with adoption of technology and consolidation but slows with increase in the capital requirements. On the contrary, Moyo et.al, (2014) found that competition in the banking sector resulting from financial sector reforms has increased in Sub-Saharan Africa. The study also found that the H-Static is positive and significant in the post-reform period implying that time to bank distress (lead time) increases as the degree of competition among the banks increase supporting the competition-stability paradigm.

That said, a look at central bank's statistics reveal that activity remains concentrated among few banks. The top eight banks accounts for 70% of the sectors net assets and 67% of customer deposits. In a sector with 44 banks, this distribution could add some fuel to the argument that the sector is overbanked. However, competition may be more nuanced than the traditional look at market power. Perhaps a more product centric approach may provide more insights on competition on the nature of competition. To be

sure, as customers become more informed and the competition landscape more stringent, competition on products has been evident as margins thin across both funded and non-funded product lines.

The declining spread in part reflects rising influence of non-traditional 'banking' channels on the market power of banks. M-Pesa has been revolutionary in driving innovations within the Kenyan banking sector with considerable gains for financial inclusion. Mobile money has been a major driver of formal inclusion and has created the rails for further innovation, inspiring a plethora of digital borrowing and savings solutions now emerging in the market (FSD 2019).

Although the overall lending by Fintechs as a percentage of total credit remains somewhat small, their influence has increased exponentially in the consumer segments, particularly in facilitating payments. In line with global evolution, many consumers in Kenya are switching to e-commerce, and more e-retail payments are made through mobile phones. The ability of Fintechs to offer better targeted, faster and cheaper financial services should sustain their edge over banks on this front. For banks, this may mean considerable reduction in fees and commission income. Their entry into to the credit business may further weaken interest income growth for banks. Whereas banks will continue to leverage partnerships with Fintechs to enhance their product offering, emergence of bigger, faster and dominant non-traditional players remains an existential risk to the traditional bank.

Figure 1: Mpesa Rev Vs. Financial inclusion

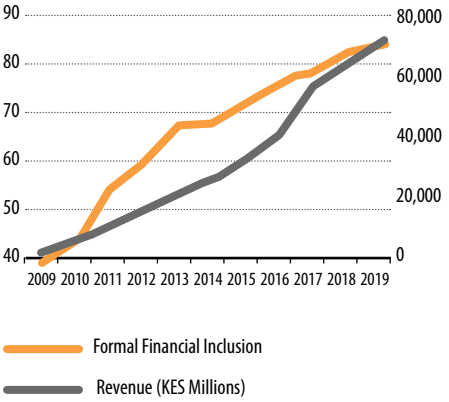
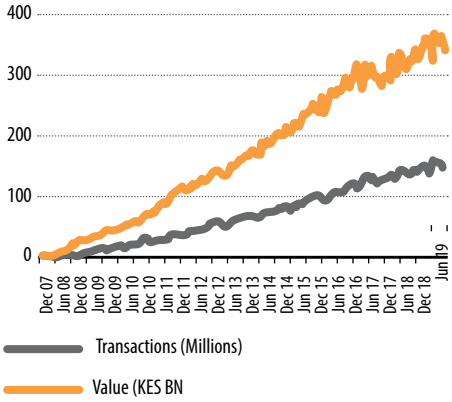


Figure 2: Mobile Payments



Source: Safaricom and Central Bank of Kenya

1.3 Regulation

Regulations have the potential to influence both stability and competition within the banking sector depending on their magnitude and the cost of compliance. The regulatory landscape in the Kenyan banking sector has been rather stable in the last decade. In response to lagged effects of the financial crisis of 2008/09 and to create a structural buffer for the sector, the Central Bank of Kenya in 2012 increased core capital requirements for banks to KES 1,000 Million from KES 250 Million. The capital adequacy ratio was increased to a minimum of 12.5% from 10.5%.

However, critics have argued that raising capital requirements increases concentration in banking reducing competition, with no guarantee for stability. Oduor et al, (2017) concluded that higher capital did not make African banks safer due to the use of varied international models that allow banks to understate their risks in order to maintain the regulatory capital which exposes the entire sector. To remedy this, the Central Bank of Kenya accompanied the capital increase with strict supervision on compliance to hide risky minimize banks' ability assets. The study also concludes that, increase in capital has no impact on competition at industry level but increases the competitive advantage of foreign banks who have access to cheaper capital compared to their peers.

The most definitive yet controversial piece of legislation in the sector was the introduction of interest rate controls through the Banking (Amendment) Act 2016. This established a ceiling on lending rates at 4.0 percentage points above the CBR and a floor on deposit rates at 70% of the Central Bank Rate. The objective of this legislation was noble; to increase affordability of credit, which is fundamental for stronger and sustained economic growth. However, the cap has been partly credited for the credit rationing for individual borrowers and small and medium enterprises, that has characterised official lending channels over the last three years. Moreover, the Central Bank of Kenya in 2018 argued that interest rates had undermined the conduct of monetary policy by constraining the use of CBR to signal its policy stance and creating an environment of possible perverse outcomes.

Relatedly, surveillance for banks has tightened following the collapse of Dubai Bank and Imperial Bank in 2015 and Chase Bank in 2016. These failures significantly impacted confidence in the sector and their reverberations remains clear even in 2019. Markets have remained somewhat segmented due to investors' flight to quality. The regulatory landscape is expected to tighten further with the adoption of the IFRS 9 reporting standards in 2021. The environment may be even more stringent in the event of another global recession as regulators tighten macro-prudential guidelines to avert another shock to the financial system.

Certainly, the banking sector in Kenya remains core to facilitating growth through its intermediation role. According to the Central Bank of Kenya data, the sector has KES 4,420 Billion in assets, an equivalent of 49.6% the country's GDP. The sector has been on a stable footing with solid returns on earnings and solid capitalisation. Over the last 10 years, the sector's ROE has declined from 29.0% in 2015 to 21.0% in 2018, still substantially above the global average. While the banking sector in Kenya has remained resilience even in the phase of global and domestic vulnerabilities, there have been pockets of systemic threats.

While in some cases, this has been attributed to governance issues, the role of competition in driving risk taking behaviour of some backs remains unclear. In the years 2016-2018, sectors NPL's have remained stubbornly in the double digits averaging 12.50%. While the implication for capital is evidently dire, the greater question is whether competition had any influence in driving some banks to take on more risks and did macroeconomic conditions play any role?

1.4 Motivation of the Study

While we believe that increased competition in the banking sector has led to more innovative products and increased access to financial services due to lower prices and increased convenience, literature on its role on bank stability is limited. Nyanchama (2018) recommends continuous research on banking competition due to the ever-changing techniques and strategies employed by banks towards improved banking performance and continued existence.

Our contribution to literature is two-fold. First, to the best of our knowledge, this is the first study that investigates the competition-stability nexus in the Kenyan banking sector. Prior studies have investigated the nature of competition in Kenya and its impact on efficiency. However, none has tested the competition-fragility/stability hypothesis.

Secondly, we add a new measure of stability by estimating a Bank Stability Index using CAEL (Capital adequacy, Asset quality, Earnings, Liquidity and Sensitivity to market changes) framework adopted by Shijaku (2017) which builds on the Uniform Financial Rating System adopted by the Federal Financial Institutions Examination Council in the US in 1979. This can be used comparatively to the traditional measures of stability including the Z-score and asset quality-based measures including NPLs and the distance to default.

1.5 Research Questions

The main aim of this study is to investigate the relationship between bank stability and competition in Kenya.

We seek to answer two specific research questions.

1. What are the determinants of stability in the Kenya banking sector?
2. What is the nature of competition within the banking sector?

1.6 Research Objectives

1.6.1 General Objective

To investigate the impact of competition on the stability of banks in Kenya.

1.6.2 Specific Objectives

The specific objectives are:

1. To investigate the determinants of stability in the Kenya banking sector
2. To examine the impact of competition on bank stability

2.0 Literature Review

The importance of banking system stability is widely recognised given its fundamental role in driving a country's economic agenda as the intermediation agent of the monetary authority. Following the financial crisis of 2009, regulators and policy makers have placed greater emphasis on banking stability, culminating in stricter enforcement of regulations both prudential and conduct.

While these adjustments were meant to preserve financial sector stability, protect consumers and encourage responsible innovations, some legislatures believe that the laws may be burdensome and that the need for 'rightsizing' regulatory requirement, targeted amendments and refining communication of expectations by regulators cannot therefore be gainsaid (Deloitte 2018).

On one hand, deregulation may have intensified competition among banks, with positive repercussions for financial depth (Dick and Lenhert, 2001), growth (Cetorelli and Gambera, 2001) and efficiency (Bertrand et al., 2007). On the other, Keely (2009), argued that deregulation may have been self-defeating as it eroded margins, increasing incentives for banks to take risks. Vives 2016, also added that during the deregulation period, efficiency and competition consideration overshadowed financial stability concerns. (Vives, 2001) underscored that contagion effects of bank failures produce strong negative externalities both for the financial sector and for the real sector with a large social cost.

Given the said ramifications of banking sector imbalances mostly through weaker credit extension and distortions to the interbank market and payment systems (Noman, Isaa 2017), the need to understand the role of competition, against a backdrop of fast evolving economic and regulatory backdrops remain fundamental in effective policy formulation. Thus far, theoretical forecasts and empirical outcomes

remain inconclusive despite a deluge of studies to this effect.

The traditional view of competition–fragility also known as the franchise value hypothesis as propagated by Keely (2009) posits that, competition dilutes market power, reduces profit margins and capital buffers for banks, weakening their franchise value. This motivates banks to aggressively take risks to compensate for the loss in value, with the risk of contagion spelling vulnerability to the entire sector. Hellmann, Murdock, and Stiglitz (2000) showed that the liberalization of both the US and Japanese banking sectors had increased competition to such an extent that it could be held accountable for subsequent bank failures in both countries.

Similarly, competition for deposits may increase cost of funding for banks, thereby lowering their net interest margins and profitability, making the banks more vulnerable. To this end, Marquez (2002) argued that increased competition in the banking industry would lead to inefficiency, with incumbent banks having an informational advantage over smaller banks. Repullo (2004) also supported the competition–fragility view by suggesting that in a highly competitive market, the franchise value of banks would be eroded resulting in a gambling equilibrium would such that banks as a whole would take on excessive risk.

Caminal and Matutes (2002) show that reduced competition could result in reduced credit rationing and larger loans, consequently increasing the probability of bank failure. Diallo (2015) also established that bank competition increases the probability of a systemic banking crisis and that it is positively related to the duration of the crisis.

Proponents of the franchise view argue that large banks dominate less competitive markets by benefiting from scale and scope and more diversified portfolios. This provides banks less incentive to monitor borrowers prudently which may increase moral hazards and adverse selection (Gale 2004). Saez L, Shi X (2004) argue that contagion effect is more prominent in competitive markets as all banks are price takers and a solvent bank may have little incentive to provide liquidity to troubled banks in periods of uncertain.

The parallel view of the competition stability as proposed by Boyd and Nicolo (2005) hypothesizes that high competition promotes stability by lowering interest rates on loans and therefore reducing the moral hazard problem that may result in high non-performing loan ratio. Banks with stronger market power enjoy lower competition in the loans market which encourages them to set high interest rates for borrowers, increasing their risk-taking tendencies and potentially moral hazard and adverse selection and therefore the risk of default. Furthermore, large banks in a concentrated market influence other through the contagion effect. Hence, failure of large banks in a concentrated market renders the whole system fragile (Abu et all 2005). Results by Agoraki et al. (2011) suggests that a weak competitive environment is not necessarily synonymous with financial instability.

Schaeck and Cihak argued that efficiency is the mechanism through which competition contributes to stability.

However, Martinex-Miera and Repullo (2010) have argued that the two; the fragility and stability paradigms can coexist. This was supported by Berger, Klapper (2009) who postulated that the competition stability and fragility views are not opposing theories, rather both may be concurrently applicable if high risk-taking can be hedged with a high capital buffer.

That said, economic cycles may have considerable implications for stability. Naturally, banks will flourish in an economically sound environment as both the demand for credit tends to be high and the credit risk environment sound. Generally, banks do adopt aggressive risk policy in stable to bullish economic landscape but will be more prudent and risk averse during periods of economic uncertainty to minimize moral hazards. However, Cook (2008) posits that few banks suffered moral Hazard problem during the 1997-98 Asia Financial Crisis, as crisis changes the risk taking behaviour of banks with a natural bias to conservative lending to reduce risks associated with moral hazards. Business cycle theory suggests that during recession, banks adopt conservative approaches to credit management, shrink loan extension and focus on building capital buffers (Jokipii and Miline 2008). This helps minimize banks' exposure to risk and moral hazard bolstering stability.

2.1 Empirical Literature Review

Many studies have explored the linkage between competition and banking sector stability with mixed outcomes. This divergence has been partly linked to the different variables or methods deployed by researchers in interrogating the relationships. Historically, several measures reflecting market concentration, market power, bank efficiencies and the quality of assets have been deployed in gauging competition. Biiker, et al (2007), argue that competition is determined by various factors including market structure, contestability, inter-industry, institutional and macroeconomic variables. Conventionally, there are two approaches to estimating competition; structural and non-structural.

Structural measures first developed by Mason (1939) and Bain (1959) subscribe to the structure-conduct-performance (SCP) paradigm which assume that the competitive behaviour of banks is principally determined by the structural characteristics of the market in which they operate such as the degree of concentration. Most common measure is the HHI (Herfindahl-Hirschman Index) although some others would use market share to proxy for concentration. Highly concentrated markets are associated with higher prices and profits reflecting low levels of competition and prospects of collusion. However, doubts have been raised about the structural measures which leans heavily on market concentration as a proxy for competition. Smirlock (1985) argued that

higher profits in the banking sector could also be a result of greater production and managerial efficiency, in the case of US banking sector.

To address the said limitations of structural models in estimating competition, more recent analyses have mostly deployed the non-structural measures. These are based on the New Empirical Industrial Organisation Framework and link competition to mark-ups applied by banks, with a higher mark-up (marginal costs and marginal revenues) reflecting greater market power and therefore less competition (Cuestas, 2019). They assess the degree of competition directly by observing behaviour of firms in the market and draws from the assumption that markets reallocate resources to the most efficient firms, making them more profitable.

The first generation of non-structural measures was based on oligopoly theory and static model of competition (Florian, 2014). Attached to this concept are the Lerner Index (Lerner, 1934) and Panzar and Rosse (1987)'s H-Statistic. A more recent addition to the non-structural measures is the Boone Indicator by Boone (2008) which captures the dynamism of the market, an advancement from the static measures of Lerner and Panzar-Rosse.

However, there is still no consensus in literature about the best measure of competition Northcott (2004). Moreover, the different measures whether structural or non-structural do not provide similar inferences about competition (Liu et al.., 2013). The choice of the technique therefore involves trade-offs including data availability as well as the hypothesis being tested.

Proponents of non-structural measures argue that they are micro-founded and offer a more realistic backdrop for estimating the competitive conditions (Carlos, 2019). That said, studies have shown very weak correlation between the different indicators of competition. Bikker and Haaf (2002) found little correlation between the Lerner Index and the Hefindahl-Hirschman Index (HHI) which is estimated from the sum of the squared market share of each bank in the system.

A 2015 study of the influence of competition on Turkish banks between the years of 2002-2012 utilised the Boone Indicator and Lerner Index as measures of competition and used non-performing loans and Z-score as measures of stability. The result revealed a negative correlation between bank competition and nonperforming loans but a positive link with the Z-score, offering some backing to the competition fragility narrative. The study added that banks risk appetite is largely influenced by competition.

Schaeck and Cihak (2008) in establishing how competition affect efficiency and soundness in 3500 banks in ten European banks and 9000 banks from the US between 1995 and 2005 found that Boone Indicator as a measure of competition causes bank stability to increase by promoting bank efficiency and that financial stability benefits the more concentrated markets.

Fu, Lin (2014) explored bank competition and financial stability in Asia Pacific using bank level data between the years of 2003-2010 from 14 countries. The study uses the Lerner Index and the large three bank's concentration ration as a measure of competition and Merton's contingent claim pricing model along with Z score as a measure of banks risk taking. The study concludes that the Lerner Index is negatively correlated to risk taking while concentration positively relate to banking sector fragility.

Panzar-Rosse model catches the transmission of input process on firm's earnings, where weak transmission suggests strong market power in pricing and higher values indicate perfect competition (Florian (2014) and the other end of the spectrum is collusion. The popularity of Panzar_Rosse's H-Statistic can be explained by its simplicity and the fact that it does not pose stringent data requirements. However, the model suffers from some subjectivity in interpretation of results. The conventional interpretation is that observations in a competitive equilibrium would exhibit $H = 1$, while $H \leq 0$ in profit-maximizing monopolies.

While researchers pick the measure of competition depending on the specific characteristic of the market, more often, other indicators are equally deployed to check robustness of the findings. Bolt and Humphrey (2015) used all the three measures on a sample of 2655 banks and reported weak correlation among the three measures in so far as measuring competition, understandably because the three measures competition differently.

3.0 Research Methodology

As elaborated in the literature, numerous studies have sought to establish the relationship between competition and banking sector stability with varied outcomes. However, literature on this interplay in the context of Kenya remains thin. This study seeks to add to the literature by using bank level data for a sample of banks operating in Kenya to determine the nature of the relationship between competition and the stability of banks in the country.

The empirical model used in this study draws from previous studies in particular Shijaku (2017) for the development of the bank stability index and Claessens (2003) for the development of the competition indicator. Whereas both studies based their analysis no a cross-country panel data set, this study will only focus on one country, Kenya. The main model is a modification of the approach used by Shijaku (2006) using a dynamic General Method of Moments (GMM) as proposed by Arellano and Bond (1991). The model is dynamic and contains a large N (1193 bank observations) and small T (52 quarters for this study).

3.1 Data collection and Sources

The study deploys quarterly data from 23 commercial banks operating in Kenya between 2006 and 2018. The country's quarterly GDP is used to proxy for business cycle. The sample data is compiled from various data sources, specifically bank-specific financial statements, the Central Bank of Kenya (CBK) and the Kenya National Bureau of Statistics (KNBS). The data consists of 1193 observations for the 23 banks operating in Kenya.

3.2 Econometric Model

The model is specified as follows;

$$\textit{Bank Stability Index}_{it} = (\textit{Competition Indicator, Efficiency Ratio, Leverage Ratio, GDP})_{it} \quad \ldots\ldots 1$$

Where *Bank Stability Index* is derived from the CAELS framework (excludes S-market sensitivity), *Competition Indicator* is proxied by the Panzar-Rosse H-Statistic, *Efficiency Ratio* is total operating expenses to total operating income, *Leverage Ratio* is the ratio of total equity to total assets, while *GDP* is a proxy for business cycle.

3.2.1 Main Stability Indicator: Bank Stability Index

We estimate a proxy for bank stability using the methodology adopted by Shijaku (2017) which builds on the Uniform Financial Rating System adopted by the Federal Financial Institutions Examination Council in the US in 1979. This method is endorsed by the IMF and also literature which supports it as a tool that could help monitor bank stability on a real time basis Bets et al. (2014). The rating system takes into consideration measures of **CAELS** rating (**C**apital adequacy, **A**sset quality, **E**arnings, **L**iquidity and **S**ensitivity to market risk) to infer stability of a bank. However, due to data limitations, our model excludes the sensitivity measure.

Model specification;

$$BSI_{(t,w)} = \omega_1 \sum_{i=1}^{n} Z^*_{t,C} + \omega_2 \sum_{i=1}^{n} Z^*_{t,A} + \omega_3 \sum_{i=1}^{n} Z^*_{t,E} + \omega_4 \sum_{i=1}^{n} Z^*_{t,L} \quad \ldots\ldots 2$$

Where, n is the number of indicators in each sub index; C relates to the capital adequacy; A is a proxy for asset quality; E represents bank earnings and L is a proxy for liquidity risk. Z^* is the exponentially transformed simple average of the normalized values of each indicator included in the sub index of the individual bank stability index. The Indicators used for the construction of the Bank Stability Index are presented in **Table 4** and for the derived Bank Stability Index, an increase in the value of the index corresponds to a lower risk in that period compared to other periods and a decrease will denote increased vulnerabilities.

Table 4: Indicators used to estimate Bank Stability Index

	Code	Variables/Formula	Explanation	Expected sign
Capital (C)	c1	$\frac{tcap}{trwa} = \frac{total\ capital}{total\ risk\ weighted\ capital}$	Capital Adequacy Ratio	+
	c2	$\frac{ccap}{trwa} = \frac{core\ capital}{total\ risk\ weighted\ capital}$	Core Capital to Total Risk Weighted Asset	+
	c3	$\frac{te}{ta} = \frac{total\ equity}{total\ assets}$	Leverage Ratio	+
	c4	$\frac{ta\text{-}l.ta}{l.ta} = \frac{total\ assets\text{-}log(total\ assets)}{log(total\ assets)}$	Total Asset Growth	+
	c5	$\frac{te\text{-}l.te}{l.te} = \frac{total\ equity\text{-}log(total\ equity)}{log(total\ equity)}$	Total Equity Growth	+
	c6	$\frac{pat}{te} = \frac{profit\ after\ tax}{total\ equity}$	Return on Equity	+
	c7	$\frac{gnpl}{ccap} = \frac{gross\ nonpeforming\ loans}{core\ capital}$	Gross NPLs to Core Capital	-
Asset Quality (A)	a1	$\frac{gnpl}{la} = \frac{gross\ nonpeforming\ loans}{loans\ and\ advances}$	NPL Ratio	-
	a2	$\frac{la}{ta} = \frac{loans\ and\ advances}{total\ loans}$	Total Loans and Advances to Total Assets	+
	a3	$\frac{la\text{-}l.la}{l.la} = \frac{loans\ \&\ advances\text{-}log(loans\ \&\ advances}{log(\ loans\ and\ advances)}$	Growth in Loans and Advances	+/-

Earnings (E)	e1	$\frac{pat}{ta} = \frac{profit\ after\ tax}{total\ assets}$	Return on Assets	+
	e2	$\frac{tii\text{-}l.tii}{l.tii} = \frac{total\ interest\ income - log(total\ interest\ income)}{log(total\ interest\ income)}$	Total Interest Income Growth	+
	e3	$nim = net\ interest\ margin$	Net Interest Margin	+
	e4	$\frac{toe}{toi} = \frac{total\ operating\ expenses}{total\ operating\ income}$	Efficiency Ratio	+
	e5	$\frac{nii\text{-}l.nii}{l.nii} = \frac{net\ interest\ income - log(net\ interest\ income)}{log(net\ interest\ income)}$	Net Interest Income Growth	+
	e6	$\frac{tii}{toi} = \frac{total\ interest\ income}{total\ operating\ income}$	Total Interest Income to Total Operating Income	+
Liquidity (L)	l1	$\frac{la}{cd} = \frac{loans\ and\ advances}{customer\ deposits}$	Loans and Advances to Customer Deposits	-
	l2	$lr = liquidity\ ratio$	Liquidity Ratio	+

The data was tested for unit root using Fisher-type F-fuller for unbalanced panel, the absence of which allowed for use of the variables at level. The indicators within each sub index were first normalised into a common scale with a mean of zero and standard deviation of one using the formula below:

$$z_t = \frac{(x_t\text{-}\mu)}{\sigma} \quad .....3$$

Where $Z_t - Z$ score (normalised value), X_t is the value of indicator X at time t; μ is the mean and σ is the standard deviation for individual banks. This minimizes potential distortions that could arise from differences in the means of the indicators. Secondly, the normalised data is converted to a single uncorrelated index using the Principal component analysis approach.

To predict the indices, we restrict our index estimation to the components with eigen value of above one. The results were again normalised to a mean of zero and standard deviation of one and transformed to a common scale of 0-1 using exponential transformation and the indices were then aggregated, (at equal weighting) to get the bank stability index.

$$\frac{1}{1+exp\text{-}z^{*}} \qquad \text{.....4}$$

3.4.2 Secondary Stability Indicator: Z – score

As a comparable measure, the study computes the **Z**-score which is included among the indicators of The Global Financial Development Database (World Bank), to check for the BSI's robustness. The study deploys the **Z**-score as captured by Lepetit and Strobel (2014) which uses standard deviation estimates of the return on assets that are calculated over the full sample and combines these with current values of the equity-asset ratio as below;

$$Z = \frac{(\mu(ROA)_t + EA_t)}{\sigma(ROA)_t} \qquad \text{.....5}$$

Where μ denotes the expected value and σ denotes the standard deviation of the ROA. The basic principle of the **Z**-score is to relate bank capital to variability of its return that is to say, how much variability in returns can be absorbed by capital without making the bank insolvent. The **Z**-score indicates with how many standard deviations profits can fall before capital is depleted and is therefore the inverse of insolvency (Lepetit and Strobel, 2014). Thus, a higher **Z**-score indicates that the bank is more stable. What the study seeks to infer from this indicator is that the lower the capital base the higher the likelihood of bankruptcy and that higher variability in returns also increases the probability of bankruptcy.

3.4.3 Competition Indicator: H-Statistic

The study uses the Panzar-Rosse approach by Rosse and Panzar (1987) to estimate the **H**-statistic, a proxy for competition. This is a non-structural approach to competition that derives a profit maximizing equilibrium conditions i.e. assesses variations in a firm's revenue relative to input prices. Its use of bank-level data makes it robust to the geographic extent of the market. The model estimates a reduced form equation relating total revenues to a vector of input prices using the equation below;

$$log(TR/TA)=\alpha+\sum_{i=1}^{n}\beta_i\, log\omega i + \mu log(TA) + error \ldots\ldots\ldots\ldots\ldots\ldots 6$$

Where

TR/TA is interest income/total assets is used as a proxy for output price, ω_i corresponds to the different input factors which are: ω_1 is interest expense on deposits to customer deposit as a proxy for average funding cost, ω_2 is staff costs to total assets reflects the price of labour, ω_3 is total other operating expense to fixed assets as a proxy for the price of capital expenditure, TA represents total assets and is used to control for bank size.

Table 1: Interpreting the Panzar-Rosse H-Statistic

$H=\sum_{i=1}^{n}\beta_i$	
$H < 0$	Monopoly or variations of short run oligopoly
$0 \geq H \leq 1$	Monopolistic Competition
$H = 1$	Perfect Competition or Natural Monopoly in a contestable Market

4.0 Research Findings

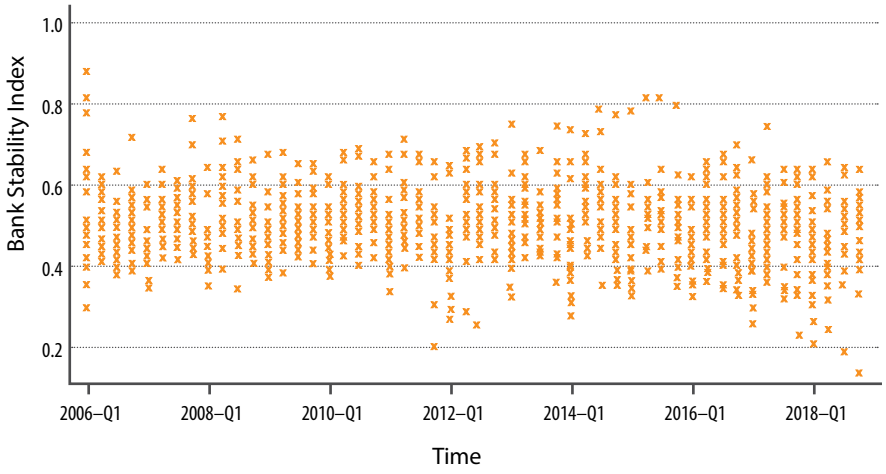
This section reports the results of our empirical analysis for the construction of the bank stability index. To estimate the Bank Stability Index (BSI), the study generated sub-indices for capital adequacy, asset quality, earnings and liquidity using the variables in **Table 2**.

Table 2: Construction of the H-Statistic

In (Output Price)	Coefficients	Std. Err.	P-value
In (Average Funding Costs)	$\beta_1 = 0.400$	0.012	0.000
In (Price of Labour)	$\beta_2 = 0.329$	0.013	0.000
In (Capital Expenditure)	$\beta_3 = 0.047$	0.012	0.000
In (Total Assets)	$\mu = 0.060$	0.007	0.000

The sub-indices are then aggregated, at equal weights to determine the bank's stability index. The computed bank stability index is graphically shown in **Figure 3**

Figure 3: Bank Stability Index



Our results from the Bank Stability Index (as shown in graph 3) show a generally stable banking sector. The sector remains profitable, well capitalised and liquid. While asset quality deteriorated between 2016 and 2018 years weighing on overall stability, strong capital buffers have kept the industry in a stable state.

4.1 Competition Indicator: H-Statistic

The computed Panzar-Rosse H-statistic over the sample time period is 0.776 (∑β) - see **Table 2**. This is consistent with a monopolistic competition market structure. Such a competitive environment can drive collusive behaviour among banks especially when demand is low (Green and Porter, 1981) and supervisory framework weak.

4.2 Relationship between Bank Stability and Competition in Kenya

Results from the Breusch-Pagan Heteroscedasticity indicate the presence of Heteroscedasticity (Prob F <0.05) meaning that the independent variables explain some variations in the error term. The study further seeks to establish the most appropriate methodological approach for the model. The study employs the Hausman test whose results reveal that the fixed effect model is appropriate for use (P<0.05).

The study finds that an increase in competition, is associated with a decline in bank stability, in line with the competition-fragility paradigm propagated by Keely (2009). However, the impact is small and statistically insignificant at the 5.00% level using GMM. Findings are consistent when both Z-score and the Bank Stability Index are used as proxies for bank stability. The results are also in line with the findings of Repullo (2014) who posited that highly competitive markets could lead to a 'gambling equilibrium' such that there is increased bank risk-taking thus eroding the franchise value of banks (Repullo, 2004) thereby stabilising the sector. A general shift in bank stability to the downside between 2016 and 2018 may reflect increased risk-taking activity by banks that resulted in a surge in Non-performing loans.

According to Smith, Grill and Lang (2018), the leverage ratio incentivises banks that are bound by the ratio to modestly increase risk-taking. However, our results suggest that an increase in the leverage ratio is associated with increased bank stability. Further, the leverage ratio has a significant impact on bank stability with a percentage point increase resulting in 22.20% improvement in bank stability.

Contrary to the theoretical framework, our results establish that economic growth is negatively associated with bank stability. Further, the impact is small and statistically insignificant at 5.00% level. This contradicts finding from Calderon and Liu (2003) who showed that the finance-growth link is more active in developing countries than in developed countries. The atypical inverse relationship may be due to the possibility that finance investments respond to economic developments, potential biases in our sample period effect or inadequate time lag in the variables.

Efficiency implies a bank's ability to turn its resources into revenues at the lowest possible cost. The study finds that the efficiency ratio is significant at the 5.00% but negatively associated with bank stability. A percentage point improvement in efficiency leads to a 6.70% deterioration in bank stability. This is also contrary to most theoretical literature that argue a positive relationship between bank efficiency and stability. However, results are somewhat in line with findings from Akhter (2018) which finds that as bank risk increases (decline in bank stability) bank's operational efficiency improves albeit at a decreasing rate.

Table 3: Generalized Method of Moments (GMM) Model

	Bank Stability Index
Bank Stability Index Lag (1)	-0.100**
	(0.032)
Competition Indicator (H-Statistic)	-0.008
	(0.005)
Efficiency Ratio	-0.067**
	(0.007)
Leverage Ratio	0.222**
	(0.022)
GDP Growth	-0.0002
	(0.004)

Source: Authors' calculations

**Statistically significant at 5.00%

5.0 Conclusion and Policy Recommendations

Theory has remained ambiguous on the effects of competition on bank stability. Contributing to this ambiguity is the lack of consensus on the proper measures of competition. Using a sample of 23 commercial banks in Kenya over the 2006 – 2018 period, our empirical findings indicate that higher competition, though not significant, leads to a decline in bank stability perhaps alluding to increased risk taking among banks as competition increases. Ideally, with an effective regulatory and supervisory framework, competition should not impede bank stability.

From the foregoing, it is evident that competition should not be a major concern for policy makers. Rather policy makers and regulators should focus on enforcing a macroprudential framework that ensures that the sector is adequately cushioned against negative shocks. From the analysis, capital remains a key determinant of stability and therefore regulators should prioritize compliance to capital requirement.

Even then, our finding should be interpreted with some caution given the evidence that competition may be a source of fragility for the sector. Policy makers should therefore actively monitor evolutions in the competition landscape and effectively adjust policies with the fast-changing banking landscape as well as product portfolios. Proper surveillance should also minimize prospects of collusion that could undermine and increase vulnerabilities in some banks. It is also paramount that regulatory and supervisory frameworks are constantly updated as new products and interlinkages emerge.

References

1. Acosta Smith, Jonathan and Grill, Michael and Lang, Jan Hannes, *The Leverage Ratio, Risk-Taking and Bank Stability* (June 20, 2017). ECB Working Paper No. 2079. Available at SSRN: https://ssrn.com/abstract=2990215

2. Andries A M, Capraru B. *Impact of financial liberalization on banking sectors performance from central and eastern European countries*. PloS ONE. 2013; 8(3): e59686 10.1371/journal.pone.0059686

3. Andries, Bogdan C, 2013. *"Impact of Financial Liberalization on Banking Sector Performance from Central and Eastern European Countries".*

4. *Assessing competition with the Panzar-Rosse Model: The Role of Scale, Cost and Equilibrium*

5. *Banking Sector concentration, Competition and financial stability: the case of the Baltic countries* (Juan Carlos Cuestas, Yannick Lucotte and Nicolas Reigl)

6. Beck, T. 2008. *"Bank competition and Financial Stability: Friends and Foes".*

7. Beck, T., De Jonghe, O., Schepens, G., (2013). *Bank competition and stability: cross-country heterogeneity.*

8. Berger, A.N., Demirguc-Kunt, A., Levine, R., & Haubrich, J.G. (2004). *"Bank concentration and competition: an evolution in the making".*

9. Boyd J, Nicolo G., 2005. *"The Theory of bank risk taking, and competition revisited".*

10. Calderón, C. and Liu, L. (2003) *The Direction of Causality between Financial Development and Economic Growth. Journal of Development Economics,* 72, 321-334. http://dx.doi.org/10.1016/S0304-3878(03)00079-8

11. Central Bank of Kenya (CBK), *Annual Supervision Report 2017*

12. Cihak, Martin & Hesse, Heiko. (2010). *"Islamic Banks and Financial Stability: An Empirical Analysis".* IMF Working Papers. 38. 95-113. 10.1007/s10693-010-0089-0.

13. De Nicolo, Gianni. (2009). "The Theory of Bank Risk-Taking and Competition Revisited".

14. Deloitte (2019), Banking Regulatory Outlook

15. Demirguc-Kunt, Asli & Klapper, Leora. (2012). *"Measuring Financial Inclusion: The Global Findex Database*". 10.1596/1813-9450-6025.

16. Does Competition Reduce the Risk of Bank Failure? David Martinez-Miera, Rafael Repullo

17. Dulal Miah, Md.; Uddin, Helal (2017): *Efficiency and stability: A comparative study between islamic and conventional banks in GCC countries, F*uture Business Journal, ISSN 2314-7210, Elsevier, Amsterdam, Vol. 3, Iss. 2, pp. 172-185, http://dx.doi.org/10.1016/j.fbj.2017.11.001

18. Financial Sector Reforms, Competition and Banking System Stability in Sub-Sahara Africa Jennifer Moyo; Boaz Nandwa; Jacob Oduor and Anthony Simpasa (2014)

19. Gerti Shijaku, 2017. *"Bank Sta*bilit*y and Competition. Evidence from Albania Banking Market".*

20. H. Boyd, John & E. Runkle, David. (1993). *Size and performance of banking firms: Testing the predictions of theory. Journal of Monetary Economics. 31. 47-67. 10.1016/0304-3932(93)90016-9.*

21. Jackson, Mdoe & O. Omolo, Jacob & H. Wawire, Nelson. (2018). *"Bank Competition in Kenya. Journal of Industry, Competition and Trade".* 10.1007/s10842-018-0279-2.

22. Jacob, Ngoka and Oduor, 2017. *"Capital requirement, bank competition and Stability in Africa".*

23. Kasman, Carvallo O., 2014 *"Financial Stability, Competition and Efficiency in Latin American and Caribbean Banking"*

24. Keeley, Michael C, 1990. *"Deposit Insurance, Risk, and Market Power in Banking,"* American Economic Review, American Economic Association, vol. 80(5), pages 1183-1200, December.

25. Khan et.al., (2016), *Bank competition and monetary policy transmission through the bank lending channel: Evidence from ASEAN;*

26. Laetitia Lepetit, Emmanuelle Nys, Philippe Rous, Amine Tarazi. *"The expansion of services in European banking: implications for loan pricing and interest margins".* Journal of Banking and Finance, Elsevier, 2008, 32 (11), pp.2325-2335.

27. Laeven, Luc & Levine, Ross, 2009. *"Bank governance, regulation and risk taking,"* Journal of Financial Economics, Elsevier, vol. 93(2), pages 259-275, August.

28. Martinez-Miera, David & Repullo, Rafael. (2008). *"Does Competition Reduce the Risk of Bank Failure?".* C.E.P.R. Discussion Papers, CEPR Discussion Papers.

29. Measuring Competition in Banking: A critical review of methods: Florian Leon (2014)

30. Odundo, Godfrey. (2018). *"Bank Size and Financial Stability of Commercial Banks in Kenya: Empirical Evidence".*

31. Priscilla Nyanchama Ombongi, and Wei Long. *"Assessing Nature of Competition in Kenya's Banking Sector" International Journal of Research in Business Studies an*d Management, vol 5, no. 1, 2018, pp. 11-19.

32. The 'Competition-Stability/Fragility Nexus: A Comparative Analysis of Islamic and Conventional Banks.

33. Vives, X. (2016). *"Competition and stability in banking: The role of regulation and competition policy. Princeton, NJ: Princeton University Press".*

Appendix

Table 5: Descriptive Statistics for the computation of the Bank Stability Index

	Variable	Obs	Mean	Std. Dev.	Min	Max	Kurtosis	Skewness
Capital Adequacy	c1	1,193	0.202	0.089	-0.225	1	18.816	2.491
	c2	1,193	0.182	0.085	-0.239	0.980	14.449	2.063
	c3	1,193	0.147	0.043	0.043	0.393	6.993	1.261
	c4	1,167	0.040	0.172	-4.167	1.135	315.209	-12.115
	c5	1,167	0.051	0.241	-4.001	3.688	126.160	0.417
	c6	1,193	0.089	0.140	-2.3	0.923	79.949	-4.924
	c7	1,193	5.427	8.467	-0.630	97.093	40.346	5.074
Asset Quality	a1	1,193	20.170	22.065	0.735	253.286	23.085	3.359
	a2	1,193	0.528	0.106	0.157	0.770	3.187	-0.575
	a3	1,167	0.041	0.203	-5.172	1.484	378.999	-14.051
Earnings	e1	1,193	0.014	0.018	-0.25	0.132	48.957	-2.694
	e2	1,167	0.403	2.158	-0.991	70.127	934.852	28.915
	e3	1,193	0.071	0.054	-0.1	0.48	3.128	16.380
	e4	1,193	0.777	1.490	-4.367	39.106	398.868	17.004
	e5	1,167	0.247	1.053	-5.448	26.804	350.707	13.481
	e6	1,193	1.194	1.646	-11.263	36.471	247.885	11.934
Liquidity	l1	1,193	0.833	2.702	0.192	93.335	1153.453	33.701
	l2	1,193	0.418	0.147	-0.2	0.95	4.559	0.654

Competition Indicator: H-Statistic

Table 6: Descriptive Statistics

	Obs	Mean	Std. Dev.	Min	Max	Kurtosis	Skewness
Output Price	1,193	0.0584	0.029	-0.002	0.159	2.564	0.477
Average Funding Cost	1,193	0.0378	0.182	-0.055	6.238	1127.298	33.111
Price of Labour	1,193	0.0160	0.011	-0.016	0.102	8.941	1.702
Price of Capital Expenditure	1,193	1.2543	1.301	-2.188	14.72692	26.59	3.615
Total Assets	1,193	89,435.880	103,432.000	-1,800.000	620,000.000	6.818	1.861

Table 7: Correlation

	Output Price	Average Funding Cost	Price of Labour	Price of Capital Expenditure	Total Assets
Output Price	1				
Average Funding Cost	0.094**	1			
p-value	0.0012				
Price of Labour	0.498**	-0.003	1		
p-value	0	0.9121			
Price of Capital Expenditure	0.257**	0.021	0.195**	1	
p-value	0	0.474	0		
Total Assets	0.033	-0.049	-0.008	0.102**	1
	0.2619	0.0958	0.7732	0.0004	

***significant at 5% confidence interval*

Graph 3: Evolution of competition over the sample period

Table 8: Descriptive Statistics for Main Empirical Model

Column1	Obs	Mean	Std. Dev.	Min	Max	Kurtosis	Skewness
Bank Stability Index	1,193	0.496	0.087	0.136	0.8853141	4.408	0.34
H-Statistic	1,193	0.246	0.224	-0.610	0.7156056	5.819	-0.991
Efficiency Ratio	1,193	0.777	1.490	-4.367	39.10625	398.868	17.004
Leverage Ratio	1,193	0.147	0.043	0.043	0.3928571	6.993	1.261
GDP	1,193	0.050	0.017	0.003	0.083	3.813	-0.889

Source: Authors calculations

Table 9: Correlation for Main Empirical Model

	Bank Stability Index	Efficiency Ratio	GDP	Leverage Ratio	H-Statistic
Bank Stability Index	1.000				
H-Statistic	0.059**	-0.080**	0.106**	-0.043	1.000
Efficiency Ratio	-0.279**	1.000			
Leverage Ratio	0.533**	-0.077**	0.010	1.000	
GDP	-0.028	-0.013	1.000		

**Significant at 5.00% Confidence Interval

Source: Authors calculations

Table 10: Unit Root Test for Main Empirical Model

	ADF- Fisher Chi-square		PP Fisher Chi-Square	
	Intercept & Trend	P-Value	Intercept & Trend	P-Value
Bank Stability Index	0.0000	0.0000	0.0000	0.0000
H-Statistic	0.0000	0.0000	0.0000	0.0000
Efficiency Ratio	0.0000	0.0000	0.0000	0.0000
Leverage Ratio	0.0000	0.0000	0.0000	0.0000
GDP Ratio	0.0000	0.0000	0.0000	0.0000

Source: Authors calculations

Table 11: Breusch-Pagan test for Heteroscedasticity

```
. reg e_squared lnbsi lnhstat lner lngdp lnte_ta
```

Source	SS	df	MS		
				Number of obs	= 1,031
				F(5, 1025)	= 16.65
Model	.171459849	5	.03429197	Prob > F	= 0.0000
Residual	2.11083632	1,025	.002059353	R-squared	= 0.0751
				Adj R-squared	= 0.0706
Total	2.28229617	1,030	.002215822	Root MSE	= .04538

e_squared	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnbsi	-.0880441	.0106247	-8.29	0.000	-.1088927	-.0671955
lnhstat	.0002431	.0022607	0.11	0.914	-.0041931	.0046793
lner	-.0069219	.0027297	-2.54	0.011	-.0122784	-.0015654
lngdp	.003041	.0021524	1.41	0.158	-.0011825	.0072645
lnte_ta	.0126972	.0059758	2.12	0.034	.0009709	.0244234
_cons	-.0136806	.0129745	-1.05	0.292	-.0391402	.0117791

Table 12: Hausman Test for fixed and random effects - model specification

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnhstat	.0087994	.0094967	-.0006972	.
lner	-.0721418	-.0851557	.0130138	.0015519
lngdp	-.0100739	-.0101668	.0000929	.
lnte_ta	.2582355	.2667046	-.0084691	.0029295

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       76.92
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

Notes

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