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Price and Non-Price Competition Interactions: Implicit Pricing of Network Size and Differentiation Effects

Jared Osoro and Kiplangat Josea[1]

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Abstract

Contrary to predictions that brick-and-mortar banking declines with increased financial innovations and technological adoptions, bank branch network between 2006 and 2018 has tripled and ATM networks have increased four-fold. In this paper, we examine whether network convenience matter for price competition. Using a panel data framework over the 2006 to 2019 period for thirty-eight commercial banks, we find that non-price competition indicators matter for the bank's pricing behaviour. In particular: (i) the provision of an extensive branch network is associated with a higher operating costs per unit of deposits, a 'shadow price' of deposits, but is not directly priced in the case of ATMs network; (ii) the effect of network convenience on the deposit rate is negative for both bank branch network and ATMs network albeit insignificant, while the a higher deposit to branch network ratio is associated with a significant reduction in the deposit rate and but seems to be offset by a higher labour to branch network ratio, with the net effect being positive thus suggesting that deposit rates tend to rise with increased network convenience; (iii) a more extensive branch network and a higher labour-to-branch staffing ratio are significantly associated with higher loan rate, while inversely and significantly associated with a higher deposit-to-branch network ratio suggesting that the benefits of higher branch output productivity (and revenues) is passed on to borrowers in the form of a lower loan rates; (iv) differences in bank branch and ATMs significantly affects fee income albeit inversely in the case of branch network and positively in the case of ATMs network.

Keywords: Banks, Competition, Branch, ATMs, and Pricing Behaviour

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1.0 Introduction

In recent decades, the Kenyan banking industry has undergone substantial structural transformations. In its evolution, two contrasting trends have emerged. On the one hand, after years of technologically-enabled financial innovations and enhanced contestability of markets[2], the branch network has not lost importance and continues to an important distribution channel. Branche network has risen three-fold in absolute numbers and doubled from 3 branches in 2006 to 5 branches in 2018, contrasting with widespread expectations of its declines as financial innovations become entrenched. ATM network in absolute number increased four-fold from 617 in 2006 to 2459 ATMs as of December 2019. It tripled from 3 ATMs per 100,000 inhabitants to 9 ATMs over the same period in per inhabitant terms. On the other hand, it has witnessed episodes of shifting market leadership as banks pursue organic growth. These transformations are significantly widening the array of alternative distribution channels[3] and hence a more extensive outreach of financial products and services by maximising a bank's geographical reach.

Financial innovations and the branch and ATM networks (*network size* and *differentiation effects)*[4] while leading to increased geographical reach has provided an avenue for exploiting new growth opportunities while minimising portfolio risk through diversified markets. More importantly, these developments are shaping retail banking competition in innumerable ways. First, financial innovations and technology adoptions are rapidly increasing alternative delivery channels for financial services and products while also enhancing borrowers' screening through collection and processing information, thus mitigating adverse

2 Technologically-enabled financial innovations have resulted in the developments of new forms of delivery of financial products and services and seems to be eroding the comparative advantage associated with traditional channels. And since the birth of MPesa in 2006, a number of technologically-driven financial innovations have emerged. These include the widespread of electronic mode of payments, internet, and mobile banking as well as agency banking.

3 These developments have buttressed retail banking services delivery, by fostering economies of scale, and widening a bank's geographical reach of its services (Northcott, 2004, Corvoisier and Gropp, 2009).

4 One of the main features of the institutional structure that facilitates the creation and processing of information may be attributed to the branch network. By introducing branches in a certain geographical area banks can better obtain and process borrower-specific local information, and thus maintain the quality of their loan portfolio.

selection problems. Second, the diffusion of the branch and ATM network sizes shapes the competitive conditions of the banking system in a manner that is also affecting the pricing behaviour of commercial banks significantly. For instance, the decision to open a new branch or install an ATM can affect a competitor bank's behaviour, thus treating them as exogenous could bias the price-cost margins and the degree of market competition.

The diffusion of both branch and ATM network remains a strategic variable that affects the extent of market competition (Kim and Vale, 2003; Carbo et al., 2009). While branching is among the way banks seek to retain market power, it also improves competitive conduct by decreasing market power[5]. Importantly, since the branch network proxies for bank size, a bank's branch expansion strategy changes can lead to rival's response function changing. In Spain, for instance, Carbo *et al*. (2004) find that an additional one branch expansion by a bank leads to 1.4 branch creation by its rivals, on average. Thus, branch banking and ATM network expansion. According to the contestable markets' theory[6], bank's competitive behaviour is related to the underlying structure and market entry and exit barriers and their intensity which could also be inferred from the expansion and contraction of the branch and ATM network.

The implications of the co-existence between technologically-enabled financial innovations and branch network diffusion are not well understood, yet they have significant consequences for bank competition. More importantly, while non-price and price competition co-occurs, relatively little research, especially in an emerging economy context, has examined the simultaneity of the interactions. Thus, with this consolidation-financial innovations-diffusion trend[7], several important questions arise to which significant attention is emerging with a significant amount of research effort devoted to understanding its implications on the competition dynamics.

In this paper, we ask the question: does the diffusion of branch network and alternate distribution channels, especially ATM network matter for price competition? Much of the literature on bank competition dynamics have focused on price competition dynamics[8]. The banking competition literature in Kenya presents peculiarities: it has focused mainly on price competition (Mwega, 2011; Gudmundsson, Ngoka and Odongo,

5 This arises as a result of increased effective size of the market and ensures uniform pricing across remote and urban locations thus benefiting consumers by increasing access to services. For a detailed review of literature on the subject see Northcott (2004).

6 The concept of market contestability has spanned a large theoretical and empirical literature covering many industries. The basic idea of market contestability is that, on the one hand, there are several sets of conditions that can yield competitive outcomes, with a competitive outcome possible even in concentrated systems. On the other hand, collusive actions can be sustained even in the presence of many firms.

7 The consolidation pattern in other jurisdictions has often been accompanied by an opposite diffusion trend in the branch network (De Young et al. 2004; Alessandrini, Presbitero and Zazzaro 2008a)

8 A related empirical literature uses the Panzar-Rosse (1987) methodology based on estimating the factor price elasticities of firms' revenue functions to make inferences about the appropriate model of competition for a particular industry.

2013; Sanya and Gaertner, 2012; Mdoe, Omolo and Wawire, 2019; Kiemo and Kamau, 2019; Agung, Atiti and Kimani, 2019). This literature assumes that banks offer homogenous products; however, banks differentiate themselves in many ways - reputation, product packages, and the extensiveness and location of their branch networks (Northcott, 2004), which affect the extent of market competition.

Our paper, therefore, adds to a strand of emerging banking literature examining the role bank networks in influencing both price and non-price competition (Mester, 1987; Calem and Nakamura, 1995; Kim and Vale, 1997; Carbó, and Maudos, 2009; Valverde, and Humphrey, 2009; Pham, Talavera, and Tsapin, 2018) and observes that branch network has been used as a strategic nonprice variable in competition9. However, it diverges in that while these studies focus on developed and emerging economies, we focus on developing economies, and this distinction is critical given that differences in operating environment characterise these economies. We thus contribute to the ongoing debate on bank competition and the literature by quantifying the possible effects of non-price competition pricing behaviour of banks using panel data on 38 banks over the period 2006 to 2019. The rest of the paper is structured as follows.

The rest of the paper is organised as follows. In Section 2, we review the literature of studies focussing on competition - price and non-price –outside the Kenyan banking. Section 3 presents the empirical models. Section 4 discusses the data and empirical specifications adopted, while Section 5 discusses the empirical results. Finally, Section 6 concludes.

9 There is also some empirical work on the effect of branching on service availability (eg Evanoff 1988) and on the determinants of banks' branching decisions (eg Buono and Eakin 1990, Barros 1995).

2.0 Kenyan Banking Sector: Stylised Facts

The banking system in Kenya comprises commercial banks and microfinance banks that the Central Bank of Kenya (CBK) regulates. At the end of 2018, the banking sector comprised 43 institutions, out of which 42 were commercial banks – with 40 privately owned and government majority ownership in three institutions[10], 1 mortgage finance company, 9 representative offices of foreign banks, 13 microfinance banks. More importantly, the Kenyan financial system is bank-lend, with the sector's assets standing at Ksh. 4.4 trillion.

As Table 1 shows, two trends emerge when examining the banking system's evolution over the last decade. First, technologically-enabled financial innovations have co-existed with rapid bank network diffusion. The number of bank branches has risen three-fold and two-fold for ATM networks, contrary to expectations that with financial innovations and technological adoptions picking traction, brick-and-mortar banking declines. It can further be seen that the ratio of ATMs to bank branch network has remained relatively stable, suggesting that as ATM network grows so does the bank's branch network.

The penetration ratio increased, on the one hand, branch networks per 100,000 adults doubled. Even so, post-2015 growth in the branch network slowed as a result of rationalisation of distribution channels, amidst a challenging macroeconomic environment and more importantly exacerbated further by policy distortions that capped interest rates and set floors on deposit rates in 2016. The ATM network tripled from 3 ATMs per 100,000 adults in 2006 to 9 ATMs in 2018. More importantly, the ATM network has increased even faster than the number of the branch network. Second, the level of competition has also been increasing. Asset concentration index based on the over the period 2006-2017 declined from

10 Out of the 40 commercial banks, 25 of them are locally owned (i.e. controlling shareholders are domiciled in Kenya) and 15 were foreign owned.

62.19 in 2006 to 52.91 in 2017, due to the continuous market and regulatory-driven reforms. The lending-deposit spread has also been declining. These dynamics have significant consequences for bank competition.

Table 1. Kenyan Banking Sector Stylized Facts

	No. of Branches[a]	Branches (per 100,000 adults) [b]	ATMs (per 100,000 adults) [b]	ATMs[a]	ATM to Branch Ratio[c]	5-bank asset concentration [d]	Bank concentration (%)[d]	Bank lending-deposit spread [d]	Bank net interest margin (%)[d]
2006	575	2.68	2.91	617	1.07	62.19	49.24	8.5	8.36
2007	740	3.49	4.63	833	1.13	65.09	51.59	8.18	8.16
2008	887	4.05	5.9	1187	1.34	65.4	48.01	8.71	6.41
2009	996	4.34	7.15	1643	1.65	62.62	44.09	8.84	7.42
2010	1063	4.64	8.76	1851	1.74	61.58	42.54	9.81	8.16
2011	1161	4.9	8.96	2074	1.79	59.76	40.21	9.42	8.18
2012	1272	5.17	9.36	2225	1.75	54.6	37.79	8.15	8.07
2013	1342	5.26	9.45	2372	1.77	52.8	35.6	8.67	9.56
2014	1443	5.46	9.61	2503	1.73	48.65	33.48	8.14	8.47
2015	1523	5.58	9.68	2563	1.68	55.79	40.41	6.9	6.31
2016	1541	5.37	9.16	2613	1.7	53.53	37.38	7.87	8.96
2017	1518	5.22	9.45	2591	1.71	52.91	36.6	5.99	9.42
2018	1505	5.03	9.2	2546	1.69	..	..	..	..

Source: [a]Annual Reports of the CBK, [b]World Development Indicators, [d]computations based on data from CBK, and [d]Global Financial Development.

Notes: .. implies that the data points are not available.

3.0 Literature Review

Two strands of prior research have addressed questions related to these issues. One strand is the decomposition of the interest rate spreads, structure-conduct-performance" paradigm based on the bank concentration. These regulatory indicators measure the banking sector's contestability and market power based on the "new empirical industrial organisation" literature. The other is literature focusing on price competition using either the structural approach or the non-structural approaches. On the other, a strand of literature examining non-price competition and its interaction with price-competition, albeit non-current exists.

In this section, we review the developments on the two fronts. First, this paper relates to the literature focusing on price competition, focusing on either a structural or non-structural approach. The structural approach focuses on either the deposit or loan market structure based on the market concentration index and the Herfindal-Hirschman Index (HHI) approach or non-structural measures, including the Panzar and Rosse (1987) H-statistic[11], loan or deposit interest margins, and Lerner indices. In the Kenyan context, five studies using the Panzar and Rosse (1987) H-statistic are notable (Mwega, 2011; Sanya and Gaertner, 2012; Gudmundsson, Ngoka and Odongo, 2013; Kiemo and Kamau 2020; Agung, Atiti and Kimani, 2020) and point a banking sector characterised by monopolistic competition.

Mwega (2011) examined commercial banks' competitiveness and efficiency for the period 1998 and 2008 and found that a decline characterised the Herfindahl-Hirschman index (HHI), a measure of the extent of market power. It also established that the H-statistic stood at 0.38 percent and using a random-effects panel estimator further showed that competition is affected by factor input prices. Sanya and Gaertner (2012) also found the H-statistic of the banking

11 The H-statistic ranks current competitive behaviour on a scale from 1.0 (perfect competition) to less than or equal to 0.0 (monopoly) based upon the degree to which changes in input prices are reflected in contemporaneous changes in unit revenues. While intermediate values can signal more or less competition, there is no guideline regarding the point at which a sufficiently competitive market becomes an insufficient one

sector in Kenya to be 0.60 percent and is influenced by structural and socio-economic factors. In particular, they find that institutional structure, level of economic development, inflation, and market size, market structure and other market contestability indicators affect the degree of competition. In contrast, foreign banks in the region, a proxy for market contestability, are established not to be associated with higher competition[12].

Similarly, Gudmundsson, Ngoka and Odongo (2013) using a sample of 36 Kenyan commercial banks over 12 years from 2001 to 2011 finds the industry as being monopolistically competitive using both the Lerner Index and the Panzar and Rosse H-statistic. They further, using a fixed-effects panel estimator finds that capital has a significantly positive effect on competition. They also document a positive relationship between returns on equity, a proxy for stability, thus providing support favouring capital regulation in improving bank's performance and financial stability.

Further, Kiemo and Kamau (2019) used a sample of 37 commercial banks over the period 2001 and 2017 to evaluate the Kenya banking sector's efficiency and competitive dynamics under a three-stage model. In the first stage, they examine bank efficiency using a non-parametric Data Envelopment Analysis (DEA) and finds that over the period, efficiency stood at 69 per cent and more intriguingly, has been on the rise. In the second stage, the estimate of the competition level using the Panzar-Rosse (P-R) H-statistics finds the sector to be monopolistically competitive with the H-statistic estimate established to be 0.59. They also find that managerial efficiency influences the extent of competition. Agung, Atiti and Kimani (2019), examine the competition-stability nexus and find that the banking sector is monopolistically competitive, and that stability is positively associated with competition, supporting the competition stability nexus.

More recently, these price-based competition indicators have been augmented with non-price measures of competitive behaviour under the assumption that banks may substitute one for the other in certain instances. Banking literature examining the role of bank networks in influencing both price and non-price competition remains scant. Mester (1987) and Calem and Nakamura (1995) examine the competitive effects of branching versus unit banking strategies in the United States and find that branching tends to lead to more competitive outcomes because banks become less geographically differentiated form each other. Kim and Vale (1997) investigate the role of branches for competition in the Norwegian credit market and find that the branch network has been used as a strategic nonprice variable in competition[13].

12 Which they argue is they are often concentrated to big corporations hence leaving out SMEs which constitute a significant segment of these respective economies.

13 There is also some empirical work on the effect of branching on service availability (eg Evanoff 1988) and on the determinants of banks' branching decisions (eg Buono and Eakin 1990, Barros 1995).

Yakhlef (2001) examined the internet and bricks-and-mortar bank branches complementarity or substitutability among Swedish banks. The study establishes that even though branch banking trends declined overall with the rise of internet banking, its co-existence was efficiency-enhancing with internet banking adoption as a strategic device for business transformation. Kim and Vale (2001) showed that loan demand in Norway is affected by the availability of a bank's own and a rival's branch network. Since a branch network approximates bank size, changes by one bank can lead rivals to respond. In Spain, Carbó et al. (2004) show that an increase in a bank's branch network triggers an increase in a competitor's branching network.

Corvoisier and Gropp (2002) use a European dataset to examine the relationship between concentration and loan pricing while controlling for competitive conditions, cost structures, and risk. Different banking products may be affected differently by concentration; they develop different concentration and price measures for each of four products: loan, demand, savings, and time deposits. They find that increased concentration is associated with less-competitive prices in the loan and demand deposit markets, but not for the other products. Different product markets may be affected differently by concentration. Carlson and Mitchener (2009) established that branch banking, using state-level data on national banks during the 1920s and 1930s in the U.S, finds that it increases banking system competition by forcing weak banks to exit.

Carbó and Maudos (2009) estimated the intensity of price and non-price competition in banking in Spain, and Valverde, and Humphrey (2009) studied the role of technological innovation in banking, especially the shift to ATMs and implicit pricing of the network convenience in Spain. Carlson and Mitchener (2009) use a dataset of Californian commercial banks, considered to be pioneers of large-scale branching in the 1920s and 1930s, to examine the effect of branch banking as a device for discipline and more importantly on its influence on competition and banking system stability. They find that branch banking was associated with increased bank competitiveness as banks took concerted efforts to improve efficiency and profitability, by reducing administrative costs relative to other expenses and shifting their portfolios away from securities to loans, characterised by higher returns. In turn, they observe that these developments led to improved banking system's stability.

Coccorese (2012) find that among Italian banks over the period 1995 and 2009, finds that single-stage specifications underestimate the degree of market competition in the market and assert while overinvestment in branch network is used as a strategy of keeping high prices, it is also used as a way of accommodating entry of new players in a given jurisdiction. Finally, Pham, Talavera, and Tsapin (2018) studied the interaction between branch network structure and lending behaviour among Ukrainian banks.

Overall, the reviewed studies, especially in the Kenyan context, reveal a typical focus on prices and priced-services in assessing the degree of market competition and largely ignore fundamental changes in the distribution of financial services primarily with the advancement in bank branch and ATM network developments. These channels are changing the market structure by enhancing competitive pressures and the degree of contestability.

4.0 Data, Variables and Methodology

Our analysis is based on unbalanced panel dataset constructed on an annual basis and covers the entire Kenyan banking sector. Our sample includes a panel of 38 commercial banks over the period 2006 to 2019. Bank-level data is obtained from annual audited and publicly published financial statements from both the balance sheet and income statements. Data on ATMs is obtained from annual bank supervision reports of the Central Bank of Kenya (CBK) albeit at an industry level. The policy rate (central bank rate) data is also obtained from the central bank MPC meeting press releases, and a weighted average for the year estimated, data on the real GDP is obtained from the various economic surveys published by the Kenya National Bureau of Statistics (KNBS). Table 3 below presents the operationalisation of the variables.

Table 2. Operationalisation of Variables

Variable	Operationalisation
Price Competition indicators (Independent variables)	
Operating Cost-to-deposit	Expressed as operating cost (*OC*), composed of labour, physical capital, and material expenses divided by the value of deposits (Q_{dep}), and represents the operating cost 'shadow price' of deposits (OC/Q_{dep})
Deposit rate	Expressed as interest costs or expenses (*IC*) is divided by the value of loans (Q_{loan}), IC/Q_{dep}
Loan rate	Expressed as loan revenue (*LREV*) is divided by the value of loans (Q_{loan}), $LREV/Q_{loan}$
Fee Income-to-deposit	Expressed as a ratio of fee income *(Fee Income)* to deposits (Q_{dep}) and it approximates a composite 'price' for fee-based services *(Fee Income)*/Q_{dep}
Non-price competition indicators (Independent variables)	
No. of branches	Number of bank branches network (Q_{br})
No. of ATMs	Industry aggregate of the ATMs network (Q_{ATMs})
Deposit-to-branch ratio	Expressed ratio of the value of deposits (Q_{dep}) to the number of bank branches (Q_{br})

Variable	Operationalisation
Labour-to-branch ratio	Expressed ratio of the labour expenses (i.e. wages and salaries) to the number of bank branches, (Q_{br})
Control Variables (Bank-level and aggregate (macroeconomic) indicators)	
Herfindal-Hirschman Index	Expressed or computed as the industry deposit Herfindal-Hirschman Index (*HHI*)
ATM-to-branch ratio	Industry aggregate of the ATMs network (Q_{ATMs}) to bank branches network (Q_{br})
Price of labour	Expressed ratio of the labour expenses (i.e. wages and salaries) to the number of bank employees (P_l)
Price of capital	Expressed ratio of the non-interest income to the total assets (P_k)
Security holdings to loans ratio	Expressed ratio of the security holdings to the total loans (*SHLR*)
Policy rate	Weighted Central Bank rate of the respective months in a year (*MR*)
Real GDP	Real GDP in Billions (*RGDP*)

4.1 Descriptive Statistics

Table 3 presents the descriptive statistics of the price and non-price competition indicators and the control variables over the 2006 to 2019 period used in the analysis. The mean of operating cost-to-deposit ratio, a proxy for the shadow price of deposits is 0.09 (i.e. 9 per cent) and ranges from -0.08 and 0.40. The average loan rate is 0.12 (i.e. 12 per cent), while the average deposit rate is 0.05 (i.e. 5 per cent) and 0.03 for fee income per unit of deposits. The average number of bank branches is 0.31 and ranges between 1 to 199. Average ATM network is 1990 and ranged between 617 to 2613. The average total deposit to branch ratio ranges from 114 to 21,874 with an average of 2,118. The average labour to branch staffing ratio is 52 and ranges from 4 to 513. The Herfindahl-Hirschman Index (HHI), a measure of deposit concentration ranges from 619 to 812 with a mean of 702. The ATMs to branch ratio has been stable, ranging from 5 to 1557, with an average of 211. The mean price of labour ranges is 2.23, while the average price of capital is 0.05. The ratio of security holdings to loans ratio ranged between 0.00 to 0.86, with an average of 0.26. The policy rate (CBR), a benchmark rate that influences the deposit and loan rates' movements, averaged 9.61 per cent. Finally, the average gross domestic product, in real terms, stood at 3.32 trillion.

Table 3. Summary of Statistics

Variable	Mean	Std.Dev.	Min	Max
Operating Cost-to-Deposit Ratio	0.09	0.06	-0.08	0.40
Loan Rate	0.12	0.05	0.01	0.28
Deposit Rate	0.05	0.03	0.02	0.09
Fee Income-to-Deposit Ratio	0.03	0.03	0.00	0.39
No. of Branches	30.52	41.42	1.00	199.00
No. of ATMs	1990.11	668.63	617.00	2613.00
Deposit-to-Branch Ratio	2118.47	2624.99	114.08	21873.57
Labour-to-Branch Staffing Ratio	52.26	60.14	3.85	513.21
Herfindal-Hirschman Index	702.43	63.90	619.05	812.01
ATM-to-Branch Ratio	210.91	226.32	5.19	1556.67
Price of Labour	2.23	1.54	0.14	15.32
Price of Capital	0.05	0.02	0.01	0.19
Ratio of Security holdings to Loans Ratio	0.26	0.16	0.00	0.86
Policy Rate (CBR)	9.61	2.20	6.36	16.50
Real GDP in Billions	3320.00	1220.00	1250.00	5050.00

Notes: The table reports summary statistics for 506 bank-level observations from 2006 to 2019.

As a first look at the relationship between bank branch network size, a non-price competition strategic variable and the deposit and loan rate, price competition indicators, the main focus of this paper, we present a scatter plots of bank branch network size and the deposit and loan rate (Figure 1). Two striking but theoretically consistent features are worth noting. On the one hand, bank branch network size is inversely related to deposit rates, and on the other, it is positively correlated to loan rate albeit low suggesting while it plays a role in influencing pricing, other factors seem at play and thus the importance of adding controls for those observable differences in deposit and loan rates.

Figure 1: Scatter Plots of Bank Branch Network Size and Deposit and Loan Rate

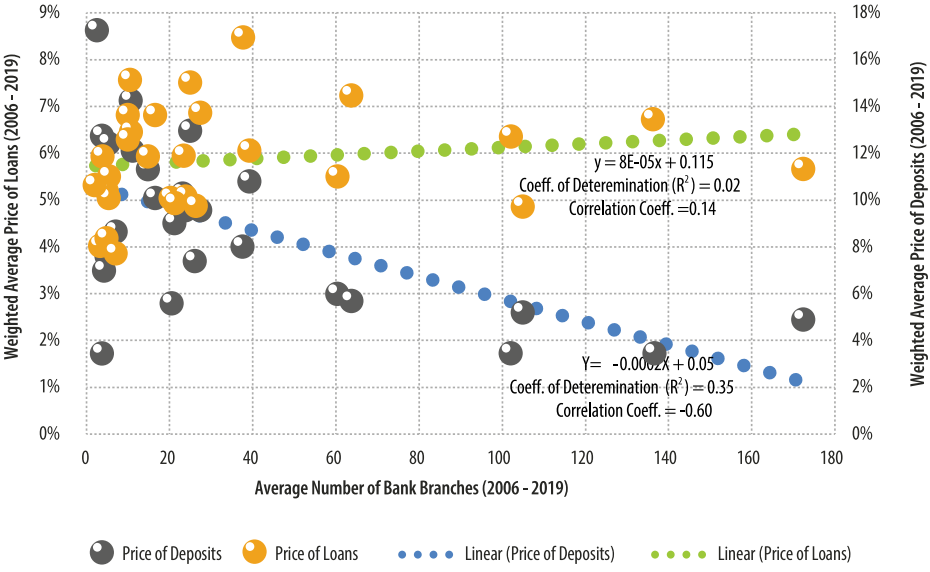

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Table 3. Pairwise Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Operating Cost-to- Deposit Ratio	1.00														
(2) Loan Rate	0.30	1.00													
(3) Deposit Rate	0.04	0.70	1.00												
(4) Fee Income-to-Deposit Ratio	0.52	0.08	-0.17	1.00											
(5) No. of Branches	0.13	0.03	-0.29	0.21	1.00										
(6) No. of ATMs	-0.07	0.01	0.19	-0.21	0.20	1.00									
(7) Deposit-to-Branch Ratio	-0.34	-0.23	-0.15	-0.19	-0.12	0.17	1.00								
(8) Labour-to-Branch Staffing Ratio	-0.17	-0.21	-0.23	-0.06	0.00	0.16	0.91	1.00							
(9) Herfindal-Hirschman Index	0.12	-0.12	-0.17	0.15	-0.14	-0.81	-0.09	-0.08	1.00						
(10) ATM-to-Branch Ratio	-0.20	-0.14	0.22	-0.15	-0.48	0.10	0.32	0.24	-0.09	1.00					
(11) Price of Labour	-0.20	-0.20	-0.12	-0.18	-0.06	0.34	0.87	0.90	-0.19	0.32	1.00				
(12) Price of Capital	0.26	0.12	-0.08	0.64	0.11	-0.18	0.15	0.20	0.14	-0.02	0.11	1.00			
(13) Security holdings-to-Loans Ratio	-0.40	-0.14	-0.11	-0.22	-0.02	0.10	0.27	0.20	-0.10	0.08	0.22	0.31	1.00		
(14) Policy Rate (CBR)	0.00	0.24	0.27	-0.11	0.03	0.19	0.02	0.02	-0.18	0.00	0.05	-0.04	0.00	1.00	
(15) Real GDP in Billions	-0.049	-0.046	0.154	-0.195	0.201	0.954	0.193	0.175	-0.691	0.092	0.365	-0.17	0.11	0.116	1

4.3 Econometric Model Specification

To examine the effect of non-price competition on bank's pricing behaviour, we, therefore, estimate, a set of four equation; relating to; the operating cost to deposit function (Equation 1), a proxy for the shadow price of deposits, deposit rate function (Equation 2), loan rate function (Equation 3) and the fee-income to deposit function (Equation 4) outlined below.

$$\ln(OC/Q_{dep}) = \alpha_0 + \sum_{(0=br)}^{atm} \alpha_0 \ln Q_0 + 1/2 \sum_{(0=br)}^{atm} \sum_{(m=br)}^{atm} \alpha_{(0,m)} \ln Q_0 \ln Q_m + \sum_{(p=l}^{k} \alpha_p \ln P_p + 1/2 \sum_{(p=l}^{k} \alpha_0 \ln Q_0 \sum_{(p=l)}^{k} \alpha_{(p,n)} \ln P_p \ln P_n + \sum_{(p=l)}^{k} \alpha_{(p,br)} \ln P_p \ln Q_{br} + \sum_{(p=l)}^{k} \alpha_{(p,atm)} \ln P_p \ln Q_{atm} + \alpha_{(dep,br)} (\ln Q_{dep} - \ln Q_{br}) + \alpha_{(labour,br)} (\ln Q_{labour} - \ln Q_{br}) + \alpha_{mix} Q_{mix} + \alpha \ln HHI + \varepsilon \quad \ldots\ldots (1)$$

$$\ln(OC/Q_{dep}) = \beta_0 + \sum_{(0=br)}^{atm} \beta_0 \ln Q_0 + 1/2 \sum_{(0=br)}^{atm} \sum_{(m=br)}^{atm} \beta_{(0,m)} \ln Q_0 \ln Q_m + \beta_r \ln P_r + 1/2(\beta_{r2}) (\ln P_r)^2 + \beta_{(r,br)} \ln P_r \ln Q_{br} + \beta_{(r,atm)} \ln P_r \ln Q_{atm} + + \beta_{(dep,br)} (\ln Q_{dep} - \ln Q_{br}) + \beta_{(labour,br)} (\ln Q_{labour} - \ln Q_{br}) + \alpha_{mix} Q_{mix} + \beta \ln HHI + \varepsilon \quad \ldots\ldots (2)$$

Whereas the provision of non-priced services possibly alters the deposit rates, it also affects bank revenues by attracting depositors with higher incomes who offer loan opportunities and place a higher value on non-priced services than others[14]. The potential influences may be determined from the following loan rate function

$$\ln(LREV/Q_{dep}) = \theta_0 + \sum_{(0=br)}^{atm} \theta_0 \ln Q_0 + 1/2 \sum_{(0=br)}^{atm} \sum_{(m=br)}^{atm} \theta_{(0,m)} \ln Q_0 \ln Q_m + \theta_{pdep} \ln P_r + 1/2 (\theta_{pdep2}) (\ln P_{pdep})^2 + \theta_{(pdep,br)} \ln P_{pdep} \ln Q_{br} + \theta_{(pdep,atm)} \ln P_{pdep} \ln Q_{atm} + \theta_{(dep,br)} (\ln Q_{dep} - \ln Q_{br}) + \theta_{(labour,br)} (\ln Q_{labour} - \ln Q_{br}) + \theta_{mix} Q_{mix} + \theta_{ind} \ln RDGP + \theta \ln HHI + \varepsilon \quad \ldots\ldots (3)$$

Lastly, the fees for priced deposit and loan services may also be adjusted to compensate banks for the provision of an extensive branch and ATM networks.

14 As a result, depositors that value greater ATM access, and more convenient branch offices maybe less concerned with the loan rates and service fees they may pay relative to depositors in other banks.

$$\ln(\text{FeeIncome}/Q_{dep}) = \emptyset_0 + \sum_{(0=br)}^{atm} \Phi_0 \ln Q_0 + 1/2 \sum_{(0=br)}^{atm} \emptyset_{(0,m)} \ln Q_0 \ln Q_m + \sum_{(p=l)}^{k} \emptyset p \ln P_p + 1/2 \sum_{(p=l)}^{k} \sum_{(n=l)}^{k} \emptyset_{(p,n)} \ln P_p \ln P_n + \sum_{(p=l)}^{k} \emptyset_{(p,r)} \ln P_{-p} \ln Q_{br} + \sum_{(p=l)}^{k} \emptyset_p \ln P_p Q_{atm} + \theta_{dep,br} (\ln Q_{dep} - \ln Q_{br}) + \emptyset_{labour,br} \ln Q_{labour} - \ln Q_{br} + \varepsilon \ldots\ldots\ldots (4)$$

Where;

- OC/Q_{dep} is operating cost, (OC) composed of labour, physical capital, and material expenses divided by the value of deposits (Q_{dep}) , and is a proxy of the 'shadow price' of deposits.
- IC/Q_{dep} is interest expenses (IC) is divided by the value of deposits (Q_{dep}), and is a proxy for the deposit rate.
- $LREV/Q_{dep}$ is interest income ($LREV$) is divided by the value of loans (Q_{loan}), a proxy for the loan rate
- (*Fee Income*)/Q_{dep} is the ratio of fee income (*Fee Income*) to total deposits (Q_{dep}), a proxy for composite 'price' for fee-based services.
- Q_{br}, Q_{atm} represents the (a,m), number of bank branches (Q_{br}) and ATMs (Q_{ATMs}).
- P_{dep} is the bank's deposit rate, computed as a ratio of interest expenses to total deposits, (Q_{dep}).
- P_l, P_k represents the (p,n) operating cost inputs – the average price of labour (P_l)and physical capital (P_k); these are the cost shares for the labour input.
- Q_{dep}, Q_{labour} is the value of deposits (Q_{dep}) and the number of workers[15] (Q_{labour})which, along with the number of branches .
- (lnQ_{dep}- lnQ_{br}) and (lnQ_{labour} - lnQ_{br}) in Equation 1-4 represents the deposit-to-branch productivity and the labour-branch staffing ratios, respectively.
- Q_{mix} represents the ratio of loans to security holdings, and is a measure of portfolio diversification
- *HHI* represents the Herfindahl-Hirschman Index, is calculated using the deposits of the banking system, and is a proxy for the degree of competition among financial institutions.
- *RGDP* is the gross domestic product which affects loan demand.

15 Labour is the number of staff employed by each bank. It is natural to consider that banks employing more staffs can lend much greater amounts of money. Thus, the coefficient of Labour will take positive sign. Labour is converted into a natural logarithm.

4.4 Findings and Discussions

Results obtained from estimating Equation 1-4 above are presented in Table 4, and the detailed results presented in Appendix A1. The evidence obtained indicates that the variation in the size of either bank branch and ATMs network is associated with a reduction in the operating costs per unit of deposits, a 'shadow' price of deposits, albeit insignificantly for branch network after controlling for deposit-to-branch network ratio, labour-to-branch staffing ratio, along with portfolio diversification, factor input prices as well as market concentration influences on operating expenses specified in equation (Equation 1) above. A higher deposit-to-branch ratio significantly reduces unit operating costs while employing more labour per branch raises these costs. Although the signs of these two are expected, the almost similar magnitude of their elasticities is not, and in effect, one offsets the other. Higher market concentration (HHI), on the other hand, is significantly associated with higher operating costs.

The effect of network convenience on the deposit rate (Equation 2) is negative for both bank branch network and ATMs network albeit insignificant thus suggesting that even though branch network could be seen as an avenue for higher deposit mobilisation, it does not affect its pricing. Also, having a higher deposit to branch network ratio is associated with a significant reduction in the deposit rate and seems to be offset by higher labour to branch network ratio. This suggests that the ability to raise more deposits per branch capital outlay – which also generates more significant revenues per branch – is passed onto depositors. Indeed, the net effect - the difference between the coefficients on deposits to-branch ratio, and the labour-to-staffing levels-is positive, suggesting that the deposit rates tend to rise in tandem. Further, the effect of market concentration as reflected by the coefficients on HHI implies that an increase in market concentration reduces deposit rates. That said, the low values in Table 4, it is clear that explaining the variation in the deposit rate is low and even with the inclusion of the policy rate, that is the central bank rate which is a proxy for the market rate, and thus other factors not accounted for in the model plays a role too.

Looking at the loan rate variations, a more extensive branch network and a higher labour-to-branch staffing ratio are significantly associated with higher loan rate, while inversely and significantly associated with a higher deposit-to-branch network ratio, market concentration, but insignificantly associated with the ATM network. The inverse relationship between the loan rate and deposit-to-branch network ratio suggests that greater branch output productivity (and revenues) is passed on to borrowers in the form of a lower loan rate, and more importantly, the estimated model is modest in explaining the variations with the values at 0.54. Finally, it is also evident that differences in the bank branch and ATMs significantly affect fee income, albeit inversely in the case of branch network and positively in the ATMs network. Further, the deposit-to-branch network ratio and labour-to-staff branching ratio significantly affect revenues from fees; these influences are opposite in sign and appear to largely offset each other as the differences in their elasticity values are small. These results, of course, given our simple estimation framework, are suggestive rather than definitive.

Table 4. Effect of Non-Price Competition on Bank Pricing Behaviour (2006-2019)

	Branches	ATMs	Deposit-to-Branch Ratio	Labour-to-Branch Staffing Ratio	HHI	N	R^2	Adj. R^2
Operating Cost-to-deposit ratio	-0.006	-0.048*	-0.098***	0.103***	0.074***	506	0.565	0.517
	(-0.20)	(-1.79)	(-19.05)	(13.31)	(3.17)			
Deposit rate	-0.238	-1.305	-0.226***	0.335***	-1.326***	506	0.271	0.197
	(-0.66)	(-0.77)	(-2.65)	(3.62)	(-2.74)			
Loan rate	0.811***	-0.190	-0.265***	0.194***	-1.280***	506	0.541	0.492
	(3.68)	(-1.43)	(-7.01)	(4.55)	(-7.17)			
Fee-income to deposit ratio	-0.699*	0.738**	-0.518***	0.621***	-0.627*	506	0.571	0.524
	(-1.80)	(1.98)	(-7.38)	(5.88)	(-1.96)			

Note: t statistics in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The functions are estimated by a panel fixed estimator, and the estimator's choice based

on the Hausman test performed.

5.0 Conclusions

Contrary to predictions that brick-and-mortar banking declines with increased financial innovations and technological adoptions, bank branch network between 2006 and 2018 has tripled and ATM networks four-fold. The implications of the continued co-existence between technologically-enabled financial innovations and branch network diffusion are not well understood, yet they have significant consequences for bank competition. Further, while studies on banking competition in the Kenyan context typically focus on prices and priced-services in assessing the degree of market competition, they mostly ignore fundamental changes in the distribution of financial services primarily with the advancement in bank branch and ATM network developments. These channels are changing the market structure by enhancing competitive pressures and the degree of contestability.

This paper examines whether the diffusion of branch network and alternate distribution channels, mainly, the ATM network matter for price competition. Using a panel data framework for commercial banks in Kenya over the 2006 to 2019 period, we show differences in bank branch and industry ATM network matter for bank pricing. We find that non-price competition indicator, especially bank branch and industry ATM network, matter for banks' pricing behaviour. In particular we show that; (i) while the provision of an extensive branch network is associated with a higher operating costs per unit of deposits, a 'shadow' price of deposits, it is not directly priced in the case of ATMs network; (ii) The effect of network convenience on the deposit rate is negative for both bank branch network and ATMs network albeit insignificant, while the a higher deposit to branch network ratio is associated with a significant reduction in the deposit rate and but seems to be offset by a higher labour to branch network ratio, and the net effect being positive thus suggesting that deposit rates tend to rise with increased network convenience; (iii) we also find that a larger branch network and a higher labour-to-branch staffing ratio are significantly associated with higher loan rate, while inversely and significantly associated with a higher deposit-to-branch network ratio suggesting that the benefits of higher branch output productivity (and revenues) is passed on to borrowers in the form of a lower loan rates; (iv) iv) It is also evident that differences in bank branch and

ATMs significantly affects fee income albeit inversely in the case of branch network and positively in the case of ATMs network.

References

1. Agung, R., Atiti, F., & Kimani, S. (2020) Competition and Banking Sector Stability in Kenya. *Kenya Bankers Association-KBA Centre for Research on Financial Markets and Policy Working Paper Series*.
2. Allen, F. And D. Gale. (2000a). Comparing Financial Systems. Cambridge, MA: MIT Press.
3. Calem, P. And L. Nakamura. (1998). Branch Banking and the Geography of Bank Pricing. The Review of Economics and Statistics 80: 600–10.
4. Carbó, S., Humphrey, D., Maudos, J., & Molyneux, P. (2009). Cross-Country Comparisons of Competition and Pricing Power in European Banking. *Journal of International Money and Finance*, *28*(1), 115-134.
5. Carlson, M., & Mitchener, K. J. (2009). Branch Banking as a Device for Discipline: Competition and Bank Survivorship during the Great Depression. *Journal of Political Economy, 117(2), 165-210.*
6. Coccorese, P. (2012). Banks as 'Fat Cats': Branching and Price Decisions in a Two-Stage Model of Competition. *Journal of Economics and Business, 64(5), 338-363.*
7. Corvoisier, S., & Gropp, R. (2002). Bank Concentration and Retail Interest Rates. *Journal of Banking & Finance*, *26*(11), 2155-2189.
8. Corvoisier, S., & Gropp, R. (2009). Contestability, Technology and Banking. Working Paper.
9. Freixas, X. And J. Rochet. 1997.Microeconomics of Banking. Cambridge: MIT Press.
10. Gudmundsson, R., Ngoka-Kisinguh, K., & Odongo, M. T. (2013). *The Role of Capital Requirements on Bank Competition and Stability: The Case of The Kenyan Banking Industry*. Kenya Bankers Association-KBA Centre for Research on Financial Markets and Policy Working Paper Series.
11. Kiemo, S., & Kamau, A. (2020). Banking Sector Competition and Intermediation Efficiency In Kenya. *Kenya Bankers Association-KBA Centre for Research on Financial Markets and Policy Working Paper Series*.
12. Kim, M., Kliger, D., & Vale, B. (2003). Estimating Switching Costs: The Case of Banking. *Journal of Financial Intermediation*, *12*(1), 25-56.
13. Kim, M., Kristiansen, E. G., & Vale, B. (2005). Endogenous Product Differentiation in Credit Markets: What do Borrowers Pay for? *Journal of Banking & Finance*, *29*(3), 681-699.
14. Mester, L. J. (1987). Multiple Market Contact Between Savings and Loans: Note. *Journal of Money, Credit and Banking*, *19*(4), 538-549.
15. Mwega, F. (2011). The Competitiveness and Efficiency of the Financial Services Sector in Africa: A Case Study of Kenya. *African Development Review, 23(1), 44-59.*

16. Neven, D. J., Röller, L. H., & Zhang, Z. (2006). Endogenous Costs and Price-Cost Margins: An Application to the European Airline Industry. *Journal of Industrial Economics*, *54*(3), 351-368.

17. Northcott, C. A. (2004). *Competition in Banking: A Review of the Literature* (No. 2004-24). Bank of Canada. Working Paper No. 2004-24.

18. Pham, T., Talavera, O., & Tsapin, A. (2018). *Branch Network Structure and Lending Behaviour*. National Bank of Ukraine Working Paper No. 03/2018.

19. Sanya, S., & Gaertner, M. (2012). Assessing Bank Competition within the East African Community (No. 12-32). International Monetary Fund.

20. Ukka Vesala, J. (1998). *Delivery Networks and Pricing Behaviour in Banking: An Empirical Investigation Using Finnish Data*. Bank of Finland Discussion Paper No. 18/98.

21. Valverde, S. C., & Humphrey, D. B. (2009). Technological Innovation in Banking: The Shift to ATMs and Implicit Pricing of Network Convenience. *Financial Innovation in Retail and Corporate Banking*, 89.

22. Vesala, J. (2000). *Technological Transformation and Retail Banking Competition: Implications and Measurement*. Bank of Finland Discussion Paper No. 20/00.

23. Yakhlef, A. (2001). Does the Internet Compete With or Complement Bricks-and-Mortar Bank Branches? *International Journal of Retail and Distribution Management*.

Appendix

Table A1. Cost and Revenue Effects Associated with Non-Price Competition (2006-2019)

	(1)	(2)	(3)	(4)
	OC	lnPd	lnPloans	lnFIDR
Branches	-0.006	-0.238	0.811***	-0.699*
	(-0.20)	(-0.66)	(3.68)	(-1.80)
Automated Teller Machines (ATMs)	-0.048*	-1.305	-0.190	0.738**
	(-1.79)	(-0.77)	(-1.43)	(1.98)
Deposit-to-Branch Ratio	-0.098***	-0.226***	-0.265***	-0.518***
	(-19.05)	(-2.65)	(-7.01)	(-7.38)
Labour-to-Branch Staffing Ratio	0.103***	0.335***	0.194***	0.621***
	(13.31)	(3.62)	(4.55)	(5.88)
Herfindahl-Hirschman Index	0.074***	-1.326***	-1.280***	-0.627*
	(3.17)	(-2.74)	(-7.17)	(-1.96)
Interaction term (Branches * ATMs)	-0.012	0.043	-0.130***	-0.025
	(-1.56)	(0.54)	(-2.85)	(-0.25)
Price of labour	-0.092*			-1.071
	(-1.88)			(-1.60)
Price of capital	0.238***			0.078
	(4.19)			(0.10)
Interaction term (Price of labour * Price of capital)	0.007			-0.427**
	(0.48)			(-2.23)
Interaction term (Branches * Price of labour)	0.001			0.106
	(0.13)			(0.85)
Interaction term (Branches * Price of capital)	-0.037***			-0.534***
	(-4.08)			(-4.25)
Interaction term (ATMs * Price of labour)	0.022*			-0.076
	(1.88)			(-0.47)
Interaction term (ATMs * Price of capital)	-0.050***			0.458**
	(-3.09)			(2.05)
Security holdings to loans ratio	-0.009	-0.224	-0.180	-0.267
	(-0.56)	(-0.79)	(-1.48)	(-1.17)
Policy rate		-2.879	0.114**	
		(-0.59)	(2.20)	

	(1) OC	(2) lnPd	(3) lnPloans	(4) lnFIDR
Policy rate squared		-0.525		
		(-0.74)		
Interaction term (Branches * Policy rate)		0.009		
		(0.10)		
Interaction term (ATMs * Policy rate)		0.636		
		(0.88)		
Deposit rate			1.137***	
			(4.68)	
Deposit rate squared			0.087***	
			(5.21)	
Interaction term (Deposit rate * ATMs)			-0.115***	
			(-3.20)	
Interaction term (Deposit rate * Branches)			0.121***	
			(4.88)	
Real GDP			-0.195***	
			(-2.94)	
Constant	0.441	12.971	12.187***	2.160
	(1.63)	(0.97)	(7.32)	(0.58)
N	506	506	506	506
R^2	0.565	0.271	0.541	0.571
adj. R^2	0.517	0.197	0.492	0.524
F	42.179	15.504	41.393	43.208
Df	(50, 455)	(47, 458)	(49, 456)	(50,455)

t statistics in parentheses. * p<0.10, ** p<0.05, *** p<0.01

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