

Estimating Bank Substitutability in the Personal Transactional Account Market in SA*

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Abstract

Research into South African retail banking has sought to assess the level of competition in banking markets without accounting for the degree of substitutability between banks. We combine consumer survey data with a constructed dataset of bank prices to estimate South African customer demand for personal transactional accounts using a flexible choice model. We find evidence of consumer responsiveness to price increases, as well as evidence of bank substitutability between a relatively recent entrant and the incumbent banks. These results, when contrasted with insight from an 2006-2008 banking inquiry which found limited evidence of competitive outcomes, suggests an improvement in competition in the personal transactional account market over time.

1 Introduction

The study of competition in the personal transactional account (“PTA” hereafter) market has been subject to scrutiny by competition authorities in various regions such as South Africa, the United Kingdom and the EU.¹ A common concern is that this market is historically dominated by a small group of firms that exercise market power over product offerings. Limited customer switching, due to high switching and search costs has been identified as a contributor to this market power. An inquiry into the banking industry set up by the Competition Commission of South Africa (2008)

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¹In other regions transactional accounts may also be referred to as current or cheque accounts

proposed various ways to introduce greater consumer switching in this market. Underpinning these recommendations was the view that potential customer switching is critical to the intensity and nature of competition in markets (European Commission 2007b). The World Bank Group (2018) has also made recommendations aimed at facilitating consumer comparisons of various banks' PTAs. Along with this scrutiny by various institutions, there have been a number of academic articles that have sought to estimate the extent of competition in the South African banking industry. These studies have primarily sought to measure whether bank conduct is consistent with different types of market structures.

This study departs from existing literature and instead provides aims to assess potential for substitutability between banks in the South African PTA market. We do so using by estimating consumer demand for PTAs using a flexible demand model referred to as a paired combinatorial logit ("PCL" hereafter) choice model. This estimation approach provides direct evidence of the degree of substitutability between banks through the estimation of similarity parameters. These parameters are inversely related to correlation in the consumer utility gained from using certain banks' PTAs². Correlation in the consumer utility from using bank A or bank B's PTAs occur when consumers view those banks as closer substitutes. The higher this correlation is, the lower the estimated similarity parameter is estimated to be. It is through these similarity parameters that we're able to measure and test whether there is likely to be greater levels of substitution between certain banks than others. This methodological approach extends the multinomial logit model that assumes proportional patterns of substitution between alternatives. We place the 5 banks, largely accounting for all PTAs in South Africa³, into unique pairs of nests and estimate similarity parameters for banks within these nests. We later test whether we're able to statistically reject a hypothesis of non-correlated utilities for different pairs of banks' PTAs. Using the parameters estimated from this PCL approach, we estimate own-price and cross-price elasticities that take into evidence of bank substitutability.

Our results indicate that Capitec and FNB, as well as Capitec and Standard Bank are closer competitors than they are competitors with other banks. We also estimate own and price elasticities that reflect this competition. We also find evidence of consumer responsiveness to PTA price increases with **Nedbank customers being the most price sensitive, followed by Capitec and FNB.** These results are particularly interesting when read in conjunction with the Competition Commission of South

²[[cite Koppelman & Wen, Train, Yves and show how the similarity parameter can be estimated differently but that the package is one thing]]

³First National Bank, ABSA, Standard Bank, Nedbank and Capitec.

Africa (2008)’s market inquiry findings. The Competition Commission of South Africa (2008) found evidence that consumers were captive to banks thus conferring considerable market power to them. This captivity arose due to high switching and search costs. These were estimated to be high enough to make hypothetical small but significant non-transitory price increases profitable. The high switching and search costs were attributed to transport costs, the opportunity cost of the time used to communicate banking arrangements to the new bank and complicated PTA product offerings that made the comparison of PTAs difficult. Interestingly, the inquiry found that Capitec was operating on a competitive fringe at the time, but noted that they had the potential to be a competitor to the big-4 banks. Our results suggest that some of this potential may have been realised.⁴

Our paper contributes to the existing literature of competition in SA banking. However, our focus is aimed at assessing the substitutability between banks in a well-defined market for PTAs. This is different to existing South African banking studies that have largely sought to estimate the level of competition present in the banking industry (see Kasekende et al. 2009; Mlambo and Ncube 2011; Simbanegavi, Greenberg, and Gwatidzo 2015; Simatele 2015; Rapapali and Simbanegavi 2020). These studies use a variety of methodological approaches to assess how evidence of bank conduct can be used to determine which models of competition are reflected in the industry. The tested models of competition range from monopolistic, oligopolistic, monopolistically competitive to purely competitive. They find that the SA banking industry exhibits features of monopolistic competition. These results are expected. Firms that produce non-standardised products, as SA banks do, will necessarily have a degree of market power even in markets with competing firms, as is indicated by Chamberlain (1962)’s theory of monopolistic competition. Furthermore, this study restricts its attention to a well-defined market. Merger proceedings. Our focus on bank PTA substitutability, although not estimating a level of competition, provides results that could better inform a potential merger investigation in the PTA market or market inquiry investigation. Additionally, our empirical approach involves the creation of a unique dataset that pairs a set of PTA prices computed from publicly available bank marketing material with FinScope consumer survey data.

The rest of the paper is structured as follows. In Section 2 we provide a review of literature that assesses the degree of competition in banking markets in South Africa and other jurisdictions. In Section 3, we define the market we analyse and describe the data we use. Section 4 describes our

⁴Our analysis does not segment consumers into different income groups. It is possible that Capitec’s competitive presence may be concentrated at lower income levels.

estimation approach. Section 5 provides the estimation results and Section 6 concludes.

2 Literature review

There have been a number of studies that have provided estimated the extent of competition in the SA banking industry. The empirical approaches of their methods have relied in inferring the extent of competition through assessing bank conduct.⁵ These South African studies have relied on widely used techniques applied in the banking literature commonly referred to the Lerner index, Panzar-Rosse model and Boone Indicator (Lerner 1934; Rosse and Panzar 1977; Panzar and Rosse 1982; Panzar and Rosse 1987; Boone 2008). Estimates that rely on the estimation of structural demand models, of which this paper is one, are common in empirical industrialisation organisation (Mariuzzo, Walsh, and Whelan 2010) but have not been adopted more widely in the South African banking literature.

The Lerner index is a measure of the margin earned on the products it sells. It is expressed as the difference between the price of the product sold and its marginal cost divided by the price of the product (Lerner 1934). Under perfectly competitive conditions, a firm's price would be the marginal cost, resulting in a Lerner index of 0. More market power is conferred to the firm under less competitive conditions with the index reaching its highest possible value if the firm in question was a monopoly. Leon (2014) indicates that whilst this index has been known for years, it's application in the banking literature has been recent owing to the difficulty of estimating marginal costs. The Panzer-Rosse model is premised on the how much of an input price increase translates into total revenue increases (Rosse and Panzar 1977; Panzar and Rosse 1982; Panzar and Rosse 1987). Leon (2014) explains that the Panzer-Rosse model computes a statistic, referred to as an H-statistic, that is derived from the regression of firm revenue to input prices. The H-statistic is the sum of elasticities with respect to input prices (Leon 2014). In perfectly competitive or perfectly contestable markets an H-statistic would be equal to 1, where a 1% increase in input prices translates into a 1% increase in firm revenue (Shaffer 1982; Leon 2014). Leon (2014) indicates that values between 0 and 1 indicate monopolistic competition. Negative H-statistics provide evidence of a monopoly where input price increases translate into negative changes in total revenue. Boone (2008) introduced a measure of competition that is premised on the view that the the re-allocation of output from less efficient firms to more efficient firms is greater under more

⁵This type of analysis is part of what is often referred to as a New Empirical Industrial Organisation approach. This is a departure from a structure-conduct-performance paradigm that found a causal link between the structure of a market, how firms compete and resultant market outcomes. The reader is referred to Davis and Garcés (2009) and Leon (2014) for a further description.

competitive conditions. The Boone Indicator is the estimated coefficient from the regression of firm profits or market share on firm marginal costs (Boone 2008; Leon 2014).

Studies on South African banking competition have used the tools described above to reach the conclusion that South African banking industry produces outcomes that reflect a cartel (monopoly outcome) or is, at best, monopolistically competitive. Kasekende et al. (2009), Mlambo and Ncube (2011), Simatele (2015) and Simbanegavi, Greenberg, and Gwatidzo (2015) primarily rely on the estimation of Panzar-Rosse models to assess the extent of competition. Their estimated H-statistics were indicative of monopolistic competition in the banking industry. This conclusions were reach from an analysis of data from 1992-2014.⁶ Rapapali and Simbanegavi (2020)’s estimated Panzar-Rosse models provides evidence of a monopoly over the period 2008-2018. Moyo (2018) and Rapapali and Simbanegavi (2020) both estimate Boone indicators in their analyses. Moyo (2018) found that their estimated indicators decreased throughout the period of their analysis, indicating improved competition over time. Rapapali and Simbanegavi (2020)’s estimated Boone estimators were provided for loan and deposits with the Boone indicator for loans being larger, in absolute value, than those estimated for deposits. Overall, Rapapali and Simbanegavi (2020) conclude from their analysis that the banking industry exhibits outcomes indicative of monopolies or a cartel. Moyo (2018) also estimated a Lerner index values over 2004-2015 finding that the extent of competition in the South African banking industry as proxied by the Lerner index, decreased between 2004-2007 and 2011-2013, and improved between 2008-2010 and 2014-2015. Gwatidzo and Simbanegavi (2024) offer the latest evidence of banking competition estimates using Boone indicators and the Lerner using bank data between 2005-2019. Their estimated Boone indicators were volatile during this period whilst their Lerner indices showed improved competition between 2009-2019.

The methods described above have provided researchers with an empirical approach that analyses whether the conduct of banks is consistent with different models of competition. However, this analysis has been conducted at the level of the industry and not in well-defined markets. The European Commission (2024) indicates that market definition is a tool that is used to “*identify and define the boundaries of competition between undertakings*”. A market that has been defined provides identification of competitors, the products they offer and the regions within which they compete (European Commission 2024). Defining bounds of competition is critical particularly due to the multi-product

⁶Kasekende et al. (2009) relied on 1992-2007 data, 1998-2008 for Mlambo and Ncube (2011), 1997-2014 for Simatele (2015) and 1998-2008 for Simbanegavi, Greenberg, and Gwatidzo (2015)

nature of banks. Banks collect funds from various sources to produce different types of loans and invest in various securities (Olds and Steenkamp 2021). Each of these markets could have unique features that separate them. Furthermore, not all banks are present in all markets, introducing further differences between markets.⁷ In light of these factors, an estimate of competition performed at an industry level offers limited insight about the extent of competition in a specific market or between specific competitors (or types of competitors).

Analysing demand is a key component to understanding firm behaviour and competition (Davis and Garces 2010). Empirical tools that involve the estimation of structural demand models have developed within industrial organisation to study markets (Dick 2008). The advantage of these models is their ability to introduce a structure within customer utility that allows the testing of various substitution patterns between firms or groups of firms (Mariuzzo, Walsh, and Whelan 2010). However, their application requires assumptions about the structure of consumer utility and have higher data requirements (Leon 2014). Nevertheless, these models provide an alternative to approach to assessing substitutability between firms.

Structural demand models have been more commonly estimated in European and US studies of banking competition. Adams, Brevoort, and Kiser (2007) and Dick (2008) estimate the demand for consumer bank choice in the US using a flexible discrete choice model. Their approach allowed for the correlation of consumer utility within a grouping of banks; namely, single and multi-state banks. They both found evidence that multi-market (single-market) banks are greater substitutes for other multi-market (single-market) banks than for single-market (multi-market) banks. Adams, Brevoort, and Kiser (2007) finds that these substitution effects are greater within urban areas than in rural areas. Adams, Brevoort, and Kiser (2007) extended their analysis by also assessing evidence of substitutability between banks and thrifts. They found within-bank and within-thrift substitution effects that are greater than for bank-thrift substitution effects. This result is confirmed by Ho and Ishii (2011). In Italy, Molnar, Violi, and Zhou (2013) estimates a similar nested logit choice model and finds evidence of greater substitution within-local banks and within-national banks than between them.

⁷By way of example, Capitec’s entry into different product segments has been staggered over time. Its entry into personal loans started in 2001; its credit card offering occurred in 2016 and it started offering mortgages in 2020. See Makhanya and Nhundu (2016), BusinessTech (2017) and Naidoo (2020)

3 Market definition and data

The market considered for analysis is the South African market for PTAs. There is no South African case precedent explicitly defining this market but experience from international market inquiries is instructive. In 2005 the European Commission conducted a banking sector inquiry aimed at identifying and remedying competition concerns in retail banking and banking insurance (European Commission 2007a). For retail banking, their competition analysis started at the personal current account market and gradually included other related credit and savings products. The Competition and Markets Authority (“CMA”) of the UK similarly conducted a market investigation into retail banking. The CMA defined a product market that comprised of personal transactional accounts with and without overdraft facilities (Competition & Markets Authority 2016). The CCSA did not formally define a market for PTA in the banking market inquiry but sought to assess market power in the provision of personal transactional accounts in South Africa (Competition Commission of South Africa 2008).

Our dataset is the FinMark Trust’s South African FinScope Survey of 2019. The FinScope Survey is conducted annually to track the usage of formal and informal financial services among South African adults. The field work for the survey was conducted between the 27th August and the 5th of November 2019 (FinMark Trust 2019). At the time of writing, the 2019 iteration is the latest available to the public and contains information from 4969 respondents. From this data, we are able to identify 3385 respondents with PTAs at any one of the largest 5 banks (in terms of PTAs); namely, Capitec, Absa, FNB, Standard Bank and Nedbank. Despite various efforts to bring about greater PTA usage, around 847 respondents reported not having a PTA.

Table 1: Observations weighted to the population

Bank	Sample	Population
Absa	549	3 649 862
Capitec	1 286	11 027 887
FNB	703	4 719 953
Nedbank	407	2 963 331
StandardBank	440	3 095 754
None	847	8 435 202

4 Model framework

4.1 Choice framework

We use a paired combinatorial logit (“PCL”) choice model to estimate where an individual will hold a PTA. Consider an individual, n , who chooses to open a PTA at bank $i \in (Capitec, Absa, FNB, StandardBank, Nedbank)$ or may opt for the outside option, $None$, which represents not having a PTA.

A choice of bank i will provide a consumer with a utility, $U_{ni} = V_{ni} + \epsilon_{ni}$. This utility is comprised of observable and unobserved components of utility, respectively set as V_{ni} and $\epsilon_{ni} \forall i$ banks. The observable component is linear in parameters as expressed in Equation (1) below. X_{ni} represents the alternative specific information described in Section 3.1.1 and Z_n is a vector representing an individual’s characteristics and usage of financial products. Parameter τ_i is a constant specific to each alternative.

$$V_{ni} = \beta_i X_{ni} + Z_n' \alpha_{ni} + \tau_i \quad (1)$$

The unobserved component of utility follows a generalised extreme value distribution (GEV) specified in Koppelman and Wen (2000). This specification allows for correlation in the unobserved components of utility ϵ_{ni} and ϵ_{nj} for $i \neq j$. This results in a more flexible estimation method than the multinomial logit choice models (“MNL”) used in discrete choice theory. MNL models assume that the unobserved components of utility are independent and identically distributed GEV. Incorporating correlation in ϵ_{ni} and ϵ_{nj} for $i \neq j$ would indicate that after controlling for observable factors, a consumer’s preference for banks’ i and j ’s PTAs share unobserved similarities. A commonly used flexible logit model that allows for this similarity is the nested logit model (“NL”). NLs place alternatives into nests that allow for correlations in utility derived from using the alternatives placed in that nest. However, the unobserved utilities of alternatives in different nests remain independent (Ben-Akiva and Lerman 1997; Train 2009). PCLs introduce greater flexibility in the nesting structures as nests are comprised of paired alternatives and each alternative can be placed into more than one paired nest.

A consumer will choose option i provided that $U_{ni} = V_{ni} + \epsilon_{ni} > V_{nj} + \epsilon_{nj} = U_{nj} \forall j \neq i$. Following

Croissant (2012) and Koppelman and Wen (2000) the probability of consumers in the sample choosing bank i is expressed in Equation (2) below. PCL estimates return J similarity parameters $0 < \lambda_{i,j} \leq 1$, for $i \neq j$ (Train 2009). These parameters measure whether there is correlation within the unobserved utilities of J paired alternatives. A value of 1 indicates that ϵ_i and ϵ_j of (i, j) nest for $i \neq j$ are independent. In this event, (2) collapses into a standard MNL. The lower the value of $\lambda_{i,j}$ the greater the correlation in the unobserved utilities of alternatives i and j . Rejecting the hypothesis that $\lambda_{i,j} = 1$ is a rejection of the MNL and indicates that the more flexible PCL model better represents consumers' choices of bank PTAs.

$$P_i = \sum_{j \neq i} P_{i|ij} \cdot P_{ij} = \frac{\sum_{j \neq i} e^{V_i/\lambda_{ij}} (e^{V_j/\lambda_{ij}} + e^{V_i/\lambda_{ij}})^{\lambda_{ij}-1}}{\sum_{k=1}^{l-1} \sum_{m=k+1}^l (e^{V_k/\lambda_{km}} + e^{V_m/\lambda_{km}})^{\lambda_{km}}} \quad (2)$$

Where

$$P_{i|ij} = \frac{e^{V_i/\lambda_{ij}}}{e^{V_i/\lambda_{ij}} + e^{V_j/\lambda_{ij}}} \quad (3)$$

$$P_{ij} = \frac{(e^{V_i/\lambda_{ij}} + e^{V_j/\lambda_{ij}})^{\lambda_{ij}}}{\sum_{k=1}^{l-1} \sum_{m=k+1}^l (e^{V_k/\lambda_{km}} + e^{V_m/\lambda_{km}})^{\lambda_{km}}} \quad (4)$$

For our purposes we place the 5 SA banks into 10 unique nests, as shown in Figure 1. The one advantage PCL estimation has over NLs is that it enables an analyst to observe the similarities between two alternatives independent of the presence of those respective alternatives in other pairs of nests (Koppelman and Wen 2000). Our interest primarily lies in whether the estimated values of $\lambda_{i,j}$ for $i \neq j$ are statistically significantly different from 1 and whether they differ across nests. This would provide evidence that consumers view certain pairs of banks as being more similar than others. Such a finding would suggest non-symmetric competitive constraints in the South African PTA market.

4.2 Own and cross price elasticity estimates

A standard MNL can be used to estimate of own and cross-price elasticities. These measures are relevant to understanding the extent of competition in the PTA market.⁸ Own-price elasticity estimates capture responsiveness in the probability of selecting a bank, following price increases and is relevant

⁸In this paper we refer to elasticities of the probability of selecting a bank following a price change.

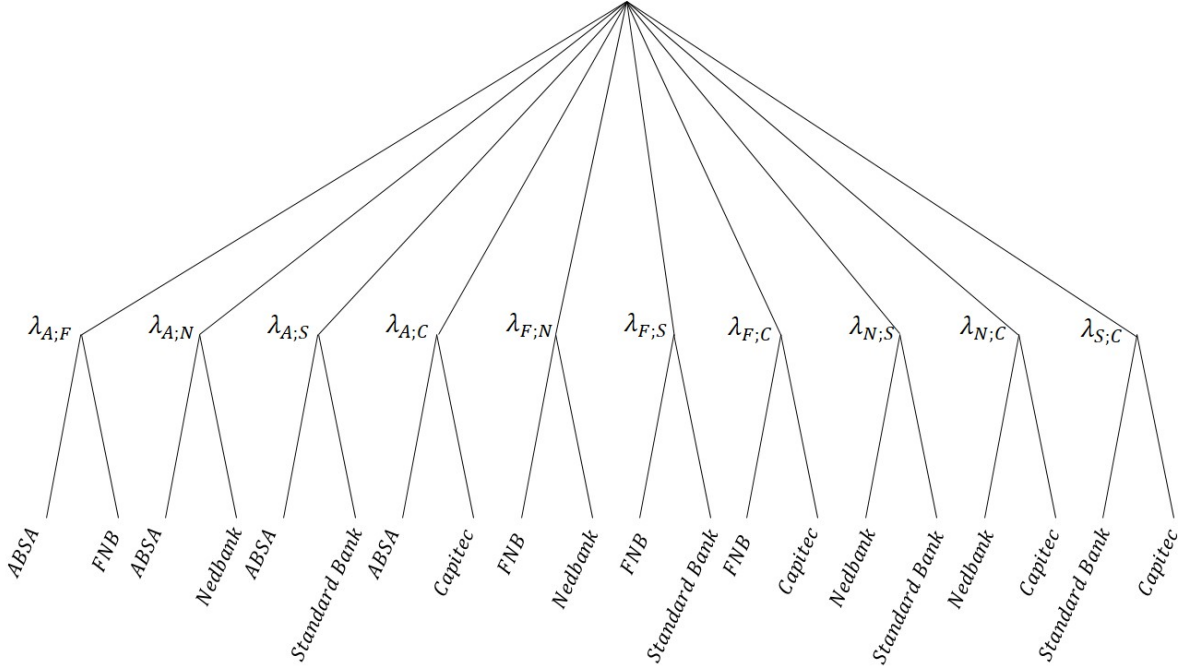


Figure 1: SA banks placed into 10 unique nests

to assessing the extent of market power that a bank may have. Cross-price elasticity estimates more directly capture the implications of greater competition between banks. MNLs are underpinned by the assumption of the independence between the unobserved components of the utilities from using different alternatives. When such independence exists, estimated own-price elasticity estimates do not capture that the bank initiating the price increase is at risk of losing a greater number of customers to a potentially close rival. Similarly, with cross-price elasticities, MNLs assume proportional substitution across all alternatives (Train 2009). In other words, when bank i increases their prices, there is a proportional increase in the probabilities of selecting all other banks $j \neq i$. This is not likely to be case if certain bank pairs are closer substitutes. Instead, when bank i increases their prices, there may be a greater than proportionate increase in the probability of selecting a closer substitute.

With the adoption of a more flexible choice model, we're able to estimate elasticities that reflect the potential correlation in the utilities of alternatives. Equations (5) and (6) respectively provide the own-price elasticities derived from the MNL and PCL estimations. Equations (7) and (8) respectively capture the cross-price elasticities from the MNL and PCL estimations; these capture the elasticities of the probability of selecting bank $j \neq i$ following an increase in the PTA price by bank i .⁹ The

⁹The elasticities provided are consistent with Koppelman and Wen (2000) but have been re-written to reflect the estimates obtained from the mlogit package prepared by Croissant (2012).

economic significance of elasticities in (6) and (8) increase as λ_{ij} tends to 0. These estimates collapse into MNL estimates when $\lambda_{ij} = 1$.

4.2.1 Own-price elasticities estimated from MNL and PCL models

$$\epsilon_i^{MNL} = (1 - P_i) B_{Price_i} Price_i \quad (5)$$

$$\epsilon_i^{PCL} = \left[\sum_{j \neq i} \frac{P(ij) \cdot P(i|ij)}{P_i} \left(\frac{1 - (1 - \lambda_{ij}) \cdot P(i|ij)}{\lambda_{ij}} \right) - P_i \right] B_{Price_i} Price_i \quad (6)$$

4.2.2 Cross-price elasticities estimated from MNL and PCL models

$$\epsilon_{ij}^{MNL} = -P_i \cdot B_{Price_i} \cdot Price_i \quad (7)$$

$$\epsilon_{ij}^{PCL} = -\left[P_i + \frac{1 - \lambda_{ij}}{\lambda_{ij}} \frac{P(ij) \cdot P(i|ij) \cdot P(j|ij)}{P_j} \right] B_{Price_i} Price_i \quad (8)$$

4.3 Variables included in PCL

4.3.1 Construction of prices

The Finscope dataset does not contain supply-side indicating costs to consumers or the service levels experienced by them. These are critical to consumer choice. To remedy this, we construct prices using publicly available bank marketing materials on PTA accounts.

Each year, the banks we study provide brochures containing the pricing structures of the various transactional accounts they sell to the public. Absa, Nedbank, FNB and Standard Bank provide a number of account types. In Table 2, we provide a list of the PTAs that were offered by each bank during the time the 2019 Finscope survey was conducted. These are largely targeted towards different consumer types who have differing levels of income. Capitec on the other hand only offers on type of account: the Global One account. A defining feature of these accounts is the nature of the pricing. Banks offer two types of pricing structures for their accounts: Pay-As-You-Transact (PAYT) and bundled pricing. Accounts with a PAYT structure charge a consumer for each transaction they engage in. These transactions could include, inter alia, withdrawing from an ATM, making electronic payments and checking account balances. Accounts with this structure also have a minimum monthly

administration fee. Accounts with bundled prices have a minimum monthly administration fee that is typically multiples of the fee charged for PAYT accounts. This is because the bundled fee accounts do not individually charge for a specified set of transactions. For example, FNB’s bundled Easy Account provided for 10 free transactions (whether external debit orders, online or mobile payments, and prepaid airtime purchases) and free ATM withdrawals of up to R2000. Once a consumer has made use of the transactions provided for in the bundled account then PAYT pricing is applied. A FNB consumer that has withdrawn R2000 on a bundled Easy Account will thereafter pay an ATM withdrawal fee of R1.90 per R100 withdrawn.

Given that a consumer’s transacting behaviour would have an impact on the final price they pay to the bank per month, we pair each bank’s PTA pricing structures with assumed transactional behaviour. We refer to four types of transaction profiles that have been developed by the Solidarity Research Institute (SRI).¹⁰ These profiles differ in the number and combinations of transactions that a consumer is assumed to make, i.e. 12, 17, 25 and 30 transactions. Table A1 in Appendix 1 provides the transaction profiles constructed by the SRI used in their 2019 Bank Charges report (Solidarity Research Institute 2019). Using the pricing structure of a given bank’s PTA, one is able to calculate the cost that each transactional profile is associated with at each bank across their PTAs.

Finally, we assign the calculated PTA prices to survey respondents in a manner similar to Bowdery (2015). However, our approach extends their analysis by assigning calculated prices based on different transaction profiles, as well as using survey information to better assign prices to consumers. We assume that individuals earning less than the national average income of R5 796 engage in fewer transactions (12 to 15 transactions).¹¹ Survey respondents earning above this average engage in 25 to 30 transactions.¹² Since we calculate prices for different types of accounts offered by banks, we use the income qualifying criteria used by these banks to assign PTA types. For example, individuals who report having a PTA at FNB would be assumed to hold a Gold account if they earned between R7 000 and R25 000 per month.¹³ The FinScope survey data reports whether a respondent pays a bundled fee or a PAYT fees for their PTAs. We use this information to assign bundled or PAYT prices to those

¹⁰Each year the SRI provides a bank charges report that compares the prices a consumer would pay if for different types of PTAs based on 4 types of transacting profiles

¹¹We thereafter randomly assign that the respondent engages in 12 or 15 transactions.

¹²We also randomly assign 25 or 30 transactions to these respondent.

¹³Below R7 000 per month, the Easy account would be assigned; above R25 000, we assign the Premier Cheque account. We note that Nedbank had recently ceased to tier their products based on income - we therefore used other bank’s thresholds for guidance.

consumers.¹⁴

Table 2: Products offered by banks during the survey period

Absa	Nedbank	FNB	Standard Bank	Capitec
Transact (PAYT)	PAYU (PAYT)	Easy Account(PAYT/Bundle)	Access (PAYT)	Global One
Flexi (PAYT/Bundle)	Ke Yona (Bundle)	Gold (Bundle)	Elite (PAYT/Bundle)	
Gold (PAYT,Bundle)	Savvy Plus	Premier Cheque (Bundle)	Prestige (PAYT/Bundle)	
Premium (PAYT/Bundle)	Savvy (Bundle)			

Figure 2 provides the distribution of the estimated and assigned PTA prices per bank based on this methodology. Across all distributions, PAYT pricing structures produce the lowest and highest prices. Since Absa and Capitec offered PAYT type accounts on the accounts offered to higher earning individuals, the distributions of the estimated prices extend beyond those from banks without PAYT pricing on these type of accounts. Capitec only offers one type of account, as such there are only 4 prices estimated for Capitec customers and these are solely due to the 4 transaction profiles used.

4.3.2 Respondent characteristics

Finscope surveys are rich in data pertaining to the characteristics of survey respondents. It follows that the probability of opting for a particular bank is likely to be partly informed by the characteristics of a given customer. Individual characteristics are useful covariates to consider as the SA banks considered in this study, with the exception of Capitec, sell a range of PTAs targeted at different types of consumers (World Bank Group 2018). The big-4 banks have standalone PTAs specifically marketed to various income groups, students, professionals, the elderly and specific income groups (Competition Commission of South Africa 2008; World Bank Group 2018). In addition, the entry strategies of the various banks also informed the type of customers it has historically and likely continues to attract. For instance, Capitec’s entry strategy was initially among unbanked low-income communities that made use of micro-loans (Makhanya and Nhundu 2016; Bankable Frontier Associates LLC 2009). In addition, Capitec (2005) indicates that its branches were set up in small cities, near retail centres and transport hubs. Research by Bankable Frontier Associates LLC (2009) also indicates that Absa, Standard Bank, FNB and Nedbank, primarily served employed customers (Bankable Frontier Associates LLC 2009), as such ones employment status may be relevant to their choice of opting for an account, potentially also a specific bank.

¹⁴Where a respondent does not report this we randomly assign a bundle or PAYT pricing structure to their accounts.

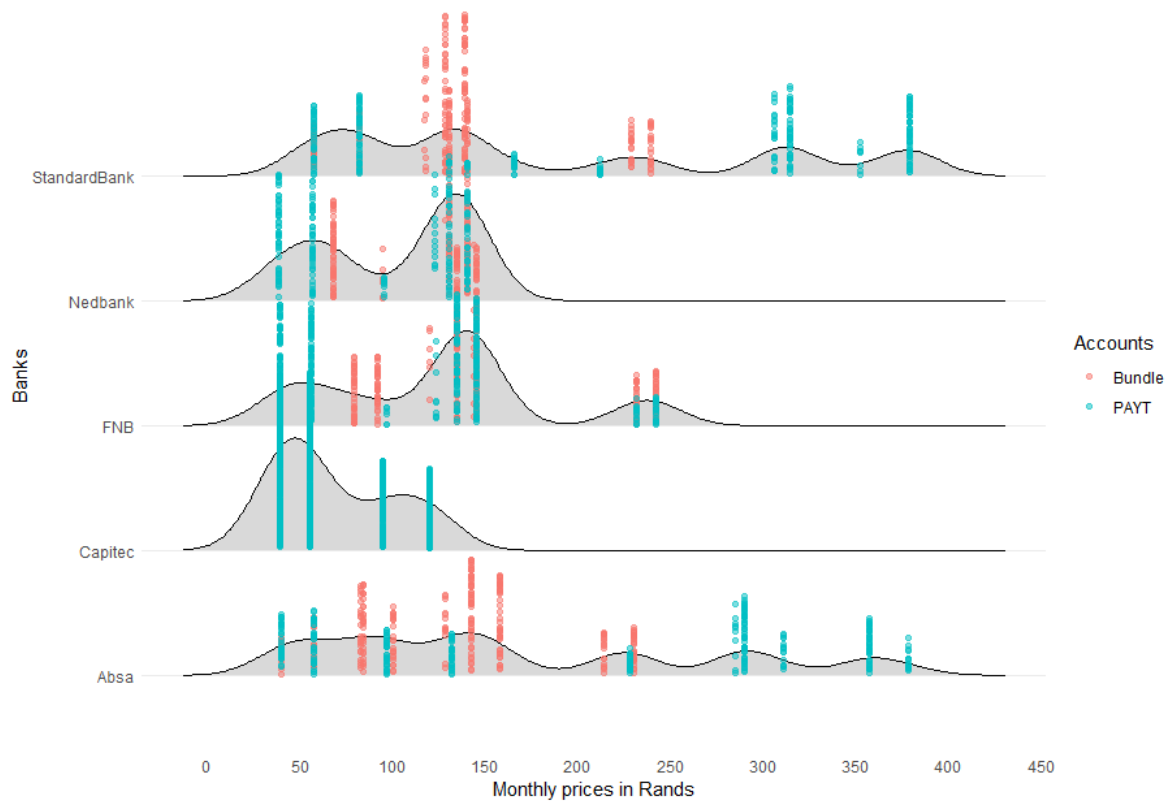


Figure 2: Distribution of computed PTA prices by bank

Literature on the determinants of financial inclusion in South Africa also provide useful references for variables relevant to the decision to opt for a transactional account. These variables are relevant to our model considering that our choice set includes the option to not opt for a PTA. Mahalika, Matsebula, and Yu (2023) assess the relationship between financial inclusion and poverty. Included in their measure of inclusion is access, usage, affordability and the quality of South African bank accounts. The authors do not specify the type of bank account they refer to. However, a review of the questionnaire underpinning the FinScope data reveals that the variable, “bank account”, that the authors use overlaps with the transactional accounts we consider in our study. Their estimates suggest that low education levels, race, and residing in a rural area are statistically related with lower levels of financial inclusion. Matsebula and Yu (2020) similarly find that race, residing in a rural area, specific provinces and unemployment and lower income levels were relevant to the levels of financial inclusion. Included in their measure of financial inclusion is having access to a bank account.¹⁵ Gwatidzo and Simbanegavi (2024) also analyse how various individual characteristics impact on financial inclusion. Their measure of inclusion includes access to debit card from a bank. They find that age, education and income are associated with greater levels of financial inclusion.

The variables we consider in our analysis reflect the above mentioned studies and developments. With regard to bank presence in different income groups, we include covariates measuring individual income, a living standards measure and dummy variables capturing the respondent’s highest level of education and their unemployment status. We include a dummy variable capturing whether a respondent lives in an urban area to reflect the historical and current geographic coverage of the banks. We also include dummy variables for race and marriage. These variables are summarised below.

¹⁵Similar to Mahalika, Matsebula, and Yu (2023), the variable “bank account” also includes transactional accounts.

Table 3: Descriptive statistics

Var	Absa	Standard Bank	FNB	Nedbank	Capitec	None	Average	Median	Sd	n
Demographic information										
Black	0.43	0.51	0.49	0.54	0.73	0.74	0.61	1	0.487	4 232
Coloured	0.16	0.12	0.14	0.11	0.15	0.15	0.14	0	0.3501	4 232
Indian or Asian	0.05	0.09	0.08	0.1	0.03	0.05	0.06	0	0.2349	4 232
Age	44.81	43.18	41.8	41.72	36.24	32.49	38.78	37	14.1199	4 232
Married	0.5	0.45	0.47	0.42	0.27	0.17	0.35	0	0.4757	4 232
Metro	0.43	0.53	0.52	0.59	0.47	0.35	0.47	0	0.4989	4 232
Rural	0.1	0.13	0.12	0.1	0.21	0.27	0.17	0	0.3781	4 232
Primary	0.01	0.02	0.01	0.01	0.02	0.06	0.03	0	0.1563	4 232
Secondary	0.47	0.46	0.47	0.49	0.58	0.38	0.49	0	0.4999	4 232
Tertiary	0.28	0.3	0.31	0.28	0.12	0.04	0.19	0	0.3914	4 232
LSM	7.39	7.32	7.44	7.22	6.27	5.69	6.7	6	1.817	4 232
Personal income	11 975.48	12 189.44	12 681.48	12 231.32	6 326.28	1 700.76	8 366.56	5 000	10 383.7	4 232
Grant	0.15	0.14	0.1	0.14	0.2	0.01	0.13	0	0.3321	4 232
Unemployed	0.07	0.08	0.06	0.08	0.15	0.44	0.17	0	0.3752	4 232
Financial product usage										
Price	168.07	187.43	125.16	101.59	68.85	NA	115.99	94.6	80.9867	4 232
Savings group	0.12	0.14	0.16	0.21	0.16	0.04	0.14	0	0.3429	4 232
Burial group	0.19	0.19	0.19	0.2	0.29	0.15	0.21	0	0.4096	4 232

Informal loan	0.08	0.1	0.1	0.12	0.12	0.06	0.1	0	0.2962	4 232
Retirement product	0.35	0.39	0.4	0.43	0.21	0.02	0.26	0	0.4381	4 232

5 Results

In this section, we present our PCL estimation results in parts. First, we provide the results of the estimated similarity parameters. Second, we provide the own-price and cross price elasticity estimates. Third, we provide the set of results examining the determinants of bank choice.

5.1 Similarity parameters

In Table 3 we report the nesting parameters obtained from the PCL estimation. For each of the bank 10 bank pairs we provide the values of λ_{ij} . For three of these bank pairs, we obtain within bound estimates, i.e. $0 < \lambda_{ij} \leq 1$. These results indicate that (i) Capitec and FNB, (ii) Capitec and Standard Bank, as well as (iii) FNB and Nedbank are closer substitutes than other bank pairs. For these pairs we test the hypothesis that the nesting parameters are independent, i.e. $\lambda_{ij} = 1$. This hypothesis is rejected with regard to (i) Capitec and FNB, and (ii) Capitec and Standard Bank.

Train (2009), however, indicates that the existence of out of bound estimates for the nesting parameters suggest that the model may not be consistent with utility-maximizing behaviour. We restrict these out of bound nesting parameters to 1; implying independence for these bank pairs. The restricted PCL results contains the estimated nesting parameters following these restrictions. As in the unrestricted case, these bank pairs remain within the bounds required for utility maximisation. We similarly tested whether we could reject the hypothesis of independent bank pairs. This hypothesis is rejected for i) Capitec and FNB and (ii) Capitec and Standard Bank.

We also find that the nesting parameters obtained from the Restricted PCL estimation are jointly significant. This indicating that their inclusion provides an improvement in fit over a standard MNL.¹⁶ In the Appendix we report the likelihood ratio statistics that indicate that the nesting parameters are jointly significant at a 1% significance level.

Table 4: Similarity parameter estimates

Unrestricted PCL			Restricted PCL		
Estimate	Std. Error	Test = 1	Estimate	Std. Error	Test = 1

¹⁶This paper will be supplemented further with the bootstrapping of these similarity parameters and the resultant elasticity estimates. This will ensure that our estimates are robust to the random assignment of transactional profiles - as described in Section 3.3.1

Absa.Capitec	1.910	1.048	0.869			
Absa.FNB	0.066	0.151	-6.179***			
Absa.Nedbank	1.012	3.852	0.003			
Absa.StandardBank	2.840	2.305	0.798			
Capitec.Nedbank	2.565	1.355	1.154			
FNB.Nedbank	0.084	0.549	-1.670**			
FNB.StandardBank	1.547	3.361	0.163			
Nedbank.StandardBank	2.785	3.550	0.503			
Capitec.FNB	0.035	0.046	-20.908***	0.017	0.011	-87.731***
Capitec.StandardBank	1.530	2.461	0.215	0.364	0.445	-1.428*

Note:

Significance levels: ‘***’ 0.01 ‘**’ 0.05 ‘*’ 0.1

5.2 Elasticity estimates

Our PCL estimations revealed that there are banks pairs whose nesting parameters are within bounds and significantly different from 1. Based in this, our PCL results can be used to calculate Equations (6) and (7). These estimated elasticities are reported in the Table 5 matrix. The first column lists the banks that are implementing a 1% price increase. The percentage change, of the aforementioned banks’ price increases, on the probabilities of selecting the other banks are provided in columns 2-6. The main diagonal contains own-price elasticities and are negative. The non-diagonal elements report cross-price elasticities.

The first row indicates that a 1% increase in Absa’s PTA prices will result in 0.043% decrease in probability of selecting Absa. Since all bank pairs containing Absa, were restricted to 1, we are only able to obtain non-varying cross-price elasticities for other banks following an Absa price increase. We see that Capitec’s own-price elasticity is estimated to be -2.1%. There is sufficient evidence indicating that Capitec is a closer competitor with FNB and Nedbank than it is with other banks. We see that the cross-price elasticities following a 1% Capitec price increase are estimated to be 0.141% for FNB and 0.145% for Standard Bank. FNB’s own price elasticity is -1.1%. Following evidence that FNB is a closer competitor to Capitec, we see that estimated cross-price elasticity is greater for Capitec at 0.097% than it is for other banks at 0.036%. Since we failed to reject the hypothesis that FNB

and Nedbank are closer competitors, the cross price elasticity for Nedbank following an FNB price increase should be 0.036% and 0.033% for FNB following a Nedbank price increase.¹⁷ Nedbank's own price elasticity estimate is -2.3%; the highest among the banks (in absolute terms). Standard Bank's own price elasticity is -0.2%; the cross-price elasticity is estimated to be 0.014% for Capitec following a Standard Bank price increase. The impact of a Standard Bank price increase is minimal on other banks at 0.004%.

Table 5: Own and cross-price elasticity estimates

	% Change on Prob(Bank)				
	Absa	Capitec	FNB	Nedbank	Standard Bank
Banks implementing price increase					
Absa	-0.1133	0.0188	0.0188	0.0188	0.0188
Capitec	0.1078	-1.8399	0.2110	0.1078	0.1977
FNB	0.0400	0.1062	-1.1336	0.0400	0.0400
Nedbank	0.0422	0.0422	0.0422	-0.3823	0.0422
Standard Bank	0.0176	0.0530	0.0176	0.0176	-0.8551

5.3 Determinants of bank choice

A range of individual and household characteristics were used in the PCL estimation to predict where an individual would hold a PTA. These are presented in Table 6. below. All coefficients are estimated in reference to the outside option (no bank), whose mean mean utility is assumed to be 0. For each alternative, we provide the specific coefficients.

Across all bank options, we find an increase in personal income is associated with the holding of a transactional account. This effect is greatest for FNB. A grant recipient status is also associated with PTAs. This is expected as grant recipients may opt to obtain their grants through their bank of choice. The LSM measure provides an indication of living standards. It is a tool developed by the South African Audience Research Foundation to gauge living standards based on amenities and assets owned in a home (South African Advertising Research Foundation 2002). The greater this value, the

¹⁷We have however reported the resultant elasticity estimates using the nesting parameters estimated in Table 4 for completeness

greater the living standards of the survey respondents. We see that a higher LSM measure is positively correlated with the holding of a PTA at FNB, Absa and Standard Bank. Those that are unemployed are found to be significantly less likely to opt for either of the banks' PTAs relative to the outside option of having no PTA.

Traditionally, lower income communities create stokvels or savings clubs in order to, inter alia, finance burials, food purchases, social events or provide rotational lump-sum payouts to members (Mashigo 2020). This variable was included in our estimation model in order to test whether users of these savings clubs had an affinity to any one particular bank with regards to their choice of PTAs. We find that members of savings clubs or stokvels are statistically more likely to have a PTA account at Capitec, FNB and Nedbank. With respect to burial societies, we find that those consumers are more likely to have a Capitec account.

Our results also indicate that indicate that educational attainment (secondary and tertiary education) are positively related to the holding of either of the PTA. Only attaining primary school education is negatively related to the holding of a Capitec PTA. This result is relative to the outside option of not having a PTA. As shown in Table 3, there is a larger proportion of respondents, who do have a PTA, who report having primary school education as their highest level of education.

For race, outside of interpreting coefficients relative to the outside option, our race parameters are interpreted in respect to the white population group as well. A given black individual is statistically more likely to opt for a Capitec PTA relative to a given white individual. The relation of age to PTA choice is non-linear and decreasing effects at higher ages.

Table 6: PCL estimation results

	Absa	Capitec	FNB	Nedbank	Standard Bank
(Intercept)	-13.085*** (0.9192)	-9.824*** (0.6781)	-14.597*** (0.8347)	-14.253*** (0.9809)	-13.524*** (0.8660)
Price	-0.001 (0.0008)	-0.005*** (0.0015)	-0.002* (0.0013)	-0.005** (0.0021)	-0.001* (0.0006)
Age	0.128*** (0.0243)	0.109*** (0.0192)	0.149*** (0.0238)	0.187*** (0.0285)	0.123*** (0.0252)
Age squared	-0.001*** (0.0003)	-0.001*** (0.0002)	-0.002*** (0.0003)	-0.002*** (0.0003)	-0.001*** (0.0003)

Table 6: PCL estimation results (*continued*)

	Absa	Capitec	FNB	Nedbank	Standard Bank
log of personal income	1.136*** (0.0888)	0.985*** (0.0516)	1.308*** (0.0790)	1.150*** (0.0983)	1.163*** (0.0890)
Grant	3.219*** (0.2858)	3.598*** (0.2596)	3.476*** (0.2753)	3.630*** (0.2844)	3.457*** (0.2819)
LSM	0.217*** (0.0554)	0.045 (0.0405)	0.176*** (0.0473)	0.118* (0.0602)	0.167*** (0.0567)
Unemployed	-0.765*** (0.1780)	-0.736*** (0.0992)	-0.692*** (0.1571)	-0.527*** (0.1934)	-0.750*** (0.1832)
Tertiary	1.442*** (0.2754)	1.329*** (0.2551)	1.314*** (0.2700)	1.431*** (0.3080)	1.415*** (0.2880)
Secondary	0.827*** (0.1336)	1.078*** (0.0927)	0.778*** (0.1183)	0.864*** (0.1389)	0.922*** (0.1397)
Primary	-1.528*** (0.4584)	-0.745*** (0.2490)	-1.526** (0.5944)	-1.183** (0.5290)	-1.345*** (0.4920)
Black	-0.465 (0.3843)	0.579 (0.3810)	0.053 (0.3715)	-0.302 (0.3974)	-0.084 (0.3773)
Coloured	-0.156 (0.4248)	0.566 (0.4179)	-0.019 (0.4164)	-0.881* (0.4943)	-0.216 (0.4315)
Indian or Asian	-1.275** (0.5666)	-0.583 (0.5177)	-0.499 (0.5116)	-0.550 (0.5540)	-0.382 (0.5200)
Savings group	0.116 (0.2082)	0.088 (0.1654)	0.256 (0.1770)	0.623*** (0.1927)	0.224 (0.1926)
Burial group	0.026 (0.1401)	0.189* (0.1020)	-0.057 (0.1257)	-0.201 (0.1410)	-0.033 (0.1404)
Retirement product	1.720*** (0.3733)	1.726*** (0.3595)	1.737*** (0.3667)	2.201*** (0.3750)	1.836*** (0.3748)
Informal loan	-0.498** (0.2317)	-0.056 (0.1659)	-0.028 (0.1828)	-0.298 (0.2292)	-0.330 (0.2234)
Married	-0.118 (0.1658)	-0.182 (0.1417)	-0.030 (0.1495)	-0.229 (0.1688)	-0.257 (0.1704)
Rural	0.025 (0.1734)	0.032 (0.1198)	0.267* (0.1514)	0.162 (0.1854)	0.482*** (0.1797)

Table 6: PCL estimation results (*continued*)

	Absa	Capitec	FNB	Nedbank	Standard Bank
Metro	-0.422*** (0.1426)	0.018 (0.1137)	0.005 (0.1325)	0.329** (0.1628)	0.014 (0.1570)

Note:

Significance levels: '***' 0.01 '**' 0.05 '*' 0.1

5.4 Discussion

This paper set out to determine whether there is evidence suggesting closeness of competition in the PTA market. Our analysis finds evidence of greater substitutability between Capitec and FNB, as well as Capitec and Standard Bank. We find greater estimated own-price and cross-price elasticities for these bank pairs than would be the case with standard MNL estimations. This is particularly true for Capitec who can count both FNB and Standard Bank as closer substitutes. There is evidence that supports our findings. Makhanya and Nhundu (2016) note that Capitec’s entry into the PTA market was subsequently associated with the provision of similar products by incumbent banks in the lower end of the market; with Absa and FNB specifically noted as Capitec competitors. This would reaffirm the view that Capitec is the leader in the provision of PTAs for lower income customers. Whilst, we do not find evidence of greater Absa and Capitec substitutability, we do find evidence of FNB and Capitec substitutability. More recently, Capitec was the first bank to provide black transactional account cards to all customers regardless of income. These black cards were typically for higher earning individuals at other banks. Following this development, FNB proceeded to offer a black card on its a newly branded Aspire PTA account (replacing the FNB Gold account we refer to in this paper).¹⁸ Whilst the reasons for these results are likely multi-facted, the value in our results is that they may provide useful guidance for in-depth investigations necessitated by potential merger investigations in the PTA market or market inquiries into the industry.

Our results also enable us to make inferences about the various determinants of bank choice. These results are interpreted in reference to the outside option (no bank). We see that participation in a savings group is strongly correlated with the holding of a PTA at FNB and Nedbank. We note that

¹⁸See <https://www.news24.com/fin24/companies/fnb-retires-gold-accounts-will-now-give-black-cards-to-middle-income-earners-20210601>

the estimated coefficient estimated for Nedbank is 1.8 times larger. This may be partly explained by the Nedbank’s specific provision of a stokvel Account that allows members of a stokvel to pool funds into a common fund. A benefit of such an account is that members will have access to a Nedbank PTA.¹⁹ Interestingly, participating in a burial society is only positively associated with the usage of a Capitec PTA. Considering that Capitec does not provide services for burial societies, this result likely reflects Capitec’s position within lower income segments.

5.5 [[find a place for these two para - moved from introduction]]

The Competition Commission of South Africa (2008) made a number of proposals aimed at increasing substitutability between banks. These included increasing transparency about bank charges and product features, the creation of various generic customer profiles to which applicability of various bank products would be contrasted, a central banking fee calculator, easier switching between banks and comparative advertising. Some of these proposals were implemented through revisions of the SA Code of Banking Practice and others were not fully implemented (Hawthorne et al. 2014). The World Bank Group (2018), in a review of transactional and fixed deposit accounts, also note that PTA product complexity hinders inter-bank PTA comparisons and proposed that banks have product design obligations. Part of these obligations would be the design of products meeting the needs of a specific target market, as well as a continuous review of whether the needs of that target market are met by the banks’ PTA. The World Bank Group (2018) also recommended that there be clear information disclosures regarding PTA products prices and features, as well as consumers’ rights to close and switch PTAs across banks. We do not estimate a direct link between these recommendations and our results, however our results suggest that the impact of continued efforts to increase bank substitutability is likely to be strongly effected between certain bank pairs.

Understanding the likely impact of entry in the PTA market also requires an understanding of the existing substitutability within a market. South Africa has recently experienced entry in the PTA market.²⁰ Tyme Bank, Discovery Bank and Bank Zero have a value proposition that is dependent on an extensive use of technology and is less reliant on traditional bank network size. These banks would ultimately aim to contest in a market where the 5 banks considered in this study comprise 96% of

¹⁹Storchi (2018) notes that certain portions of South Africans use formal financial services marginally because formal financial services providers may not provide products that better reflect the values that underpin the nature of South Africa’s financial decisions

²⁰See <https://businesstech.co.za/news/banking/352515/discovery-vs-tyme-bank-vs-bank-zero-what-south-africans-think-of-the-new-banks/>

all household cheque and savings deposits (South African Reserve Bank 2022) and where 80% of the population are banked (FinMark Trust 2018). An assessment of the existing degree of substitutability between these 5 banks, as well as identifying how these entrants position themselves would be useful to seeing which banks are likely to be meaningful competitors to the incumbents.

6 Conclusion

This paper used a paired combinatorial logit choice model to predict the bank that consumers would choose to have their personal transactional accounts in. We use FinScope data and construct a unique dataset of bank prices to estimate South African customer demand for personal transactional accounts.

Our empirical approach methodology allows us to assess the degree of substitutability between banks by assessing the correlation in the unobserved utility from using different nested banks' PTAs. We reject the hypothesis that the unobserved components of utility for the nested alternatives (i) FNB and Standard Bank, and (ii) Nedbank and Standard Bank are independent. These results indicate that these bank pairs are seen by consumers as closer substitutes suggesting non-symmetric competitive constraints in this market.

The retail banking industry has often been said to have a lack of competition. To remedy this concern, there are suggestions to improve consumer mobility and contestability in this industry. Our results suggest that there is likely to be greater competitive effects between certain bank pairs should such efforts be successful. In addition, our results suggest that entry in this market may not necessarily result in increased competitive constraints on all banks. Depending on how an entrant bank positions itself, it is likely to draw a greater proportion of customers from some banks than all banks.

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1 Appendix - Construction of prices

Table A1: Transaction profiles used to construct prices

Transactions	12 Transactions	17 transactions	25 transactions	30 transactions
Monthly administration fee	1	1	1	1
Send money below R500	1	1	2	3
Withdraw cash at point of sale	2	2	2	2
Withdraw at own ATM (R500)	0	1	1	1
Withdraw at own ATM (R1 000)	0	0	1	2
Withdraw at own ATM (R1 500)	0	0	1	1
Own ATM balance enquiry	1	1	1	1
SMS update subscription	1	1	1	1
SMS update notification	12	17	25	30
Prepaid airtime purchase	1	2	2	2
Internet banking payment	2	3	5	6
Beneficiary SMS notification	2	3	5	6
Scheduled payment (internal)	1	1	1	1
Scheduled payment (external)	1	1	1	1
Debit order (internal)	2	3	4	5
Debit order (external)	2	3	4	5

2 Appendix - Goodness of fit measures

Table A2: Likelihood ratio tests

Estimation technique	Log-likelihood	LR test statistic
MNL	-5610.64	
PCL	-5481.78	257.719***

Note:

Significance levels: '***' 0.01 '**' 0.05 '*' 0.1

3 Appendix - Robustness analysis

In this section we describe the analysis undertaken to test the robustness of the similarity parameters presented in the main body. Our analysis is premised on the assignment of computed prices to survey respondents in our dataset. As explained further in the body of the paper, we found that there are two bank pairs that we’ve identified as being close from consumers’ perspectives. That is, there are correlated preferences between Capitec and FNB customers, as well as Capitec and Standard Bank customers. This culminates in the estimation of own-price and cross-price elasticities for those paired banks being larger than what would emerge under standard multinomial logit estimations.

We note that there is a possibility that these prices have been measured with error. In calculating our prices, we assumed that consumers who earned below the national average income engaged in 12 or 15 transactions. We thereafter randomly assigned 12 or 15 transactions to those survey respondents. Similarly, we assumed those who earned above the national average income engaged in 25 or 30 transactions; we assigned the quantum of those transactions to survey respondents randomly. In addition, survey respondents who did not specify whether they used a bundle or PAYT account, were randomly assigned a bundle or PAYT account. These choices enabled us to generate a set of prices that are associated with the banks that survey respondents reported to have their PTAs at. The results presented in the paper are based on the generation of a single set of prices that followed this randomisation procedure.

To sensitise our results to differently computed prices, we generated 300 sets of unique prices following the aforementioned randomisation approach. This resulted in 300 datasets based on the Finscope survey data. From each of these datasets, we estimate equation (2) and obtain a range of λ_{ij} estimates. In table, A3, we provide a summary of these estimates. There are four bank pairs with average values for λ_{ij} falling within the required 0-1 range. This is crucial as out of bound estimates would indicate that our choice model is not consistent with utility maximisation (Train 2009). Table A3, also provides a 95% confidence interval for these estimated similarity parameters. Capitec-Standard Bank, we see that these percentiles fall within the 0 and 1 range. For Capitec-FNB we see that the 95% percentile falls slightly above the upper bound of 1. Despite this, a large share of estimated similarity parameters are within the appropriate range for both the Capitec-Standard Bank (95.67%) and Capitec-FNB (93.67%) bank pairs. These results are the primary reason we estimate similarity parameters for all bank pairs and thereafter for these two bank pairs in the body of the paper.

Table A3: Summary of the distributions of the estimated similarity parameters

Bank Pairs	Average	Min	Max	Between 0 and 1	5th percentile	95th percentile
Capitec.StandardBank	0.22	0.01	2.85	95.67%	0.02	0.89
Capitec.FNB	0.28	0.01	2.26	93.67%	0.02	1.07
FNB.Nedbank	0.22	-1.40	2.83	78.33%	-0.57	1.35
Nedbank.StandardBank	0.83	-1.98	23.75	31.67%	-1.05	2.66
Absa.StandardBank	1.55	-1.16	14.43	26%	0.07	2.82
FNB.StandardBank	1.63	-1.26	16.89	19.67%	0.28	2.60
Absa.FNB	1.82	-0.56	11.71	17.67%	0.18	2.75
Absa.Nedbank	2.09	-0.06	21.50	12%	0.21	3.24
Capitec.Nedbank	1.83	0.01	7.27	6.67%	0.49	2.74
Absa.Capitec	1.87	0.04	14.62	6%	0.93	2.73

Also included in this Section are plots of the distributions of the similarity parameters estimated from our 300 estimates. In each plot, we overlay vertical blue lines marking the 0 and 1 bounds. As explained above, a large share of the Capitec-Standard Bank and Capitec-FNB parameters are within bounds. What these plots also show are that the estimated similarity parameters for these two bank pairs are positively skewed indicating that the average values of 0.22 and 0.28, respectively, for the Capitec-Standard Bank and Capitec-FNB bank pairs overestimate the more commonly observed values of λ_{ij} . This observation is critical as values of λ_{ij} that tend to 0 provide stronger evidence of correlated preferences across bank pairs.

