ORIGINAL ARTICLE

Demand for deposit services and welfare implications of saving bank interest rate deregulation: Evidence from India

Varun Yadav[a] and Abhiman Das[b]

[a] Economics Area, Indian Institute of Management Kozhikode, Kerala, India - 673570; [b] Economics Area, Indian Institute of Management Ahmedabad, Vastrapur, Ahmedabad, Gujarat, India - 380015

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ABSTRACT
Following the deregulation of the savings deposit rates in India, the conduct of retail banks came under the scanner of the antitrust watchdog for alleged cartelization of interest rates. In this article, we estimate a discrete-choice structural demand model for retail bank deposit services. Using the estimated parameters, we assess the welfare implications of the saving rate deregulation. We find that there were significant welfare gains for consumers in most states after the deregulation. The intense non-price competition among retail banks post-deregulation was a key driver of such welfare gains. The results further indicate that consumers respond well to an increase in the deposit rate, a decrease in service fees, and an improvement in bank characteristics like employees per branch, number of branches, number of Automatic Teller Machines per branch, and digital payments infrastructure of the bank. This study not only quantifies the welfare effects of deregulation of interest rates but also underscores its antitrust policy implications, offering insights into the conduct of retail banks in the most populous nation in the world.

KEYWORDS
Deregulation, Cartelization, Demand estimation, Discrete-choice, Banking, Consumer welfare, Antitrust Policy
JEL classification: L44, L11, L89, G21

1. Introduction

Do depositors of banks respond to interest rate deregulation, and do such policies influence the conduct of retail banks in a way that leads to gains in consumer welfare? In this work, we attempt to answer such questions with reference to the interest rate deregulation in the largest democracy in the world.

We would like to thank discussants and other participants at the 7th National Conference on Economics of Competition Law 2022, organized by the Competition Commission of India, for their invaluable discussions and insightful comments.

Since the liberalization of economy in 1991, the banking sector in India has experienced significant transformations, chiefly aimed at fostering competitiveness and operational efficiency. Two pivotal developments in this era were the rise of new private banks and the progressive deregulation of interest rates, encompassing both loans and deposits. By 1997, the Reserve Bank of India (RBI), India's central bank, had deregulated all interest rates except those on savings deposits and small loans. In October 1997, the RBI deregulated the term deposit rate by delinking it with the bank rate, a key reference point for lending rates. This paved the way for further liberalization, culminating in the deregulation of all lending rates by 2010 and, notably, the saving deposit rate in 2011 (Reserve Bank of India, 2011). In its discussion paper published before the deregulation of saving deposit rates, the RBI expressed concern that the deregulation would lead to unhealthy competition among banks while also acknowledging that the deregulation has the potential to improve monetary policy transmission and increase the attractiveness of saving deposits.

After the deregulation of saving deposit rates, a general expectation among consumers, market participants, and regulators was that banks would increase the savings deposit rates, thereby benefiting consumers. However, with the exception of a few, most banks maintained the pre-regulation saving deposit rate.

This unexpected outcome drew significant media attention, suggesting potential cartelization in setting the saving deposit rate (please see Exhibit A.2 in the Appendices). Taking cognizance of the reports, the Competition Commission of India (CCI), the antitrust watchdog in India, initiated a suo motu investigation into the cartelization of the savings deposit rate (please see Exhibit A.3 in the Appendices) (CCI, 2015). In this context, we study the welfare implications of savings deposit rate deregulation using structural parameter estimates of a discrete-choice demand system. Following S. T. Berry (1994) and S. Berry, Levinsohn, and Pakes (1995), we estimate a micro-founded model of demand for differentiated products using an aggregate discrete-choice specification. We use service fees and deposit interest rates as prices along with a host of bank characteristics to model the choice behavior of consumers. Using the estimated structural parameters, we study the evolution of consumer welfare across markets for a few years after deregulation.

2. Literature review

Earlier studies on the impact of deregulation on retail banking have mostly focussed on credit side or on the efficiency of banks, in general. Krishnamurthy (2015) studied the role of the deregulation of bank branching in reducing the sensitivity of small businesses to shocks in credit supply in the United States, a perspective that underscores the wider economic implications of deregulation, akin to what we might expect in the Indian context. Bertrand, Schoar, and Thesmar (2007) analyzed the effect of deregulation in the French banking industry on the conduct of banks in the 1980s and concluded that a more efficient banking structure promotes "creative destruction", an observation potentially applicable to the Indian scenario

post-deregulation. Jayaratne and Strahan (1998) studied the effect of lifting the branch expansion restrictions on the efficiency of banks in the United States and concluded that reduction in costs of banks (due to enhanced efficiency) after the branching deregulation got passed to borrowers of the banks, alluding to potential welfare gains for consumers. Our study aims to study a deposit side regulatory event.

A critical gap in the study of the retail banking industry is the limited application of structural models from the New Empirical Industrial Organization (NEIO) tradition, a methodology that provides a robust framework for analyzing market structures and consumer behavior. The estimation of structural parameters offers various advantages over the usual reduced-form methods, as it enables us to conduct simulations to evaluate counterfactual scenarios, which have been hitherto difficult to conduct by traditional methods. This study contributes to this scant literature in banking by estimating the demand for deposits in Indian banks, thus providing insights into consumers' choice behavior while selecting a bank for deposit services in the most populous country in the world. Our study also aims to gain insights into the conduct of retail banks following a major regulatory event in Indian banking and our findings have implications for regulatory policy in developing nations. The first study to apply such methods to the banking sector (and in fact, to the services industry) was by Dick (2008) who estimated a structural model of demand for bank deposits in the United States. Other noteworthy studies of this strand include Nakane, Alencar, and Kanczuk (2006)'s analysis of deposit and credit demand in Brazil, Molnar, Nagy, and Horvath (2006)'s assessment of the degree of competition in household deposit and credit markets in Hungary, and Ho (2012)'s study on deposit markets in China. Our study applies such models to

During the period under review, the banking sector was rapidly integrating digital technologies to enhance customer experiences. Our study extends beyond previous research by explicitly incorporating a digital readiness metric to capture the evolving preferences of consumers.

We organize the rest of the paper as follows. We discuss the institutional details of the Indian banking sector in Section 3. In Section 4, we describe the demand estimation methodology, elasticity computations, and consumer welfare computations. Section 5 briefly describes the data used. In section 6, we present the results, and section 7 concludes.

3. Institutional Context

Banks in India are classified as scheduled banks and non-scheduled banks [2]. The scheduled banks can be further classified as public sector banks, private sector banks, foreign banks, regional rural banks, cooperative banks, cooperative banks, small finance banks, and payments banks [3] [4] (Reserve Bank of India, 2020). Fig A.1 depicts the current classification of banks

[2] Scheduled banks are the ones listed in the second schedule of the Reserve Bank of India Act, 1934

[3] The small finance banks and payment banks gained relevance recently, outside our analysis period (2008-2013)

[4] There are non-scheduled cooperative banks also

in India. The classification is derived from the Reserve Bank of India's *Report on Trend and Progress of Banking in India 2020-21* (Reserve Bank of India, 2020).

During the period of analysis (2008-2013), public sector banks commanded a lion's share of overall banking deposits[5]. Prasad and Ghosh (2007) conclude that the market structure can be characterized as "monopolistic competition" based on their analysis of bank revenues from 1996 to 2004. For the financial year 2021, the total deposits in all banks stood at INR 154.6 trillion. The combined share of public sector banks and private sector banks stood at more than 91% in FY 2020-21. The last decade has also witnessed significant consolidation among retail banks. Over the last 5 years (starting in 2017), the number of PSBs has reduced from 27 to 12. The share of deposits is gradually shifting from public-sector banks to private-sector banks. Industry experts foresee a new wave of consolidation led by private sector banks (Acuité Insights, 2021).

Retail banking in India has a long and rich history dating back to the pre-independence period when the first bank in India i.e. Bank of Hindustan was established in 1770. However, we'll focus on the post-liberalization (after 1991) era when the Indian economy opened up. Before liberalization, the banking sector had evolved to cater to the needs of a planned economy and was characterized by large reserve requirements, administered interest rates with a complex structure, rising non-performing assets (NPAs), bureaucratic hurdles in branch licensing, etc. (Prasad & Ghosh, 2007).

The financial sector reforms kicked off in 1992 allowed entry of new private banks and relaxed norms for entry of foreign banks in line with the recommendations of the Committee on the Financial System constituted under the chairmanship of M. Narasimhan (Prasad & Ghosh, 2007). Some of the key reforms during this period included a reduction in reserve requirements, liberalizing entry of new private and foreign banks, diversifying the ownership of public sector banks, and deregulation of interest rates to facilitate price discovery (Mohan & Ray, 2018). Recognizing the higher productivity levels of the private sector and foreign banks, the Committee on Banking Sector Reforms (also known as the second Narasimhan committee, 1998) observed that the reforms have enhanced the competition in the Indian banking sector. As a consequence of these measures, the share of public sector banks in total banking assets reduced from 90 percent (1991) to 75 percent (2004), and the CR5 concentration ratio (in assets) reduced from 0.51 (1991-92) to 0.43 (2003-04) (Prasad & Ghosh, 2007).

The deregulation of interest rates began in the early 1980s when RBI allowed banks to set interest for some maturities. The process got a fresh momentum in 1992 and the RBI linked the ceiling rate for deposits to Bank Rate in April 1997. The term deposit rates were fully deregulated in October 1997 when this linkage was removed (Reserve Bank of India, 2011). The saving deposit rate, which remained fixed since March 2003, finally got deregulated in October 2011 to further enhance competitiveness among banks.

[5]Authors calculations: Public sector banks had between 63% to 68% of overall deposits in banks and post offices

4. Methodological Framework

Most of the earlier studies aimed at analyzing banking market structure and strategic behavior use a Structure-Conduct-Performance (SCP) paradigm developed by Edward Mason and his student John Bain (Broude & Bain, 1957; Mason, 1939). One of the main criticisms of initial versions of the SCP paradigm was one-way causality from structure to conduct to performance. Moreover, the SCP paradigm and later theories of the same strand characterized by cross-industry reduced-form regressions lacked microfoundations. The New Empirical Industrial Organization (NEIO) approach (the term coined by Breshnahan) addresses the concerns of traditional industrial organizational methodologies (mainly the SCP framework with its cross-industry reduced-form regressions). The three main methods of this type are the Panzar-Rosse statistic, the Conjectural-Variations method, and the structural demand modeling using discrete-choice models. The Panzar-Rosse model studies how a change in input prices and the revenue of a bank are related. In this model, H-statistic is the sum of elasticities of revenue with respect to input prices (Panzar & Rosse, 1987). The value of the statistic indicates the structure of the market. A key drawback of this method is that it requires the market to be in long-run equilibrium for correct inference (Bikker, Shaffer, & Spierdijk, 2012). The conjectural variation method introduced by Iwata (1974) and Bresnahan (1982) incorporates beliefs that a firm has about the way its competitors may react if it varies its output or price. Although it is an improvement over the traditional Lerner index-based methods (which are not elasticity-adjusted), it is criticized as a dynamic principle in a static setup. The discrete-choice models are the workhorse models of the NEIO tradition and are popular because of their microfoundations. After the landmark work by S. T. Berry (1994) who applied aggregate discrete-choice models in studying the automobile industry in the United States, this class of models has been extensively utilized in various industries including breakfast cereals, movie theaters, television channels, pharmaceuticals, etc. (Bjornerstedt & Verboven, 2016; Davis, 2006; Nevo, 2001).

Among studies on Indian banking, Bhattacharya and Das (2003) examined the evolution of various measures of concentration from 1989-90 to 2000-01 and the effect of change in market structure on output and prices. Prasad and Ghosh (2007) studied the competition in the Indian banking sector post-financial reforms of 1992 and concluded that the revenue earnings of banks suggest a monopolistic competition behavior as the sector witnessed increased competition due to the entry of private banks and liberal entry of new foreign banks.

We estimate a discrete-choice structural model of demand using aggregate data on market shares of banks, prices, and observable bank characteristics for the period FY 2008-2013 [6]. This window includes both pre-intervention as well as post-intervention periods. We utilize data on 19 big private and public sector banks accounting for a large share of the deposits market as listed in Table 1 and Table 2 (these banks account for more than 70 percent of deposits of Scheduled Commercial Banks). Our demand model for deposit services includes

[6]The financial year in India starts from 1-April and ends on 31-March of next year

checking accounts (known as a current account in India), saving accounts, and term deposit accounts (also known as fixed deposit/recurring deposit accounts in India). We define the market as geographically local, as an Indian state. This decision is motivated by two factors. India is a union of states and within the states, we have districts as administrative units; within districts, we have tehsils and blocks, etc. Many large banks don't have branches in all districts and branches may be more concentrated in state capitals (particularly for private banks) rather than districts or district headquarters. Consequently, the Nash-Bertrand assumption on the form of competition may not hold at the district level [7]. Thus, we consider the districts and levels below as too granular for this exercise and choose the state level as the appropriate geographically local market. Another factor motivating this decision is the availability of a richer data set at the state level (state being a well-surveyed administrative unit in India) [8]. An insightful study by Dick (2007) done on US banks suggests that the nature of competition (as measured by the degree of concentration) in banking remains the same regardless of market size.

We use potential market size (S_m) as the population in the market m. Since the population census in India is a once-in-a-decade exercise, we utilize data on yearly population projections by the National Commission on Population published as Report of Technical Group on Population Projections (Registrar General of India, 2006). Market share (of deposit accounts) for a bank in market m is:

$$S_{jm} = d_{jm}/S_m \tag{1}$$

Here, d_{jm} is the number of deposits in market m. It is possible to define market share in terms of the volume of deposits or number of accounts. If we use the number of accounts only to find market share, then it ignores the variation in the volume of deposits in accounts e.g. a bank on a university campus might have a lot of student accounts with a very low value of deposits. However, such a bank will have a large market share if we use the number of accounts alone to compute market shares. Consequently, industry practitioners and competition regulators define output in terms of deposit volume (say in INR) (Dick, 2002). This poses a practical problem as we need to include an outside good also for estimating the demand system (outside good represents the options outside our choice set including the option to not avail deposit services). Following Dick (2002), we define our consumption unit as "average deposit account". We compute the "average deposit account" as the average of mean deposit volume (in INR) for all the banks computed individually. The quantity, therefore, is the bank's deposit volume (in INR) divided by such consumption unit. We compute market share by dividing this quantity by the market size (population of the market). We define *outside good*

[7] We do not explicitly use this assumption in our demand estimation but if were to model a supply side (where we use first order conditions based on an equilibrium assumption), it would have been essential

[8] We skip states with a significant area under hills from analysis as the distance from the bank may become the main determining factor in the choice of a bank as compared to other characteristics (which is impractical to include in the exercise with aggregate data)

as options available to consumers for deposit services outside our choice-set including the option to not avail the deposit services. We compute the market share of the *outside good* as $1 - \sum_{i \in B} s_i$ where B represents choice set comprising the 19 banks and s_i is the market share of bank i.

Logit Specification

The conditional indirect utility for i^{th} consumer who chooses bank j for deposit services in a market m is

$$u_{ijm} = p_{jm}^{dep}\alpha^{dep} - p_{jm}^{serv}\alpha^{serv} + X_{jm}^{'}\beta + \xi_{jm} + \varepsilon_{ijm} \tag{2}$$

Here, p_{jm}^{dep} and p_{jm}^{serv} are the interest rate on deposits and service fees respectively. X_{jm} is the vector of observable bank characteristics for bank j in market m. We use the following observable bank characteristics which affect the choice behavior of a consumer:

- Employees per branch
- ATM density
- Total number of branches
- Asset Size (a proxy for bank size)
- Digital Infrastructure (proxied by the number of outgoing National Electronic Funds Transfer (NEFT) transactions per account)
- Age of the bank

ξ_{jm} is the vector of mean unobserved bank characteristics while ε_{ijm} follows Type 1 extreme value distribution i.e. $\varepsilon_{ijm} \sim e^{-e-\varepsilon}$.

$X_{jm}^{'}$ is the vector of observable bank characteristics. Mean utility is:

$$\delta_{jm} = p_{jm}^{dep}\alpha^{dep} - p_{jm}^{serv}\alpha^{serv} + X_{jm}^{'}\beta + \xi_{jm} \tag{3}$$

δ_{jm} is also called the mean utility over all consumers for product i in market m. Following S. T. Berry (1994), if we normalize the mean utility of outside good to zero, we can show that

$$ln(s_{jm}/s_{0m}) = p_{jm}^{dep}\alpha^{dep} - p_{jm}^{serv}\alpha^{serv} + X_{jm}^{'}\beta + \xi_{jm} \tag{4}$$

Here, s_{jm} and s_{j0} are observed shares of bank j and outside good in market m.

Nested Logit specification

Nest Structure: In the nested logit specification, we assume that the consumer follows a staged approach while choosing a bank for deposit services. In a one-level nested model, she first chooses a group of banks and then chooses a bank from the group (nest) she chose at the preceding level. She follows a similar approach in the two-level nested model. A nested logit design allows more flexible substitution patterns and addresses the Irrelevance of the Independent Alternatives (IIA) problem (prevalent in the logit model) to some extent.

As per Cardell (1997), consumer i's utility for a bank j belonging to nest g is

$$u_{ij} = \delta_j + \kappa_{ig} + (1-\sigma)\varepsilon_{ij} \tag{5}$$

Here, δ_j is the mean utility, κ_{ig} is a shock that is shared among banks in the group, $\sigma \in [0,1]$ and captures how correlated is the utility for banks' deposit services in nest g are. Following S. T. Berry (1994), if we normalize the utility of outside good to 0.

$$\begin{aligned} ln(s_{jm}/s_{0m}) = p_{jm}^{dep}\alpha^{dep} - p_{jm}^{serv}\alpha^{serv} + X_{jm}^{'}\beta + \\ \sigma ln(s_{jm}/s_{gm}) + \xi_j + \xi_m + \xi_{jm} \end{aligned} \tag{6}$$

Here, s_{jm}/s_{gm} is the market share of bank j as a fraction of the market share of nest g.

We can compute own-price elasticities for a one-level nested logit specification as in Equation 7 (we are skipping the subscript m for brevity in Equation 7)

$$\varepsilon_{jj} = \frac{\partial s_j}{\partial p_j}\frac{p_j}{s_j} = -\alpha\left(\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma}s_{j|g} - s_j\right)p_j \tag{7}$$

Similarly, for a two-level nested-logit specification, we can estimate the parameters using

$$\begin{aligned} ln(s_{jm}/s_{0m}) = p_{jm}^{dep}\alpha^{dep} - p_{jm}^{serv}\alpha^{serv} + X_{jm}^{'}\beta + \\ \sigma_1 ln(s_{jm}/s_{hm}) + \sigma_2 ln(s_{hm}/s_{gm}) + \\ \xi_j + \xi_m + \xi_{jm} \end{aligned} \tag{8}$$

Here, s_{jm}/s_{gm} is the market share of bank j as a fraction of market share of nest h and s_{hm}/s_{gm} is the market share of nest h as a fraction of market share of sub-nest g. σ_1 and σ_2 are the nesting parameters to be estimated. Also, $\sigma_1, \sigma_2 \in [0,1]$.

We explore three different nest structures:

- **One level nesting based on ownership structure**: We have three groups in this classification viz. Public Sector Banks, Private Sector Banks, and the outside good. This is depicted in Fig 1.
- **One level nesting based on the size of bank**: We have three groups viz. Big Banks (State Bank of India, Punjab National Bank, Bank of Baroda, Bank of India, ICICI Bank, HDFC Bank, and Canara Bank), Other Banks, and the *outside good*. This is depicted in Fig 2. The big banks here are the top seven banks by asset size during the period of analysis.
- **Two-level nesting based on ownership structure and size**: In this specification, consumers first choose if they want to avail of the services from a public sector bank or a

private sector bank. In the second stage of decision-making, they choose a bank based on its size from the group they selected in the first stage. The two-level nest decision structure is depicted in Fig. 3.

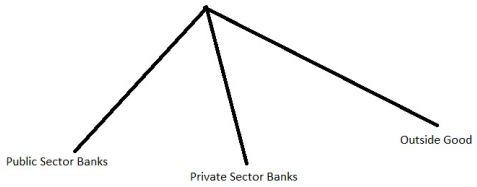


Figure 1.: Nest Structure-1 based on ownership structure

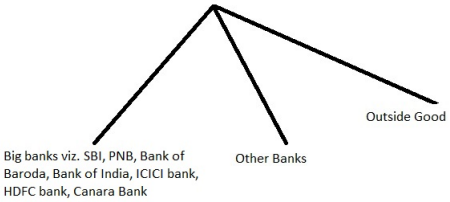


Figure 2.: Nest Structure - 1 based on bank size

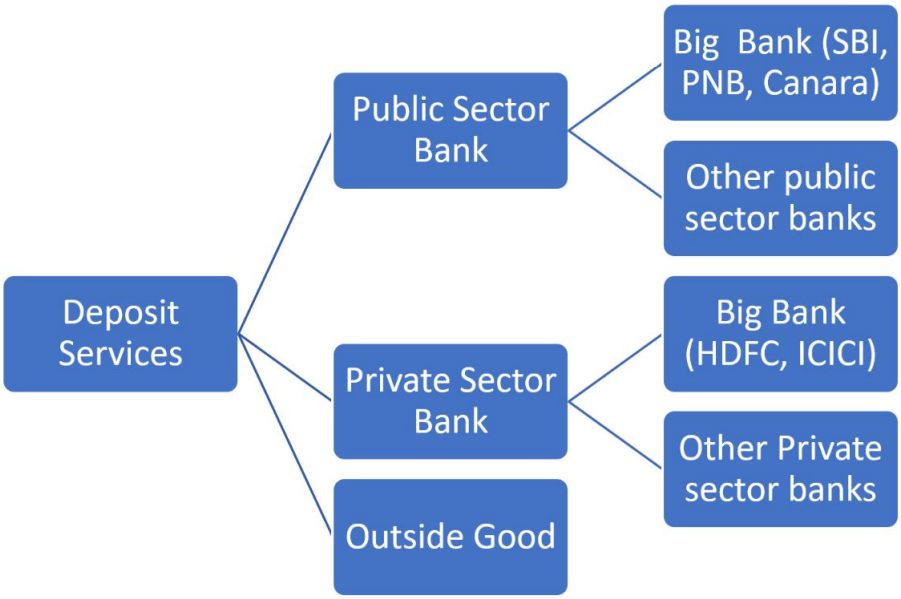


Figure 3.: Nest Structure - 2

Following S. Berry et al. (1995), we also estimate a richer random coefficient specification, the details of which are described in appendices (Section A.3). This also serves as a robustness test for our coefficients estimated using nested logit specification.

4.1. Price Endogeneity and Instruments

In the nested logit formulation in Equation 6, ξ_j represents the unobservable bank characteristics like service quality, perceived safety, the prestige of the bank, etc. These characteristics are observable for the consumer as well as the bank while unobservable for the econometrician. Since these characteristics are observable to banks, they are likely to be correlated with prices as banks take them into account while setting prices. This warrants the use of instruments for prices. We also use instruments for identification of σ in Equation 6 and σ_1, σ_2 in Equation 8. In consonance with the extant literature, we use the following class of instruments for prices and σ (Dick, 2008):

- Supply-side cost shifters e.g. Operating Expenses, Equity per employee, Cash per employee, Cash over assets
- Markup shifters (or BLP instruments)
    - Average of observable characteristics of competitor banks in a particular market
- Instruments required for identifying σ
    - Average of observable characteristics of other banks in the same nest

The supply-side cost shifters include variables that impact the marginal cost of the bank or have an impact on the financial structure of the bank, thereby increasing its funding cost. We take the operating expenses of the banks from income statements, the quantum of non-performing assets from balance sheets, and derive equity per employee, cash over employee, and cash over assets from both the financial statements (balance sheet and income statement). We'll briefly comment on the validity of each of the cost-shifter instruments. Operating expenses, include labor costs (as wage expenses), and banks are likely to factor these costs while setting prices (making it relevant). It also does not directly feature in the choice behavior of consumers and is not related to unobserved demand influencing factors (thus making it relevant). Equity per employee, cash per employee, and cash over assets are indicative of bank capitalization/liquidity. These are valid instruments as they affect the funding cost of banks and banks are likely to factor them while setting prices. The average characteristics of other banks in the market act as another class of instruments called markup shifters. These instruments are relevant as they affect the markup a bank charges (over marginal cost), and hence are likely to be correlated with price (making them relevant). They are also unlikely to be associated with the unobserved demand factors featuring in consumer choice-behavior (and hence valid).

4.2. Consumer Welfare

To quantify the change in consumer welfare, we use the compensating variation for consumer i as per Small and Rosen (1981) and McFadden (1981). The consumer surplus for i^{th} consumer for a one-level nested-logit specification is

$$CS_i = \frac{log\left(1+\sum_{p=1}^{P}\left(\sum_{b\in N_p} e^{\delta_b/(1-\sigma)}\right)^{(1-\sigma)}\right)}{\alpha} \tag{9}$$

Here, δ_b is the mean utility derived from selecting the deposit services of a bank b in nest N_p. P is the total number of nests. N is the set of all nests and N_p is the nest with index p.

Following McFadden (1981) and Small and Rosen (1981), we write the corresponding compensating variation as:

$$CV_i = CS_i^{Year2} - CS_i^{Year1} \tag{10}$$

Here, CS_i^{Year2} is consumer surplus of i^{th} consumer in Year 2. CS_i^{Year1} is consumer surplus of i^{th} consumer in Year 1.

To gain deeper insights into the source of welfare changes due to deregulation, we perform the following simulation:

- **Simulation:** We keep prices fixed at the pre-regulation level and allow bank characteristics to change and find out welfare changes

This hypothetical simulation will shed light on the main drivers of consumer welfare - price changes or bank characteristics.

5. Data

We utilize data on deposits of banks at the state level from 2008 to 2013 collected by the RBI as Basic Statistical Returns[9]. We also utilize another data set from RBI on bank characteristics like the number of employees, the number of branches, etc. at the bank-state level. This data is collected by RBI as Bank Branch Statistics. Notable studies which have utilized these data sets include the ones by Cole (2009), Das, Mishra, and Prabhala (2015), and Kumar (2020). We further complement this data with various publicly available RBI publications and bank financial statements (income statements and balance sheets). We derive interest rates and service fees from the financial statements as described in Table A2. Table 1 and Table 2 show the mean prices across markets in 2008 and 2013 for public sector

[9]The BSR data is openly available at bank group level but not at bank level. The data is proprietary at the desired granularity

banks and private sector banks respectively. Fig 4 shows a plot of the evolution of average prices for banks in the choice set across markets over the years. Table A1 shows a description of main variables used in the model, and Table A2 depicts the summary statistics for these variables.

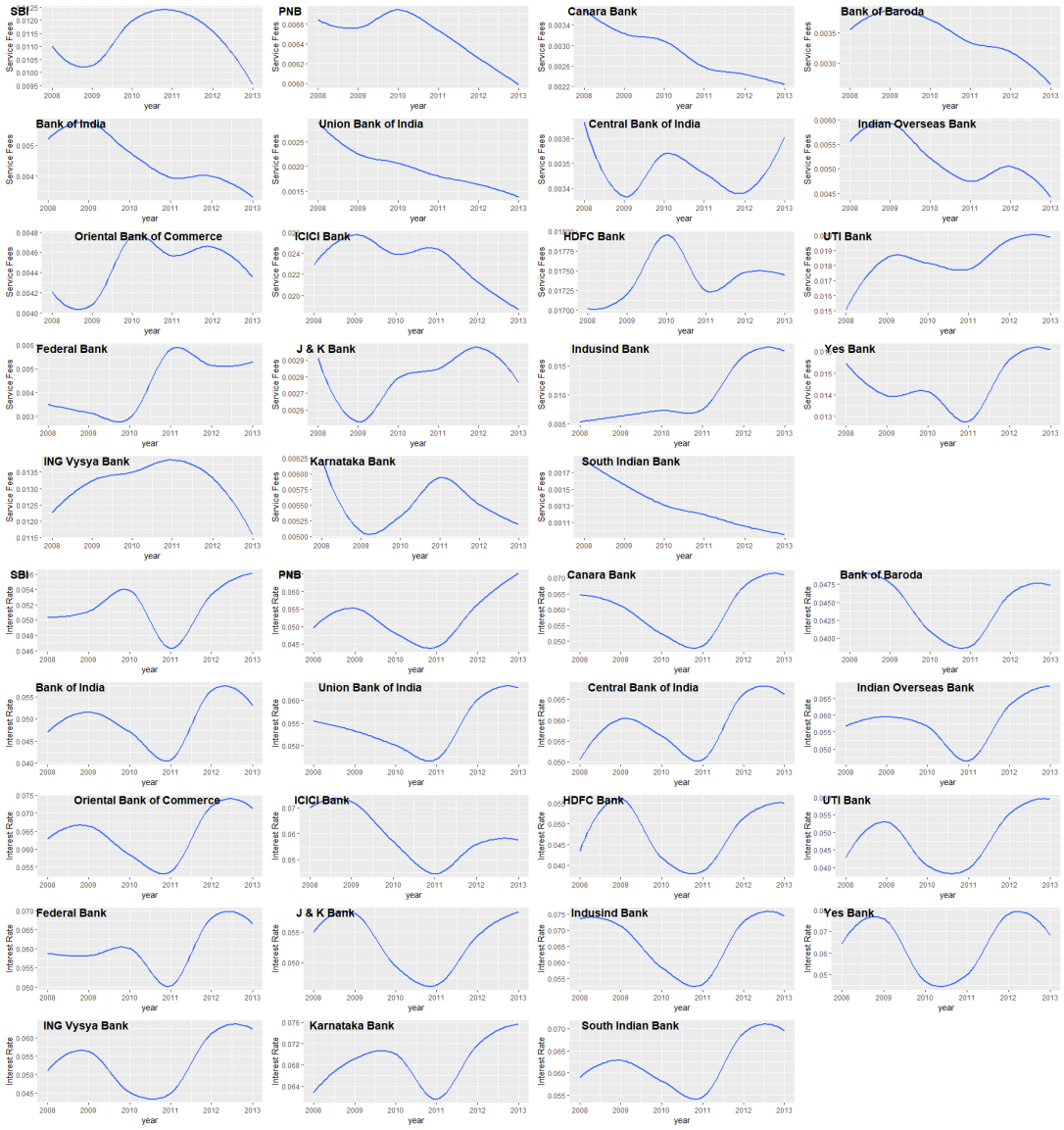
Public Sector Banks and Average Prices in 2008 and 2013				
Bank Name	Service Fees-2008	Service Fees-2013	Interest Rate-2008	Interest Rate-2013
State Bank of India	0.0110	0.0095	0.0504	0.0561
Punjab National Bank	0.0066	0.0060	0.0497	0.0651
Canara Bank	0.0037	0.0022	0.0645	0.0710
Bank of Baroda	0.0036	0.0027	0.0487	0.0474
Bank of India	0.0052	0.0033	0.0471	0.0530
Union Bank of India	0.0029	0.0014	0.0554	0.0628
Central Bank of India	0.0037	0.0036	0.0506	0.0661
Indian Overseas Bank	0.0056	0.0044	0.0567	0.0686
Oriental Bank of Commerce	0.0042	0.0044	0.0629	0.0714

Table 1.: Average prices in 2008 and 2013 for Public Sector Banks in the choice-set

Private Sector Banks and Average Prices in 2008 and 2013				
Bank Name	Service Fees-2008	Service Fees-2013	Interest Rate-2008	Interest Rate-2013
ICICI Bank Limited	0.0229	0.0187	0.0700	0.0577
HDFC Bank Limited	0.0170	0.0174	0.0435	0.0551
UTI Bank Limited	0.0151	0.0199	0.0427	0.0594
Federal Bank Limited	0.0035	0.0053	0.0589	0.0666
Jammu and Kashmir Bank Limited	0.0029	0.0028	0.0550	0.0583
Indusind Bank Limited	0.0053	0.0175	0.0736	0.0744
Yes Bank Limited	0.0155	0.0161	0.0643	0.0682
ING Vysaya Bank Limited	0.0123	0.0116	0.0511	0.0624
Karnataka Bank Limited	0.0062	0.0052	0.0629	0.0756
South Indian Bank Limited	0.0019	0.0010	0.0590	0.0696

Table 2.: Average prices in 2008 and 2013 for private sector banks in the choice-set

Figure 4.: Average prices for banks over years. The upper panel (top 5 rows) shows service fees and the lower panel shows interest rate



6. Results

We first present the results of demand estimation using baseline logit specification in Table 3. Column 1 shows the results with bank fixed-effects only, Column 2 has the bank as well as market fixed-effects. Since prices (interest rate and service fees) are endogenous, we show results of IV logit with bank fixed-effects in column 3, and column 4 shows IV logit results with both bank and market fixed-effects. All specifications include time-fixed effects. The sign of the coefficient on service fees is negative and the sign of the coefficient on deposit rate is positive as expected. The maginitude of cefficients on service fees and interest rate increases with the use of IVs. The signs on employees per branch, number of branches, ATM density, digital readiness metric, and age are positive implying that consumers derive more utility as these characteristics improve. Interestingly, the sign of the coefficient on asset size is negative (and significant in most specifications), implying that smaller banks in our choice-set are associated with higher utility derived by consumers (controlling for other characteristics). Adding state fixed-effects enables better identification implying the presence of heterogeneity among customers in different markets.

Table 4 shows the results for the two nested-logit specifications described in the methodology section. We observe that the magnitude of coefficients on prices further increase as compared to the IV logit specification of column 4 in Table 3. The nesting parameter is well-identified for both specifications. The value of the nesting parameter for both the specification is between 0.45 and 0.70 implying both nesting strategies are valid, and are indicative of consumer choice behavior. We then estimate the two-level nested logit specification explained in the methodology section. We present the results in column 3 of Table 4. We notice that the estimates of nesting parameter, σ_1, is greater than the estimate of σ_2, but σ_2 is negative which is not consistent with the consumer choice theory. This implies that the two-level nested structure may not be indicative of actual consumer behavior while choosing a bank for deposit services. We, therefore, do not use the estimated taste parameters using this specification. We use the first nested logit specification (one-level nests based on ownership) as our "key specification" for further computations. Our coefficients are robust to alternative specifications explicitly modeling heterogeneity among consumers (please refer to Section A.3) in Appendices for details.

Table 3.: Estimation results using logit specifications.

Variables	**Logit-1**	**Logit-2**	**IV-Logit1**	**IV-Logit2**
Service Fee	-40.604*	-34.250***	-76.362*	-113.630**
	(17.449)	(8.137)	(31.214)	(40.730)
Interest Rate	17.958***	13.943***	15.227*	21.230***
	(4.284)	(3.221)	(6.238)	(4.390)
Employees per branch	0.076***	0.026*	0.027***	0.028**
	(0.013)	(0.010)	(0.004)	(0.010)
No. of Branches	0.002^{+}	0.002*	0.003***	0.003*
	(0.001)	(0.001)	(0.000)	(0.001)
ATM per branch	0.177**	0.175*	0.209***	0.268**
	(0.065)	(0.071)	(0.055)	(0.083)
Digital readiness metric	652695.600**	781928.800***	882254.000***	1175875.000***
	(226037.900)	(152997.100)	(203647.900)	(147100.400)
Asset Size	-0.001	-0.063*	-0.077	-0.987**
	(0.040)	(0.029)	(0.042)	(0.310)
Age of bank	0.073*	0.093***	0.094***	0.268**
	(0.028)	(0.019)	(0.019)	(0.083)
Observations	2545	2545	2545	2545
Fixed Effects	Bank	Bank Market	Bank	Bank Market
IV's	Nil	Nil	BLP+Cost Shifters	BLP+Cost Shifters
J-Statistic	-	-	5.755	1.419
p-value (J-Statistic)	-	-	0.218	0.492
Column No.	1	2	3	4

Notes: Time (year) fixed effects included in all specifications. The dependent variable is $ln(\frac{s_{jm}}{s_{0m}})$ where s_{jm} is the share of bank j in market m and s_{0m} is share of outside good in market m. Standard errors are clustered at the state level. ***, **, *, and $^{+}$ denote significance at the 0.1%, 1%, 5%, and 10% levels, respectively.

Table 4.: Estimation results using nested-logit specifications

Variables	**NLogit-1**	**NLogit-2**	**NLogit-3**
Service Fee	-133.749***	-156.647^{+}	-146.643^{+}
	(35.929)	(86.307)	(85.505)
Interest Rate	25.888***	37.019^{+}	31.816^{+}
	(5.871)	(20.226)	(18.558)
Employees per branch	0.021***	0.015*	0.013^{+}
	(0.003)	(0.007)	(0.008)
No. of Branches	0.001***	0.001^{+}	0.001**
	(0.000)	(0.000)	(0.001)
ATM per branch	0.166***	0.098^{+}	0.176*
	(0.049)	(0.056)	(0.070)
Digital readiness metric	676823.300***	586663.900^{+}	849613.700*
	(161816.000)	(302620.800)	(331446.200)
Asset Size	-0.091***	-0.077^{+}	-1.433**
	(0.027)	(0.039)	(0.436)
Age	0.102***	0.070^{+}	0.106***
	(0.012)	(0.026)	(0.031)
Observations	2545	2545	2545
Fixed Effects	Bank Market	Bank Market	Bank
σ	0.500***	0.688***	-
	(0.105)	(0.175)	
σ_1	-	-	0.640*
			(0.250)
σ_2	-	-	-0.996**
			(0.326)
IV's	BLP+Cost Shifters	BLP+Cost Shifters	BLP+Cost Shifters
Sargan Test Statistic	2.545	2.119	1.874
p-value (Sargan Test Statistic)	0.467	0.347	0.392
Column No.	1	2	3

Notes: Standard errors are in parentheses. The dependent variable is $ln(\frac{s_{jm}}{s_{0m}})$ where s_{jm} is the share of bank j in market m and s_{0m} is share of outside good in market m. Standard errors are clustered at the state level. ***, **, *, and $^{+}$ denote significance at the 0.1%, 1%, 5%, and 10% levels, respectively.

6.1. Elasticity computations

Based on the parameter estimates using the Logit and Nested-Logit specifications, we present the own-price (service fees) elasticity summary statistics in Table 5. We observe that the mean elasticity computed using the nested-logit specification is quite different from the elasticity computations using the Logit specifications. As per this specification, most banks are operating on the elastic portion of the demand curve. A 1% increase in service fees is associated with approximately 2% (on average) decrease in market share. Table 6 shows similar statistics for own-price (deposit rate) elasticity computed using parameters estimated from our key nested-logit specification. We see that a 1% increase in deposit rate is associated with approximately 2.6 - 2.8% increase in market share. Table 6 shows similar own-price (service fees) elastic-

ity statistics for the various public sector and private sector banks. All values are computed using estimates from our key nested-logit specification. The average own-price elasticity for public sector banks is -1.169 and the average own-price elasticity for private sector banks is -2.705, i.e. more than twice that of public sector banks. This implies that consumers react more sharply (on an average) to changes in service fees of private banks than public sector banks.

Table 5.: Summary statistics of own-price (service fees) elasticity

Own-price elasticity of service fees				
Specification	Mean elasticity	Standard Deviation	Minimum	Maximum
Logit (Bank FE)	-0.323	0.255	-1.046	-0.037
Logit (Bank and State FE)	-0.273	0.215	-0.882	-0.031
Logit (Bank, State and Time FE)	-0.222	0.176	-0.718	-0.025
Nested Logit (Bank and State FE)	-1.973	1.487	-6.659	-0.216
Nested Logit (Bank, State and Year FE)	-1.816	1.362	-6.169	-0.197

Table 6.: Summary statistics for own-price (deposit rate) elasticity

Own-price elasticity of deposit rates				
Specification	**Mean elasticity**	**Standard Deviation**	**Minimum**	**Maximum**
Nested Logit (Bank and State FE)	2.771	0.550	1.380	4.046
Nested Logit (Bank, State, and Year FE)	2.612	0.530	1.209	3.836

Table 7.: Summary statistics of own-price (Service Fees) elasticity for different banks

Own-price elasticity of service fees				
Bank	**Mean elasticity**	**Standard Deviation**	**Minimum**	**Maximum**
State Bank of India	-2.257	0.329	-2.930	-1.446
Punjab National Bank	-1.616	0.120	-1.800	-1.253
Canara Bank	-0.726	0.134	-0.974	-0.470
Bank of Baroda	-0.867	0.111	-1.025	-0.581
Bank of India	-1.150	0.218	-1.533	-0.746
Union Bank of India	-0.515	0.127	-0.763	-0.344
Central Bank of India	-0.903	0.032	-0.969	-0.835
Indian Overseas Bank	-1.333	0.139	-1.585	-0.995
Oriental Bank of Commerce	-1.153	0.073	-1.272	-0.977
ICICI Bank Limited	-5.172	0.619	-6.649	-3.644
HDFC Bank Limited	-4.061	0.244	-4.642	-3.383
UTI Bank Limited	-4.236	0.463	-5.164	-2.821
Federal Bank Limited	-1.119	0.306	-1.552	-0.574
Jammu and Kashmir Bank Limited	-0.745	0.038	-0.795	-0.664
Indusind Bank Limited	-2.638	1.314	-4.662	-1.262
Yes Bank Limited	-3.859	0.308	-4.292	-3.128
ING Vysaya Bank Limited	-3.414	0.218	-3.704	-2.903
Karnataka Bank Limited	-1.456	0.116	-1.661	-1.171
South Indian Bank Limited	-0.345	0.082	-0.495	-0.215

6.2. Consumer welfare post deregulation

In this section, we assess welfare gains in various markets (state) following the deregulation, focusing particularly on changes in the rate of welfare growth. Following Small and Rosen (1981), we utilize demand parameters identified through the key nested logit specification (results in column 2 of Table 4) to compute consumer surplus, as elaborated in Section 4. Table 8 shows the average welfare (in money terms) for a representative consumer per 10,000 INR of deposit across different states, for the years 2008 and 2013.

Table 8.: Average welfare for a representative consumer per 10,000 INR of deposit across states in 2008 and 2013

Average welfare (per 10,000 INR deposit) across states in 2008 and 2013		
State	**CS-2008**	**CS-2013**
Assam (1)	2.279	3.494
Bihar (6)	1.427	2.468
Jharkhand (7)	3.524	5.700
West Bengal (10)	9.955	17.738
Orissa (16)	5.920	9.697
Tripura (18)	1.689	2.519
Uttar Pradesh (20)	4.978	13.103
Uttarakhand (21)	10.181	15.394
Delhi (29)	28.868	40.378
Punjab (30)	10.187	20.741
Haryana (34)	10.808	20.465
Chandigarh (39)	20.493	31.296
Rajasthan (50)	1.941	4.055
Gujarat (54)	10.673	26.542
Maharashtra (60)	9.304	19.651
Goa (68)	11.581	18.277
Madhya Pradesh (70)	2.553	7.070
Chhattisgarh (71)	3.223	5.174
Andhra Pradesh (80)	13.690	27.954
Karnataka (84)	13.250	24.618
Tamil Nadu (90)	11.918	23.506
Kerala (96)	8.966	15.936
Puducherry (99)	9.609	14.741

Table 9 shows the average welfare for a representative consumer holding an average deposit balance (for that state) across various states in 2008 and 2013. We observe that a consumer (holding an average deposit balance) gained between INR 11 (approx) in Tripura to INR 183 (approx) in New Delhi between 2011 to 2013.

To put things in perspective, we compare the welfare growth rates pre-regulation (2008-11) and post-regulation (2011-13) in Subsection 6.2.1.

6.2.1. Welfare gains from 2008-13

Figure 5 shows the percentage change in welfare (per INR of deposit) across Indian states from 2008 to 2013 on the map of India. We see that Madhya Pradesh, Uttar Pradesh, and

Table 9.: Mean welfare (INR) for a consumer holding average deposit amount in different states in 2008, 2011, and 2013

Average welfare across states in 2008, 2011, and 2013			
State	**CS-2008**	**CS-2011**	**CS-2013**
Assam (1)	17.619	23.019	39.440
Bihar (6)	11.030	15.254	27.851
Jharkhand (7)	27.252	37.405	64.330
West Bengal (10)	76.978	114.512	200.204
Orissa (16)	45.779	62.740	109.448
Tripura (18)	13.059	17.061	28.430
Uttar Pradesh (20)	38.492	73.577	147.894
Uttarakhand (21)	78.724	101.879	173.749
Delhi (29)	223.213	272.685	455.734
Punjab (30)	78.771	125.970	234.103
Haryana (34)	83.568	126.934	230.985
Chandigarh (39)	158.461	212.830	353.229
Rajasthan (50)	15.010	23.144	45.764
Gujarat (54)	82.527	181.353	299.581
Maharashtra (60)	71.939	115.505	221.798
Goa (68)	89.554	124.634	206.290
Madhya Pradesh (70)	19.741	30.293	79.795
Chhattisgarh (71)	24.919	34.589	58.396
Andhra Pradesh (80)	105.857	172.676	315.511
Karnataka (84)	102.451	146.828	277.863
Tamil Nadu (90)	92.152	138.995	265.315
Kerala (96)	69.325	102.485	179.867
Puducherry (99)	74.295	94.577	166.381

Gujarat experienced high levels of welfare growth over the period (more than 140%). Figure 6 shows the compound annual growth rate (CAGR) of welfare (for a consumer with an average deposit balance) across Indian states from 2008 to 2013 on the map of India. Consumers in Madhya Pradesh, Uttar Pradesh, and Gujarat experienced a CAGR of welfare of more than 90%.

Figure 5.: Consumer welfare (per INR deposit) percentage change from 2008 to 2013

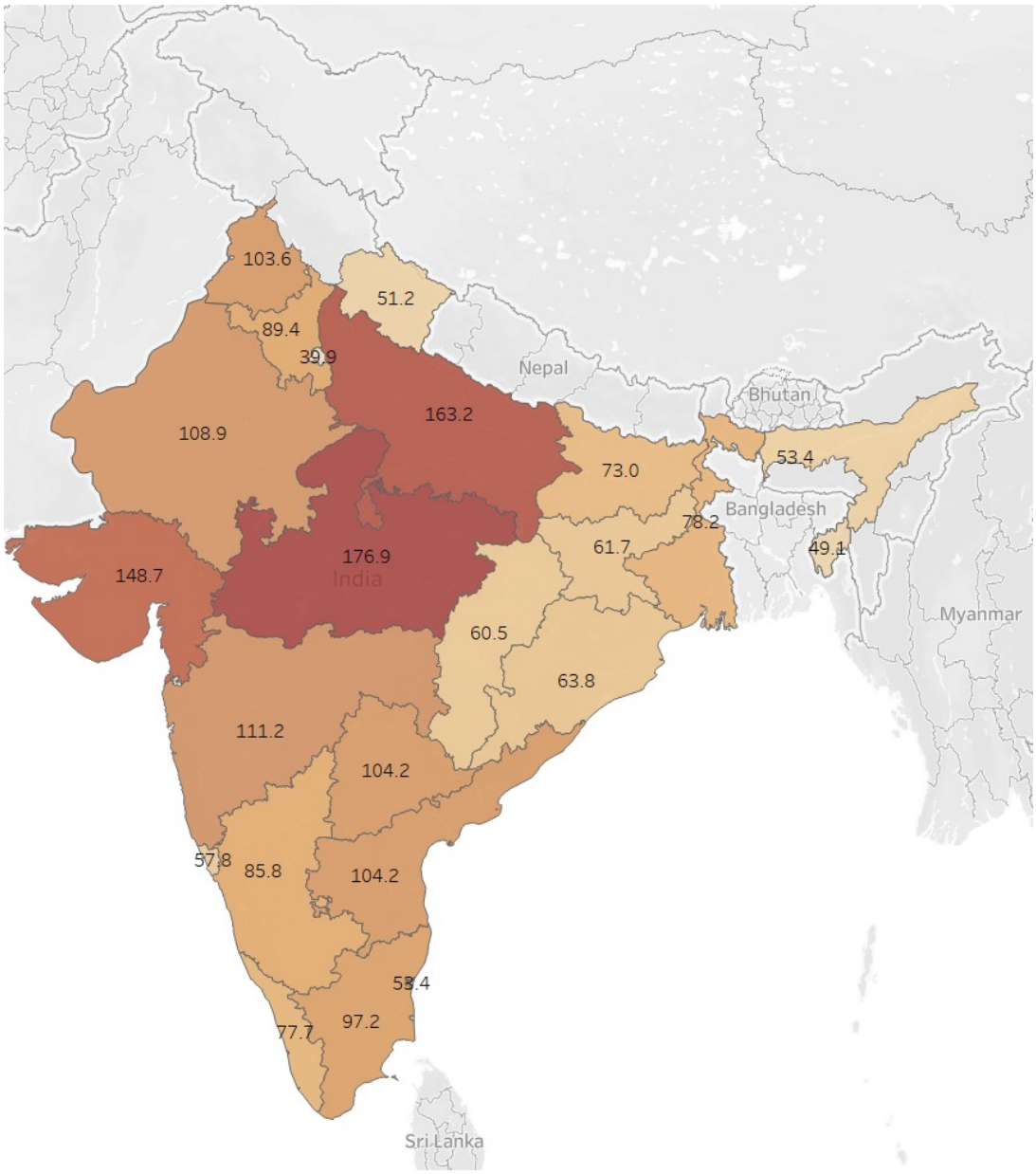


Figure 6.: CAGR of welfare (for a consumer with an average deposit balance) across the Indian States from 2008 to 2013

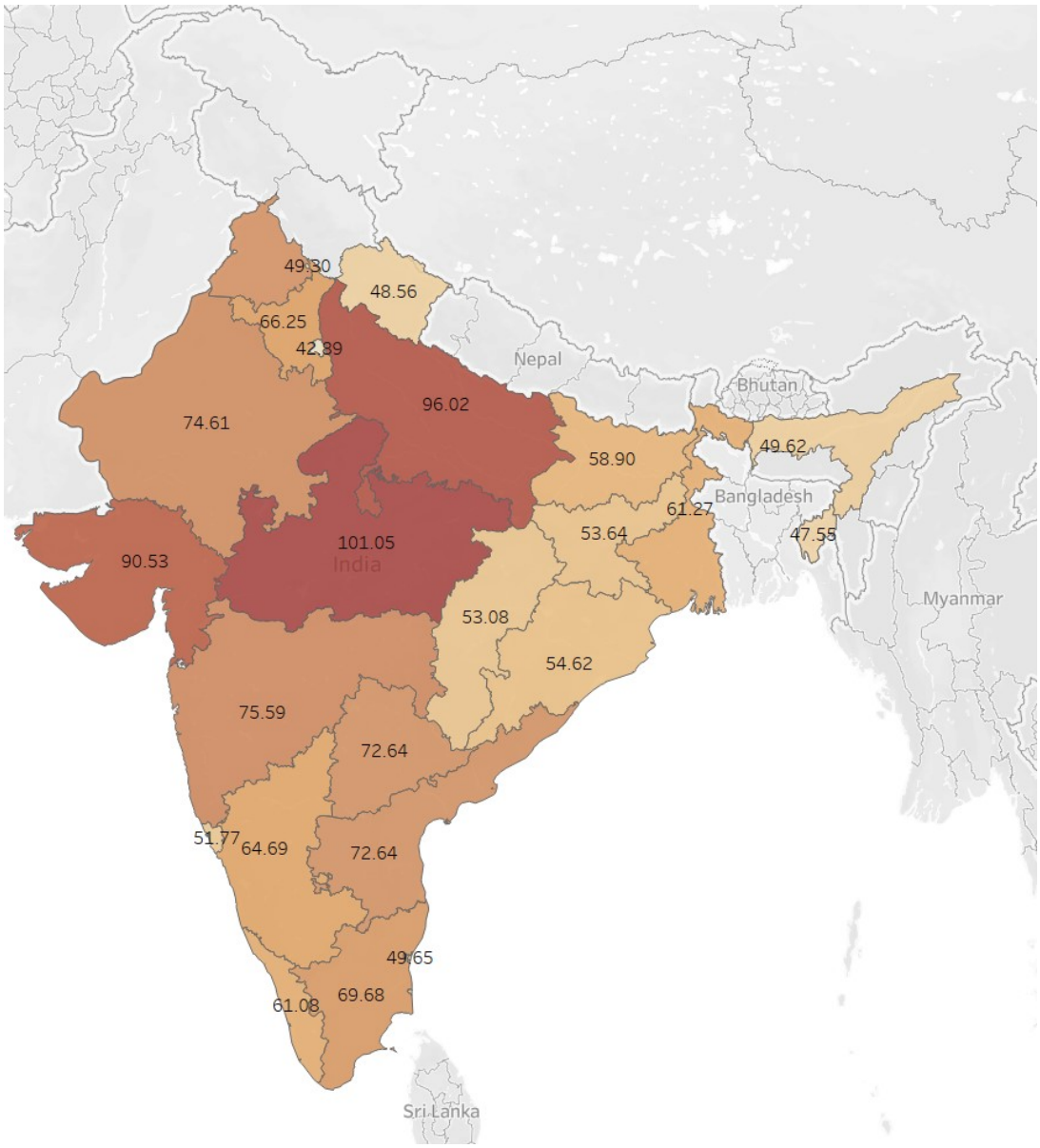


Figure 7.: Difference in the CAGR of welfare from 2011 to 2013 and the CAGR of welfare from 2008 to 2011

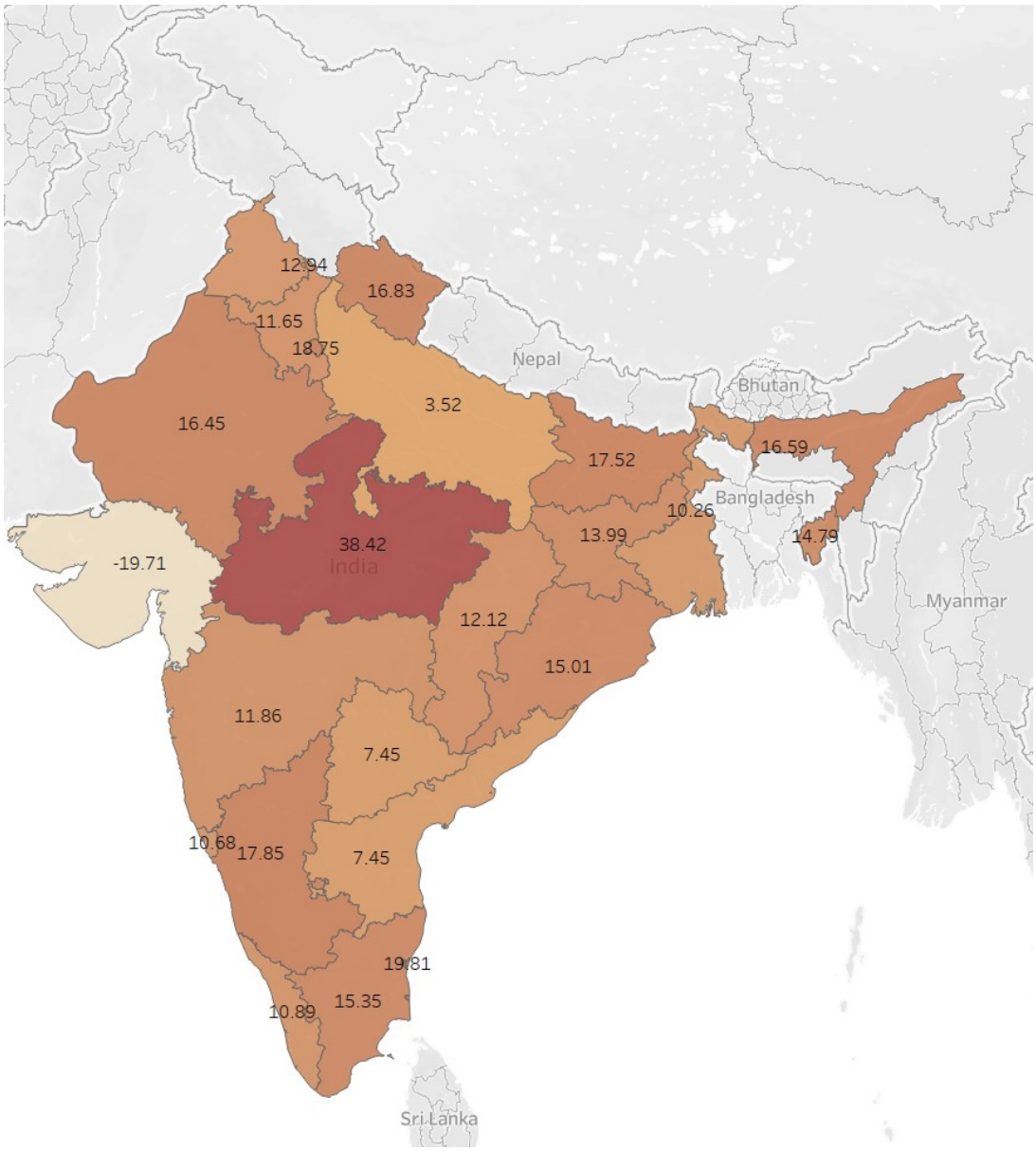


Table 10.: CAGR (%) of welfare (per INR of deposit) from 2008 to 2011 and from 2011 to 2013

CAGR of welfare (per INR of deposit) from 2008 to 2011 and from 2011 to 2013		
State	**ΔCS (2008-11)**	**ΔCS (2011-13)**
Assam (1)	-9.515	36.858
Bihar (6)	-6.906	41.277
Jharkhand (7)	-7.256	37.117
West Bengal (10)	-3.449	38.248
Orissa (16)	-7.326	38.096
Tripura (18)	-9.518	34.971
Uttar Pradesh (20)	9.447	48.236
Uttarakhand (21)	-9.945	36.542
Delhi (29)	-12.504	35.168
Punjab (30)	0.108	42.533
Haryana (34)	-2.437	41.043
Chandigarh (39)	-8.257	34.697
Rajasthan (50)	-1.702	47.026
Gujarat (54)	17.350	34.383
Maharashtra (60)	0.308	44.886
Goa (68)	-6.611	34.515
Madhya Pradesh (70)	-1.938	69.694
Chhattisgarh (71)	-6.735	35.854
Andhra Pradesh (80)	1.105	41.332
Karnataka (84)	-5.232	43.833
Tamil Nadu (90)	-2.778	44.454
Kerala (96)	-3.749	38.514
Puducherry (99)	-10.684	38.678

Table 11.: CAGR (%) of welfare for a consumer with an average deposit balance from 2008 to 2011 and from 2011 to 2013

CAGR (%) of welfare for consumers with an average deposit		
State	**ΔCS (2008-11)**	**ΔCS (2011-13)**
Assam (1)	14.303	30.895
Bihar (6)	35.121	17.599
Jharkhand (7)	31.142	21.087
West Bengal (10)	21.967	32.224
Orissa (16)	17.068	32.079
Tripura (18)	14.299	29.090
Uttar Pradesh (20)	38.257	41.777
Uttarakhand (21)	13.760	30.592
Delhi (29)	10.528	29.278
Punjab (30)	26.459	36.323
Haryana (34)	23.245	34.897
Chandigarh (39)	15.893	28.828
Rajasthan (50)	24.173	40.620
Gujarat (54)	48.240	28.527
Maharashtra (60)	26.712	38.573
Goa (68)	17.971	28.653
Madhya Pradesh (70)	23.875	62.300
Chhattisgarh (71)	17.815	29.934
Andhra Pradesh (80)	27.719	35.173
Karnataka (84)	19.714	37.566
Tamil Nadu (90)	22.814	38.160
Kerala (96)	21.587	32.479
Puducherry (99)	12.827	32.636

6.2.2. *Difference in the rate of welfare gain between pre-regulation (2008-11) and post-regulation(2011-13) period*

Figure 7 shows the difference in the CAGR of welfare from 2011 to 2013 and the CAGR of welfare from 2008 to 2011. We observe that there is a marked increase in the CAGR of welfare for most markets. Interestingly, the CAGR of welfare (for a consumer having an average deposit amount) decreased in Gujarat after 2011. Table 11 shows the corresponding differences in welfare growth rates. Table 10 summarises the CAGR of welfare for a consumer (per INR of deposit) in various states from 2008 to 2011 and from 2011 to 2013.

6.2.3. *Evolution of consumer welfare over the years across states*

Figure 10 shows the evolution of average consumer surplus (per INR of deposit) over the years across states. All the markets under analysis show a kink in 2011 after which the rate of growth in welfare shows a marked increase. Figure 9 shows the evolution of average consumer surplus (for a consumer holding an average deposit amount) over the years across states. We observe that the consumer surplus has been increasing over the years (due to an upward trend in bank characteristics valued by the consumer), and the rate of increase has spurred after 2011 in most markets. In many states, 2011 seems to be an inflection point year (see Fig 9) when the rate of consumer surplus increase becomes positive from negative.

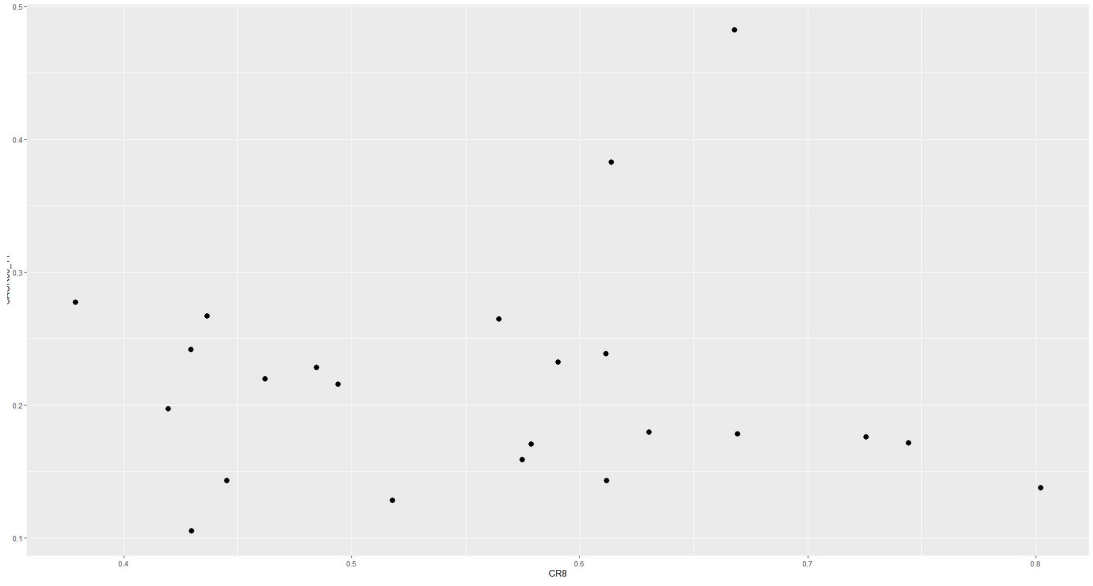
6.2.4. *Simulation*

Since we cannot attribute the whole consumer surplus increase from 2011 to 2013 to a change in prices, we perform a simulation where we keep the prices fixed at the 2011 level and let the bank characteristics evolve as they have been. We call this our baseline scenario. We compute the consumer surplus for the baseline scenario.

Figure 11 depicts the evolution of average consumer surplus for various states as per the baseline scenario (in red) and as per actual evolution (in blue). We observe that in all the states, the blue line is above the red line implying a relative gain in consumer surplus over the baseline scenario where prices are fixed at the 2011 level.

We then study how consumer welfare gains vary with market concentration. We use the CR8 concentration ratio as a measure of market concentration. Fig 8 shows a scatter plot of CR8 and welfare gains from 2011 to 2013. The scatter plot is not indicative of a particular pattern and there is a weak correlation coefficient of -0.103 between concentration and welfare gains post-deregulation.

Figure 8.: Scatter-plot of CR8 concentration ratio and welfare change from 2011 to 2013



Another noteworthy aspect is that although banks kept the saving rate unchanged, they did change the fixed deposit rate. Figure 4 shows the bank-wise evolution of service fees and interest rate (implied by the expense incurred on interest on deposits which includes both saving and fixed deposit accounts[10]) over the years. We observe that service fees decreased for most public sector banks in the choice set except for the Indian Overseas Bank while the service fees increased for many private sector banks except for the ICICI Bank. On the other hand, the interest rate showed an increase across the board. Since most banks did not change the interest rate on saving deposits, this implies banks reacted by changing the deposit rate on fixed deposits (this observation is further corroborated by CCI investigation report).

[10] fixed deposit account in India is similar to term deposit accounts

Figure 9.: Mean consumer surplus (for a consumer with an average deposit balance) in different states over the years

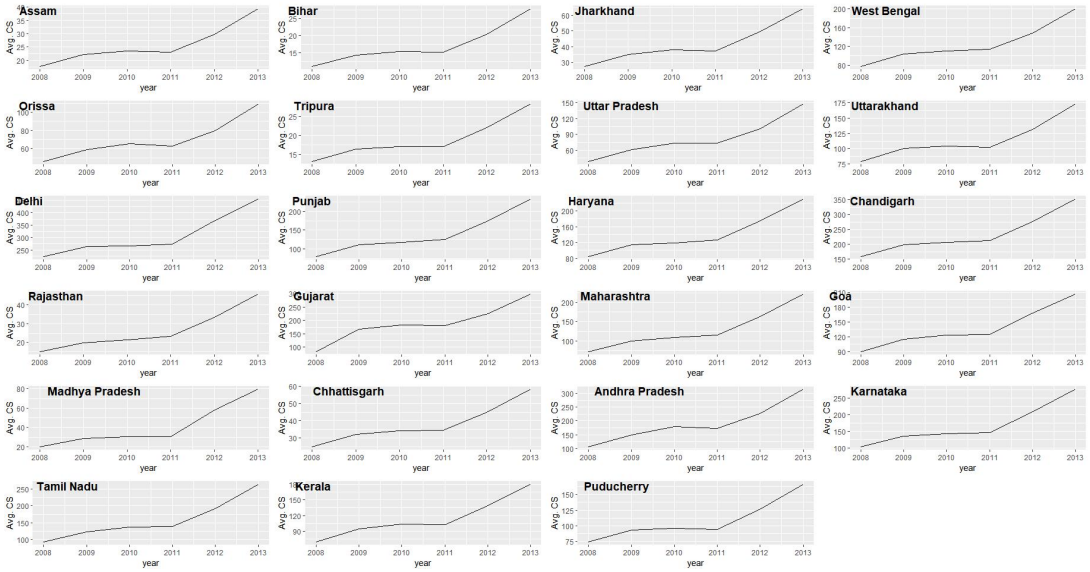


Figure 10.: Mean Consumer Surplus (per INR of deposit) in different states over the years

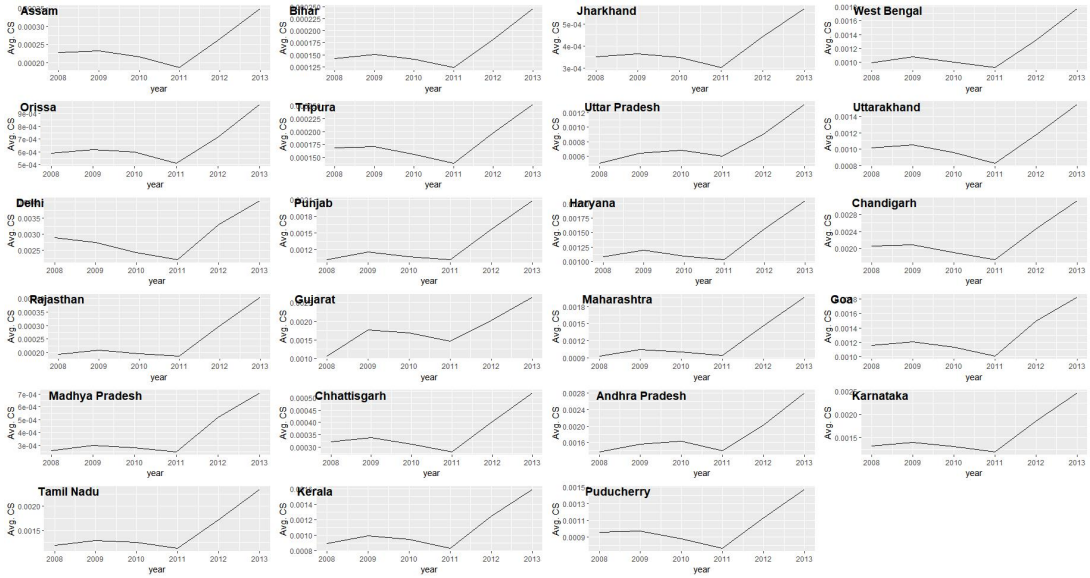
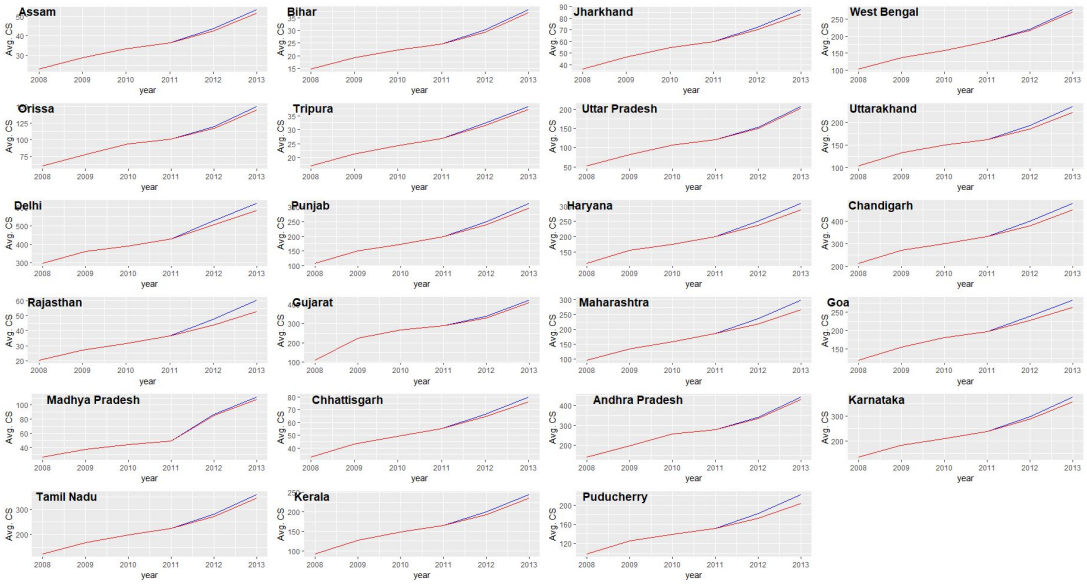


Figure 11.: Simulation 1 - Mean consumer surplus (for a consumer with an average deposit balance) for different states over the years with prices fixed at 2011 levels



Notes: Red line after 2011 shows simulated evolution with prices fixed at the 2011 level. The red line and blue line overlap till 2011 and are visible as red. The simulation period is from 2011 onward

7. Conclusion

In this study, we sought to understand consumer behavior while choosing bank deposit services and assess the welfare impact of saving deposit rate deregulation in India. We estimated the structural taste parameters and found that consumers respond favorably (derive positive utility) to an increase in the deposit interest rate and an improvement in observable bank characteristics like the number of branches, ATM density, the digital infrastructure of the bank, and employees per branch. On the other hand, consumers face disutility with an increase in service fees. Interestingly, consumers derive more utility while availing services from smaller banks (as implied by the asset size) in our choice set (controlling for other factors).

Since most banks did not increase savings deposit rates after the deregulation, we set out to analyze its potential effects on consumer welfare utilizing a broad based set of bank characteristics which may feature in the utility function of a consumer while making a bank choice. We found that the rate of welfare increase (measured by CAGR) spurred in most markets in the post-deregulation period. In fact, as we observe the evolution of consumer welfare, the year 2011 seems to be an inflection point where the rate of growth in welfare becomes positive from negative in most markets. As per our hypothetical simulation exercise, the gain in consumer surplus has been more relative to a baseline scenario where prices are kept fixed at 2011 levels.

It is insightful to note that all the consumer surplus gain post-2011 cannot be attributed

to price changes alone. A large part of it may be due to increased competition in the characteristics space where banks tried to compete fiercely along various non-price attributes that consumers value. This underscores the importance of considering a diverse range of factors, beyond just pricing, in assessing the effectiveness of banking regulations and policies. The study underscores the importance of non-price competition while assessing the conduct of banks in a monopolistically competitive market for retail bank deposits. Even though depositors might not have noticed a discernible change in the price(s) after the regulatory event, they have accrued welfare benefits driven by non-price competition triggered by deregulation, leading to an accelerated improvement in the characteristics they value.

Our results further indicate the importance of digital readiness of a bank in the choice behavior of consumer. While our study focussed on time frame around the deregulation period, future research could explore more sophisticated metrics of digital readiness and the competitive landscape shaped by neo-banks and FinTech evolution in the sector. This would provide a more comprehensive understanding of the dynamic banking market and consumer choices in an increasingly digital world.

Appendix A. Appendix

A.1. Description of key variables and summary statistics

We present a brief description of key variables in Table A1. Table A2 shows the summary statistics of the key variables.

Variable	Description
Market Share	Number of "average deposit" bank accounts/population of market
Service Fees	Income from financial services fees (including commissions)/ Total Deposits
Interest Rate	Interest expense on deposits/ Total deposits
Employees per branch	Total number of employees/Total branches
Number of Branches	Total number of branches of the bank
ATM per branch	Number of ATMs/Number of branches
Digital readiness metric	Number (in millions) of outgoing NEFT transactions for a bank (monthly average)/ Number of accounts for the bank
Age	Number of years since bank established
Total Assets	Total assets as per balance sheet in lakhs crores INR
Operating Expenses	Operating Expenses as per Income statement in millions of INR
Non-performing assets	Non-performing assets of the bank in millions of INR
Cash over employee	Ratio of cash to total employment
Cash over assets	Ratio of cash to total asset size

Table A1.: Description of key variables

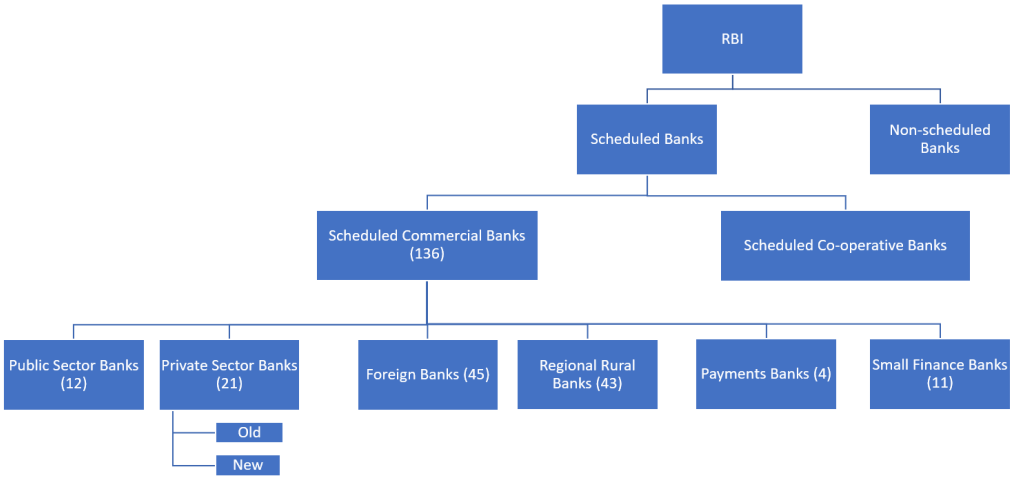
Table A2.: Summary Statistics of key variables

Variable	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Market Share	0.0124	0.0214	2.73×10^{-6}	0.2678
Service Fees	0.0081	0.0064	0.0010	0.0258
Interest Rate	0.0568	0.0095	0.0385	0.0782
Employees per branch	11.7635	6.4723	3.0000	86.3333
Number of Branches	100.6802	184.0664	1.0000	1749.0000
ATM per branch	1.4761	1.5045	0.1113	7.5353
Digital readiness metric	1.05×10^{-7}	3.04×10^{-7}	9.06×10^{-11}	1.95×10^{-6}
Age	68.3690	34.6850	5.0000	118.0000
Total Assets	2.3502	2.6547	0.1698	15.6621
Operating Expenses	397353.8	493713.2	24806.73	2928442.00
Cash over employee	3.6635	2.3630	0.2676	14.0531
Cash over assets	0.0055	0.0029	0.0005	0.0139

A.2. Banks in India

Fig A.1 depicts the current classification of banks in India. The classification is derived from the Reserve Bank of India's 'Report on Trend and Progress of Banking in India 2020-21 (Reserve Bank of India, 2020).

Figure A.1.: Classification of Banks in India. The classification is derived from the Reserve Bank of India's 'Report on Trend and Progress of Banking in India 2020-21'(Reserve Bank of India, 2020)



A.3. Robustness Test using Random Coefficient Logit (BLP Model) Estimation

To capture heterogeneity in the coefficient of prices, we estimate a random coefficient logit model where we allow the coefficient on service fees to be individual specific

$$u_{ijm} = p_{jm}^{dep}\alpha^{dep} - p_{jm}^{serv}\alpha_i^{serv} + X_{jm}^{'}\beta + \xi_{jm} + \lambda\nu_{im} + \varepsilon_{ijm} \tag{A1}$$

Here, p_{jm}^{dep} and p_{jm}^{serv} are the interest rate on deposits and service fees respectively. X_{jm} is the vector of observable bank characteristics for bank j in market m. α_i^{serv} is the random coefficient on service fees. We let $\alpha_i^{serv} \equiv \frac{\sigma}{y_{im}}$ where y_{im} is the income of individual i in market m (obtained by dividing the household income the individual belongs to by the number of members in the household). Income is an important factor determining the saving habits of consumers (Steinert, Satish, Stips, & Vollmer, 2022). This specification captures the heterogeneity in the sensitivity (price elasticity) of an individual to price as her income changes. A higher-income individual may be fine paying higher service fees as per this specification. ν_{im} is an individual-specific idiosyncratic component and is drawn from a standard normal distribution.

The above can be written as sum of mean utility (independent of consumer characteristics) i.e.
$\delta(p_{jm}^{dep}, X_{jm}^{'}, \xi_{jm}; \alpha^{dep}, \beta)$ and utility depending on consumer characteristics i.e. $\phi(p_{jm}^{serv}, \nu_{im}, y_{im}; \tau_d)$

$$u_{ijm} = \delta(X_{jm}^{'}, p_{jm}^{dep}, \xi_{jm}; \alpha^{serv}, \beta) + \phi(p_{jm}^{dep}, \nu_{im}, y_{im}; \tau_d) + \varepsilon_{ijm} \tag{A2}$$

Here, $\tau_d = (\alpha^{dep}, \lambda)$ are parameters associated with individual preference and $\varepsilon_{ijm} \sim TIEV$ (Type 1 extreme value distributed). As parameters enter non-linearly, the mean utility doesn't have a closed form in terms of market shares (as is possible in logit and nested-logit formulations). The algorithm utilizes numerical integration using simulation draws, contraction mapping, and the Generalized Method of Moments (GMM) for parameter estimation. We can show that the model-implied market shares are

$$s_{jm}(\delta_{jm}; \tau_d) = \iint \frac{e^{\delta_{jm}+\phi_{ijm}}}{1+\sum_{k=1}^{J} e^{\delta_{jm}+\phi_{ijm}}} dP(y_{im}) dP(\nu_i) \tag{A3}$$

We can compute this integral numerically using draws from a normal distribution for ν_i and draws from the empirical distribution of income in each market as surveyed in India Human Development Survey-II, 2011-12 (IHDS-II).

$$s_{jm}(\delta_{jm}; \tau_d) = \sum_{i=1}^{ns} \frac{e^{\delta_{jm}+\phi_{ijm}}}{1+\sum_{k=1}^{J} e^{\delta_{jm}+\phi_{ijm}}} \tag{A4}$$

IHDS is a collaborative research program between researchers from the National Council of Applied Economic Research, New Delhi (NCAER), and the University of Maryland. India Human Development Survey-II (IHDS-II), 2011-12 is a nationally representative, multi-topic survey of 42,152 households in 1,420 villages and 1,042 urban neighborhoods across India. A limitation of our draws is that we use the draws from the same survey to capture the distribution of per-capita income for each year. To the best of the author's knowledge, there was not any publicly available broad-based survey that could be used for the purpose of taking yearly draws of per capita income across markets. Following (S. Berry et al., 1995), we use the following nested fixed-point algorithm to find estimates of $\tau_d = (\alpha^{serv}, \lambda)$ which minimizes the distance (norm) between observed market shares and model implied market shares.

Pseudocode:

Outer Loop: Start with an initial guess of τ_d. Later we iterate over other values

Given this value of τ_d, compute the integral for market shares numerically using simulation

- **Inner Loop**
  - Use the following contraction mapping to find the mean utility
  - $$\delta_{jmt}^{new} = \delta_{jmt}^{old} + ln(s_{jmt}) - ln(s_{jmt}^{ns}(\delta_{jmt}^{old}; \tau_d)) \tag{A5}$$
  - Compute the residual ξ
  - Compute sample moment condition $m = E(z\xi) = 0$ where z represents instruments
  - Compute GMM weighting function $m^{'}\Sigma m$

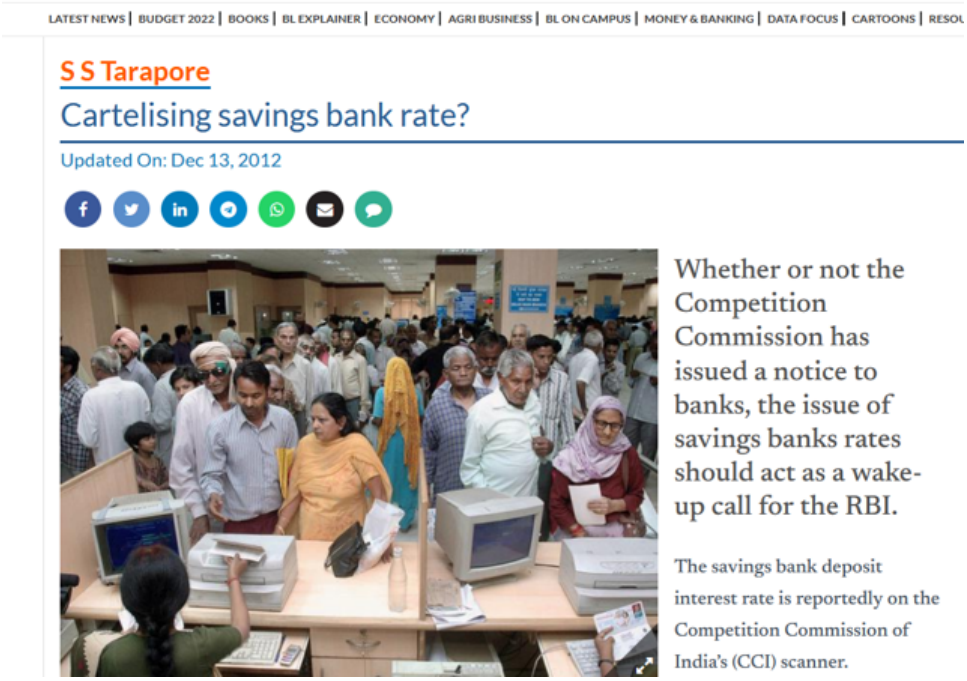
- Go to outer loop for another iteration over τ_d values
- Report τ_d which achieves a minimum value of GMM objective function

We use the same variables and instruments as our key nested-logit specification. We present the results in table A3. The negative coefficient on the inverse of per-capita income implies that as the per-capita income of agents increases, the magnitude of the coefficient on service fees decreases. This implies that higher-income agents are less sensitive to changes in service fees. We also see that coefficients on characteristics are robust as per this richer specification.

Table A3.: Estimation results using random-coefficient logit specification.

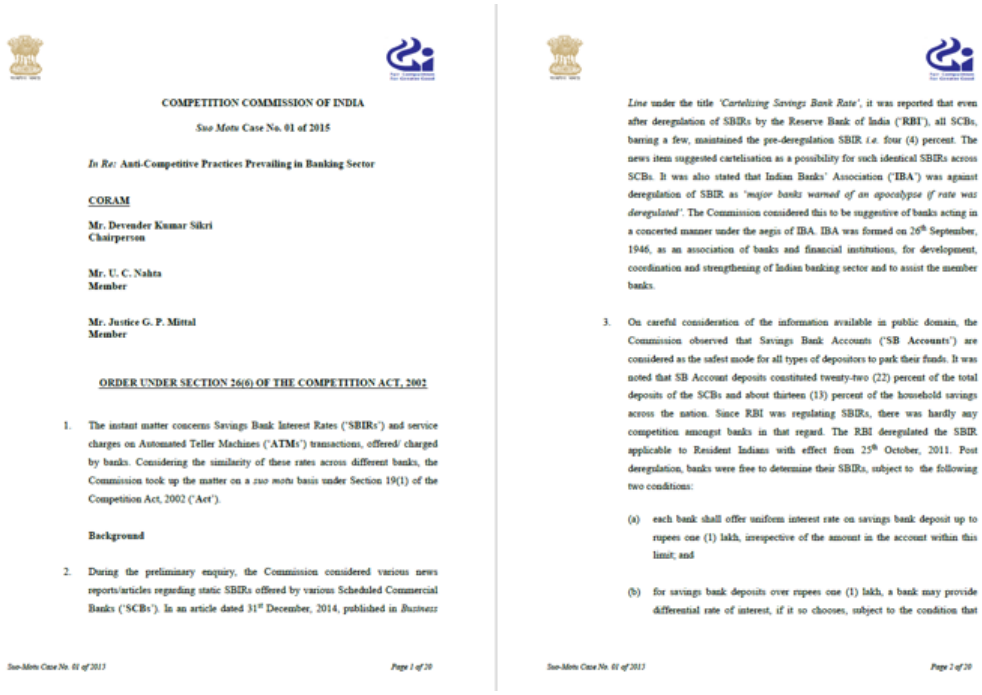
Variables	**RC Logit**
Service Fee	-84.185* (34.175)
Interest Rate	46.615** (16.156)
Employees per branch	0.031*** (0.005)
No. of Branches	0.003*** (0.000)
ATM per branch	0.269 (0.103)
Digital-readiness metric	1135623.000*** (246261.100)
Assets Size	-0.119** (0.048)
Age of Bank	0.130*** (0.006)
RC- Inverse of per capita income	-458665.200* (169314.400)
Observations	2545
No. of demographic draws per market	100
Fixed Effects	Bank Market
IV's	BLP+Cost Shifters

Figure A.2.: Exhibit of article by SS Tarapore (ex-Deputy Governor of RBI) which triggered an investigation by CCI



A.4. Exhibits

Figure A.3.: Snapshot of the title page of CCI Suo Moto case 01 of 2015



COMPETITION COMMISSION OF INDIA

Suo Motu Case No. 01 of 2015

In Re: Anti-Competitive Practices Prevailing in Banking Sector

CORAM

Mr. Devender Kumar Sikri
Chairperson

Mr. U. C. Nahta
Member

Mr. Justice G. P. Mittal
Member

ORDER UNDER SECTION 26(6) OF THE COMPETITION ACT, 2002

1. The instant matter concerns Savings Bank Interest Rates ('SBIRs') and service charges on Automated Teller Machines ('ATMs') transactions, offered/ charged by banks. Considering the similarity of these rates across different banks, the Commission took up the matter on a *suo motu* basis under Section 19(1) of the Competition Act, 2002 ('Act').

Background

2. During the preliminary enquiry, the Commission considered various news reports/articles regarding static SBIRs offered by various Scheduled Commercial Banks ('SCBs'). In an article dated 31st December, 2014, published in *Business*

Suo-Motu Case No. 01 of 2013 *Page 1 of 20*

Line under the title *'Cartelizing Savings Bank Rate'*, it was reported that even after deregulation of SBIRs by the Reserve Bank of India ('RBI'), all SCBs, barring a few, maintained the pre-deregulation SBIR *i.e.* four (4) percent. The news item suggested cartelisation as a possibility for such identical SBIRs across SCBs. It was also stated that Indian Banks' Association ('IBA') was against deregulation of SBIR as *'major banks warned of an apocalypse if rate was deregulated'*. The Commission considered this to be suggestive of banks acting in a concerted manner under the aegis of IBA. IBA was formed on 26th September, 1946, as an association of banks and financial institutions, for development, coordination and strengthening of Indian banking sector and to assist the member banks.

3. On careful consideration of the information available in public domain, the Commission observed that Savings Bank Accounts ('SB Accounts') are considered as the safest mode for all types of depositors to park their funds. It was noted that SB Account deposits constituted twenty-two (22) percent of the total deposits of the SCBs and about thirteen (13) percent of the household savings across the nation. Since RBI was regulating SBIRs, there was hardly any competition amongst banks in that regard. The RBI deregulated the SBIR applicable to Resident Indians with effect from 25th October, 2011. Post deregulation, banks were free to determine their SBIRs, subject to the following two conditions:

(a) each bank shall offer uniform interest rate on savings bank deposit up to rupees one (1) lakh, irrespective of the amount in the account within this limit; and

(b) for savings bank deposits over rupees one (1) lakh, a bank may provide differential rate of interest, if it so chooses, subject to the condition that

Suo-Motu Case No. 01 of 2013 *Page 2 of 20*

References

Acuité Insights. (2021). *Banking sector: Next phase of consolidation likely over FY22-24.* (Retrieved from `https://www.acuite.in/banking_sector_Oct-2021.htm`)

Berry, S., Levinsohn, J., & Pakes, A. (1995). Automobile prices in market equilibrium. *Econometrica: Journal of the Econometric Society*, 841–890.

Berry, S. T. (1994). Estimating discrete-choice models of product differentiation. *The RAND Journal of Economics*, 242–262.

Bertrand, M., Schoar, A., & Thesmar, D. (2007). Banking deregulation and industry structure: Evidence from the french banking reforms of 1985. *The Journal of Finance*, *62*(2), 597–628.

Bhattacharya, K., & Das, A. (2003). Dynamics of market structure and competitiveness of the banking sector in india and its impact on output and prices of banking services. *Reserve Bank of India Occasional Papers*, *24*(3), 123–159.

Bikker, J. A., Shaffer, S., & Spierdijk, L. (2012). Assessing competition with the panzar-rosse model: The role of scale, costs, and equilibrium. *Review of Economics and Statistics*, *94*(4), 1025–1044.

Bjornerstedt, J., & Verboven, F. (2016). Does merger simulation work? Evidence from the Swedish analgesics market. *American Economic Journal: Applied Economics*, *8*(3), 125–64.

Bresnahan, T. F. (1982). The oligopoly solution concept is identified. *Economics Letters*,

10(1-2), 87–92.

Broude, H. W., & Bain, J. S. (1957). Barriers to new competition. *The Yale Law Journal*, 634–636.

Cardell, N. S. (1997). Variance components structures for the extreme-value and logistic distributions with application to models of heterogeneity. *Econometric Theory*, *13*(2), 185–213.

CCI. (2015). *Suo Moto Case No. 01 of 2015: Anti-Competitive Practices Prevailing in Banking Sector.*

Cole, S. (2009). Financial development, bank ownership, and growth: or, does quantity imply quality? *The Review of Economics and Statistics*, *91*(1), 33–51.

Das, A., Mishra, P., & Prabhala, N. (2015). *The transmission of monetary policy within banks: Evidence from india* (Working Paper). Centre for Advanced Financial Research and Learning (CAFRAL).

Davis, P. (2006). Spatial competition in retail markets: Movie theaters. *The RAND Journal of Economics*, *37*(4), 964–982.

Dick, A. A. (2002). *Demand estimation and consumer welfare in the banking industry.* Available at SSRN 369401. (`https://ssrn.com/abstract=369401`)

Dick, A. A. (2007). Market size, service quality, and competition in banking. *Journal of money, credit and banking*, *39*(1), 49–81.

Dick, A. A. (2008). Demand estimation and consumer welfare in the banking industry. *Journal of Banking & Finance*, *32*(8), 1661–1676.

Ho, C. Y. (2012). Market structure, welfare, and banking reform in China. *Journal of Comparative Economics*, *40*(2), 291–313.

Iwata, G. (1974). Measurement of conjectural variations in oligopoly. *Econometrica: Journal of the Econometric Society*, 947–966.

Jayaratne, J., & Strahan, P. E. (1998). Entry restrictions, industry evolution, and dynamic efficiency: Evidence from commercial banking. *The Journal of Law and Economics*, *41*(1), 239–274.

Krishnamurthy, P. (2015). Banking deregulation, local credit supply, and small-business growth. *The Journal of Law and Economics*, *58*(4), 935–967.

Kumar, N. (2020). Political interference and crowding out in bank lending. *Journal of Financial Intermediation*, *43*, 100815.

Mason, E. S. (1939). Price and production policies of large-scale enterprise. *The American economic review*, *29*(1), 61–74.

McFadden, D. (1981). Econometric models of probabilistic choice. In C. Manski & D. McFadden (Eds.), *Structural analysis of discrete data with econometric applications* (pp. 198–272). Cambridge, MA: MIT Press.

Mohan, R., & Ray, P. (2018). Indian financial sector: Structure, trends, and turns. In *Routledge handbook of banking and finance in asia* (pp. 54–75). Routledge.

Molnar, J., Nagy, M., & Horvath, C. (2006). *A structural empirical analysis of retail banking*

competition: The case of Hungary. Available at SSRN 961776. (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=961776)

Nakane, M. I., Alencar, L. S., & Kanczuk, F. (2006). Demand for bank services and market power in Brazilian banking. *Central Bank of Brazil Working Paper*(107).

Nevo, A. (2001). Measuring market power in the ready-to-eat cereal industry. *Econometrica*, *69*(2), 307–342.

Panzar, J. C., & Rosse, J. N. (1987). Testing for "monopoly" equilibrium. *The Journal of Industrial Economics*, 443–456.

Prasad, A., & Ghosh, S. (2007). Competition in Indian banking: An empirical evaluation. *South Asia Economic Journal*, *8*(2), 265–284.

Registrar General of India. (2006). *Report of the technical group on population projections* (Tech. Rep.).

Reserve Bank of India. (2011). *Deregulation of savings bank deposit interest rate: A discussion paper* (Discussion Paper).

Reserve Bank of India. (2020). *Report on trend and progress of banking in india* (Technical Report).

Small, K. A., & Rosen, H. S. (1981). Applied Welfare Economics with Discrete Choice Models. *Econometrica*, 105–130.

Steinert, J. I., Satish, R. V., Stips, F., & Vollmer, S. (2022). Commitment or concealment? Impacts and use of a portable saving device: Evidence from a field experiment in urban India. *Journal of Economic Behavior & Organization*, *193*, 367–398.