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How Do Customers Respond to Increased Service Quality Competition?

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When does increased service quality competition lead to customer defection, and which customers are most likely to defect? Our empirical analysis of 82,235 customers exploits the varying competitive dynamics in 644 geographically isolated markets in which a nationwide retail bank conducted business over a five-year period. We find that customers defect at a higher rate from the incumbent following increased service quality (price) competition only when the incumbent offers high (low) quality service relative to existing competitors in a local market. We provide evidence that these results are due to a sorting effect, whereby firms trade-off service quality and price, and in turn, the incumbent attracts service (price) sensitive customers in markets where it has supplied relatively high (low) levels of service quality in the past. Furthermore, we show that it is the high quality incumbent's most profitable customers who are the most attracted by superior quality alternatives. Our results appear to have long-run implications whereby sustaining a high level of service quality is associated with the incumbent attracting and retaining more profitable customers over time.

Key words: empirical service operations; service quality competition; customer defection; firm performance

1. Introduction

When does increased service quality competition lead to customer defection, and which customers are most likely to defect? Despite a well-established literature that links investments in service quality to customer perceptions and behaviors, and ultimately, firm performance (Heskett et al. 1997, Sutton 1986, Zeithaml et al. 1996), the answers to these questions remain largely unaddressed. Broadly speaking, existing work documents the positive average effects of service quality but does not explore market and customer-level differences. Leveraging detailed data on 82,235 customers of a nationwide retail bank, our paper presents the first customer-level empirical investigation of the effects of service quality competition on customer defection in a multi-market setting.

The links between service quality and customer switching behavior are well-established tenets of the theoretical literature. Superior quality facilitates customer acquisition (Dana Jr. 2001, Ernst and Powell 1995, Nerlove and Arrow 1962) and retention (Cachon and Harker 2002, Cohen and Whang 1997, Gans 2002, Hall and Porteus 2000, Karmarkar and Pitbladdo 1997, Li 1992, Li and Lee 1994, Tsay and Agarwal 2000). Consistently, empirical work has documented a positive relationship

between service quality and market share at the brand level (Allon et al. 2011, Buzzell and Gale 1987, Guajardo et al. 2012, Jacobson and Aaker 1987, Phillips et al. 1983), suggesting that more quality is always desired. However, vertical (quality) differentiation theory notes that customers differ in their marginal willingness to pay for quality (Gabszewicz and Thisse 1979, Shaked and Sutton 1982, Sutton 1986, Tirole 1990). The rational consumer will only defect from the incumbent if the competitor's price/quality bundle will improve her utility. Hence, the aggregate effect of increased service quality competition on customer retention likely varies by market, depending on the the distribution of preferences among the incumbent's customers and the relative quality offered by existing competitors.

Despite these long-standing theories, empirical evidence on the differential effect of service quality between markets is lacking. Yet, these differences have important implications for how a firm should behave, both operationally and strategically. In particular, our results suggest that investments in higher service quality are not likely to yield uniform returns across markets and may in some cases be counterproductive, depending on the incumbent's service quality position relative to its local market competitors.

Even within markets, there may be important differences across customers in how they respond to increased service quality competition. For example, the theoretical literature on switching behavior assumes that a customer's sensitivity to service quality and her profitability are uncorrelated.[1] It is unclear, however, how realistic this assumption is in practice.[2] If the most profitable customers are enmeshed in more complex relationships with the firm, switching costs may reduce their probability of defection when an attractive opportunity presents itself (Klemperer 1995). However, highly profitable customers may have a higher willingness to pay for service quality as posited by the priority pricing literature (Afèche and Mendelson 2004, Lederer and Li 1997, Mendelson and Whang 1990). Furthermore, to the extent that high profitability customers have more at stake in the relationship, and more interactions with the firm than their low profitability counterparts, they may be more acutely aware of its deficiencies (Israel 2005). While the consequences of customer defection for a firm's bottom line depend critically on the foregone profitability of closed accounts, empirical evidence is lacking on the differential effect of service quality competition across customers. Indeed, our results suggest that despite increased switching costs, highly profitable customers are

[1] In models documenting customer switching behavior, customers are assumed to vary in service sensitivity, and either generate homogeneous profitability for the firm or profitability that is uncorrelated with their preferences for quality (Cohen and Whang 1997, Dewan and Mendelson 1990, Karmarkar and Pitbladdo 1997, Mandelbaum and Shimkin 2000, Stidham Jr. 1992, Tsay and Agarwal 2000).

[2] For example, it is well known in the airline industry that service-sensitive customers often fly "business" or "first-class," which is far more profitable for airlines than their coach customers. If a new, higher quality airline enters a particular market, the entrant may be especially attractive to these highly profitable customers.

disproportionately attracted by the entry or expansion of competitors that offer superior service quality.

Studying the effects of service quality competition on defection is complicated by the challenge of first observing customer-level outcomes and then linking those outcomes to market entry by firms with differential service quality levels. We overcome these challenges using unique data on a large sample of customers interacting with a single nationwide bank in 644 geographically isolated markets. We exploit regulatory data on bank entry and external ratings of bank service quality to capture variations in each market's competitive dynamics. By linking these sources of data together, our paper tests the extant theory and broadens the literature in four ways.

First, we reconcile existing theory by identifying the contingent effects of service quality competition on customer defection. We find that competing firms trade-off price and service quality, and in markets where the incumbent has held a high (low) service quality position relative to local competitors, its customers are more likely to defect following the entry or expansion of a competitor offering superior (inferior) service quality for higher (lower) prices. The effects are sizable. When the incumbent has a high quality service position, customer defection increases 9.6% over baseline rates in the year following entry or expansion by a superior service quality competitor. Similarly, when the incumbent has a low quality service position, defection increases 7.8% over baseline rates in the year following entry or expansion by an inferior service quality competitor.

Second, we provide evidence that customer sorting within each local market underpins these results. In markets where the incumbent occupies a high relative service quality position, its customers exhibit heightened sensitivity to service quality: expressing lower levels of satisfaction with comparable transactions, reporting service problems more frequently, and showing a lower level of overall satisfaction with the bank. This pattern persists after controlling for differences in objective service quality between markets, and industry-wide data suggests that the pattern generalizes beyond the focal firm.

Third, in contrast with existing theory, we demonstrate a positive correlation between a customer's service sensitivity and their profitability to the firm. Highly profitable customers (with the longest tenure, broadest relationships, and highest balances) are more likely to defect from the high quality incumbent when a provider offering superior service quality enters, or expands in, their market. Relative to baseline rates, defection probabilities increase 14.1%, 28.3%, and 17.9% respectively, for these high value customers following the local entry or expansion of superior service quality competitors.

Finally, we document a positive relationship between the relative level of service quality sustained by a firm in a given market and the profitability of customers it attracts and retains over time. Controlling for other market-level differences, the incumbent serves customers with balances

that are 8.0% higher in markets where it sustains a high service quality position relative to its competitors over the long run. Indeed, accounting for market and time period fixed effects, average balances increase $20.59 per customer for each month the incumbent maintains an above-median service quality position in their market.

The remainder of this paper proceeds as follows. In Section 2, we develop a simple economic model of service quality competition that motivates the hypotheses we test. Section 3 discusses our research context and sources of data. Section 4 outlines our methodological approach and presents the primary results. Section 5 presents an additional analysis to explore the long-term performance implications of a firm's relative service quality position. Section 6 concludes the paper.

2. Theory and hypothesis development

2.1. A simple model of service quality competition

We consider a vertical differentiation model, based initially on Tirole (1990), in which the service offerings of various firms are differentiated by quality, s. The unit mass of consumers differ in their marginal willingness to pay for quality, θ, which is distributed such that $\max(\theta) = \bar{\theta}$ and $\min(\theta) = \underline{\theta}$. Assume that n firms exist in an industry, and each firm j offers a standardized level of service quality denoted by s_j, where $s_{j-1} < s_j < s_{j+1} < \cdots < s_n$, across the multiple markets in which they compete.[3] Further assume that price is a convexly increasing function of quality that is common across all firms, $p(s)$, such that $p_j = p(s_j)$, $p'(s_j)$ is the marginal price of service quality for firm j, and $p_{j-1} < p_j < p_{j+1} < \cdots < p_n$.[4]

2.2. Aggregate effects of service competition

When a firm enters or expands in a local market, it attracts new customers from various sources, some of whom defect from incumbent competitors (Caves 1998). However, when entrants and

[3] Interviews with retail banking executives suggested that objective service quality is largely a function of centralized decisions and policies relating to process design, technological infrastructure, incentives, hiring, and training, which would be costly and require significant coordination to modify locally. Consistent with this idea, the industrial organization literature in banking reveals that even lending and pricing policies, which would be relatively easy to customize locally, tend also to be standardized, owing in part to the complexities and costs of managing a multi-market organization (Berger et al. 2007, Erel 2009). Consistently, operations management research on U.S. automotive dealerships reports substantial and persistent differences in finished-goods inventory levels between brands across markets (Cachon and Olivares 2010). Finally, organizational economics literature on "seemingly similar enterprises" concludes that within-industry productivity rankings are persistent, and increased competition leads to aggregate productivity growth but not in a manner that substantially reduces productivity dispersion (Gibbons and Henderson 2012). This is consistent with the idea that even when firms invest in making improvements in quality or productivity, it's very difficult to overcome competitors that have pre-existing advantages. Accordingly, we model service quality as an institution-level characteristic and use an institution-level service quality measure in our analysis. We directly test the appropriateness of this modeling choice in Section 3.2.3 and provide further empirical support in Section 4.3.1.

[4] This is consistent with the assumption that marginal costs are increasing in service quality, and in turn, with the notion that price and service quality are positively correlated, which we empirically test in 4.1.

incumbents offer disparate levels of service quality, the effect of entry on incumbent customer defection depends on the relationship between the incumbents' customers' willingness to pay for quality improvements, and the increase in variable costs, and in turn, prices, associated with such improvements (Sutton 1986). On the one hand, entry by a superior service quality competitor may intensify defection from incumbents offering poorer service, as ceteris paribus, incumbent customers would prefer higher quality. However, to the extent that the superior service entrant and inferior service incumbent trade-off price and service quality, customer price sensitivity may mitigate the effect of entry on defection. To illustrate, in the model described above, a consumer's utility from using the service of a particular firm j is given by $\theta s_j - p_j$. If $\theta > p'(s_j)$ for some set of a firm's customers, those customers would prefer the offerings of an entrant offering higher quality service at marginally higher prices, but would not be attracted to an entrant offering inferior service quality at marginally lower prices. Alternatively, if $\theta < p'(s_j)$ for some set of its customers, those customers would be attracted to an entrant offering inferior service quality at marginally lower prices, but would not be attracted to an entrant offering superior quality, since defection to the entrant would diminish their utility. Hence, the effect of service quality competition on customer defection depends crucially on the distributions of θ among a firm's customers in the specific markets where competitive entry occurs. Because the distribution of θ is likely to vary by market, the existence of an average effect of service quality competition on customer defection across all markets is unclear. As such, in the next section, we explore how market-level heterogeneity and customer sorting may affect the relationships between service quality competition and customer defection in particular markets.

2.3. Customer sorting and market-level heterogeneity

A rich stream of the theoretical operations management literature models customer switching behavior in response to service deficiencies, either experienced (Gans 2002, Hall and Porteus 2000), or anticipated (Cohen and Whang 1997, Tsay and Agarwal 2000). Theory suggests that when customers are underserved, which is most typically modeled as when inventory is unavailable or subject to a lengthy delivery delay (Cachon and Harker 2002, Li 1992, Li and Lee 1994) or when customers encounter an unacceptably long queue (Dewan and Mendelson 1990, Mendelson 1985, Stidham Jr. 1992, Van Mieghem 2000), they are likely to defect in favor of superior service. These service-sensitive customers may trade up to another firm in their market that offers higher service quality, albeit at higher prices.

Assume two firms (firm $j-1$ and firm j) compete in a particular market, in which the support of θ is $[\underline{\theta}, \bar{\theta}]$. Customers for whom $\tilde{\theta} = (p_j - p_{j-1})/(s_j - s_{j-1})$ will be indifferent between the two

firms, and we assume θ is distributed such that $\underline{\theta} < \tilde{\theta} < \bar{\theta}$.[5] By extension, all customers for whom $\theta > \tilde{\theta}$ will derive higher utility from firm j.

In the presence of perfect information and costless switching, every customer would immediately sort to her optimal provider. However, service has been characterized as an experience good, and customers transacting in the presence of information asymmetries may learn about a firm's service quality within a market over time (Israel 2005).[6] Moreover, to the extent the prices realized by an individual depends on her usage characteristics (e.g., interest rates and fees may vary by customer), customers may also learn about price over time (Iyengar et al. 2007). Perceived quality for firm j, in a given market m at a particular time is given by $\hat{s}_{j,m} = (1-\delta)s_j + \delta\bar{s}_m$, where $\bar{s}_m$ represents the median objective service quality level among firms in the market, $\delta \leq 1$, and $\delta \to 0$ as $T_{j,m} \to \infty$ where $T_{j,m}$ represents the number of time periods after the entry of firm j into market m that s_j has been above or below $\bar{s}_m$.[7,8] We model perceived price, $\hat{p}_{j,m}$, as a convexly increasing function of perceived quality, $\hat{p}_{j,m} = f(\hat{s}_{j,m})$.[9] Intuitively, as customers acquire more information about a particular firm's service quality and price (e.g., through word of mouth, increased advertising in the local market, etc.), they are better able to gauge its performance relative to the typical provider in the market, though their ability to interpret these performance dimensions is always subject to some degree of error. As quality perceptions of the firm rise (fall) in the market, the firm will attract and retain customers who are increasingly service quality (price) sensitive. Consistently, we hypothesize that:

HYPOTHESIS 1. *The service quality sensitivity of customers attracted and retained by a firm in a particular market is positively associated with the length of time the firm has occupied a high service quality position relative to its competitors in that market.*

[5] We further assume that $\max(p_j - p_{j-1})/(s_j - s_{j-1}) \leq \bar{\theta}$ and $\min(p_j - p_{j-1})/(s_j - s_{j-1}) \geq \underline{\theta}$.

[6] As we will now model market-specific phenomena, we will begin indexing variables by m where appropriate. With the introduction of information asymmetries and customer learning, we also diverge from the classic vertical differentiation model found in Tirole (1990).

[7] Throughout this paper, we use the median service quality level offered in a local market to delineate high and low quality service firms. We acknowledge that other market-level delimiters, such as the mean service level, the upper quartile, or even the top quality firm in a market may be relevant in different contexts. Given that quality in these terms is a relative construct, the same firm may be a high service quality firm in one market and a low service quality firm in a different market, depending on the competitive set it faces in each.

[8] Owing to the fact that customers possess different information and learn at different rates, δ, and the rate at which $\delta \to 0$ is customer-specific. For some new entrants, which possess no quality reputation, $\delta = 1$ upon entry. For others, which upon entry may have a pre-existing quality reputation (e.g., brand recognition), $0 < \delta < 1$.

[9] We note that customers may also infer service quality from price perceptions. An equivalent way to model perceived service quality, $\hat{s}_{j,m}$, is as a concave increasing function of perceived price, $\hat{p}_{j,m}$, where perceived price is the sum of the firm's objective price, a systematic error term, and a random error term unique to the individual consumer, $\hat{p}_{j,m} = (1-\delta)p_j + \delta\bar{p}_m$ where $\delta \leq 1$, and $\delta \to, 0$ as $T_{j,m} \to \infty$. A corollary of H1 below, therefore, is that the price sensitivity of customers attracted and retained by a firm in a particular market is positively associated with the length of time the firm has occupied a low service quality position relative to its competitors in that market. We find support for this hypothesis in our empirical analysis.

Now, assume that the market experiences an inflow of highly service-sensitive customers with $\theta > \bar{\theta}$, such that the new support of θ in the market is $[\underline{\theta}, \bar{\theta}']$ where $\bar{\theta}' > \bar{\theta}$.[10] In equilibrium, these customers will initially be attracted to firm j, which offers the best available service quality and correspondingly, the highest achievable utility for their given values of θ. However, such a change in the underlying demographic characteristics could make market entry profitable for a competitor offering service quality that is superior to firm j. If a new competitor, firm $j+1$, subsequently enters the market, all customers for whom $\theta > (\hat{p}_{j+1,m} - \hat{p}_{j,m})/(\hat{s}_{j+1,m} - \hat{s}_{j,m})$ would perceive a benefit from defecting to the entrant.

As $\delta \to 0$, behavior converges to that predicted under a traditional vertical differentiation model, in which customers from firm j would defect to the superior service quality entrant, while customers from firm $j-1$ would not. These sorting effects would be symmetric and equally relevant among service-insensitive, price-sensitive customers.[11] An entrant offering the market's lowest service quality for correspondingly low prices would draw customers from firm $j-1$, but not from firm j. However, while customers are learning, a superior (inferior) service quality entrant e, for which $\bar{s}_m < s_e$ (for which $s_e < \bar{s}_m$), will at some point be more appealing to all customers of any firm with a perceived service quality level between $(1-\delta)s_j + \delta\bar{s}_m$ where $T_{e,m} = 0$, and s_e, in addition to a fraction of customers from local market competitors with service quality levels adjacent to these bounds.

By extension, while traditional vertical differentiation models posit that entry by a firm offering a service quality and price tradeoff that is adjacent to the focal incumbent on either side will result in customer defection, a model with customer learning leads to asymmetric defection patterns. For example, if incumbent firm j maintains a high service quality position relative to competitors in its market, such that $\bar{s}_m < s_j$, any entrant e with an unestablished service reputation (such that $\delta = 1$ where $T_{e,m} = 0$), for which $s_{j-1} < s_j < s_e$ will at some point be perceived by each customer of firm j to offer an equivalent or improved level of utility for their given value of θ, as $\hat{s}_{e,m}$ increases from $\bar{s}_m$ to s_e. On the other hand, an unestablished entrant for which $s_{j-1} < s_e < s_j$ will be perceived as an improvement by some fraction of these customers. In contrast, if incumbent firm $j-1$ maintains a low service quality position relative to competitors in its market, such that

[10] Changes in a market's underlying demographic conditions and corresponding preferences for service quality are relatively commonplace. For example, an increase in population growth or an improvement in median household income can precipitate an accession of the underlying preferences for service quality in a market. Accordingly, demographic changes are carefully monitored by firms and factored into their market entry and exit decisions. As described in the next section, we control for these market-level characteristics in our empirical analyses.

[11] We note that some customers may exist for whom θ is sufficiently small such that negative utility would be received for engaging in service with the lowest quality provider in the market. These customers will opt not to purchase service from the existing providers, but may be attracted to new entrants offering lower levels of service quality for correspondingly lower prices.

$s_{j-1} < \bar{s}_m$, any unestablished entrant e for which $s_e < s_{j-1} < s_j$ will at some point be perceived by each customer of firm $j-1$ to offer an equivalent or improved level of utility for their given value of θ, as $\hat{s}_{e,m}$ falls from $\bar{s}_m$ to $s_{e,m}$. If instead $s_{j-1} < s_e < s_j$, unestablished entrant e would be perceived as utility improving by some fraction of these customers.[12]

This asymmetry would suggest that the entry or expansion of a competitor offering superior (inferior) service quality should have a disproportionate effect on the defection of customers from an incumbent that has sustained a high (low) service quality position relative to its local market competitors over time. Moreover, to the extent that every lesser-known firm that enters a market is initially assumed to offer a median or near median-level of service relative to local market competitors, and customer perceptions correct themselves over time, then the "middle of the market" should always be perceived by customers to be rife with options, thereby lessening the immediate defection impact of particular middle of the road entrants.[13]

Consequently, we hypothesize that:

HYPOTHESIS 2A. *The longer a firm has occupied a high service quality position relative to competitors in its local market, the more likely its customers will defect following the entry or expansion of competitors offering superior service quality, and;*

HYPOTHESIS 2B. *The longer a firm has occupied a low service quality position relative to competitors in its local market, the more likely its customers will defect following the entry or expansion of competitors offering inferior service quality (for correspondingly lower prices).*

2.4. Customer-level heterogeneity

Customer defection has a multi-period effect on firm performance, which has been extensively modeled in the operations management literature (Caine and Plaut 1976, Hill Jr. 1976, Schwartz 1966). However, the magnitude of this effect depends heavily on the foregone profitability that would have been generated by each individual defector. Indeed, a rich stream of the extant literature

[12] The disproportionate effect of the entry of adjacent superior (inferior) service quality competitors on customer defection for a high (low) relative service position incumbent extends to all cases for which $\delta > 0$ upon competitive entry. When $\delta = 0$ upon entry, the model predicts the symmetric effects of adjacent entrants offering superior and inferior quality levels on incumbent customer defection.

[13] While the asymmetric effect of adjacent competitive entry on defection is consistent with our model, a complimentary behavioral explanation for this phenomenon arises from the rich literature on loss aversion (Tversky and Kahneman 1991). To the extent that customers of high service quality firms favor service quality above price (and customers of low service quality firms favor price above service quality), loss averse customers may perceive the trade-off asymmetrically. Relative to the baseline established by her current provider, a customer who prioritizes service quality over price may perceive the degradation in service quality associated with switching to a lower quality firm to be more costly than the corresponding reduction in price. Similarly, a customer who prioritizes price over service quality may perceive the increase in price associated with switching to a higher quality provider to be more costly than the corresponding improvement in quality. Our empirical results are consistent with both explanations and we leave further investigation of these mechanisms to future research.

explores strategies for initiating, managing and terminating relationships in competitive settings with customers who vary in profitability (Villanueva et al. 2007, Musalem and Joshi 2009, Shin and Sudhir 2010, Shin et al. 2012). We contribute to this line of inquiry by exploring several factors that correlate with customer profitability that may also affect customer responses to service quality competition. We discuss three such factors below: switching costs, customer learning, and the direct link between service-sensitivity and customer profitability.

2.4.1. Switching costs Customers face switching costs when investments specific to their current service providers must be duplicated in order to receive service from new providers (Farrell and Klemperer 2007). In general, these investments that engender switching costs tend to be positively associated with a customer's profitability. Over time, as the length of a customer's relationship with a firm increases, psychological switching costs intensify, as customers develop a pattern of repeat purchase through habit or loyalty (Klemperer 1987). Customers with lengthy relationships with the firm tend also to be older, wealthier, and have more invested with the bank. Furthermore, as the number of service offerings utilized by the customer increases, setup and learning costs intensify. Setup costs exist when customers must setup a service for its initial use (Burnham et al. 2003, Klemperer 1995). Learning costs include the time and effort required to acquire the necessary skills to use a service effectively (Burnham et al. 2003, Farrell and Klemperer 2007). As such, each new service offering at play in the relationship simultaneously increases switching costs for the customer and revenue for the firm. Consistently, we hypothesize:

HYPOTHESIS 3. *There is a negative association between a customer's profitability to the firm and the probability he or she will defect from it.*

2.4.2. Customer learning The theoretical literature on customer switching behavior models customer learning in two ways: customer defection as an immediate response to a service failure (Hall and Porteus 2000), or updating one's perspective based on a history of service experiences (including failures and successes) (Gans 2002). Assuming service failures are low probability events (and especially low probability events among high quality service firms), customers with higher tenure are more likely to have experienced them than customers with lower tenure. Similarly, customers who have more relationships with the firm, and as a consequence, transact more frequently with it, are more likely to have experienced deficient service. Limited support for this perspective exists in the empirical literature. Buell et al. (2010) showed that customer defection probabilities increased in the total number of transactions conducted by a customer, controlling for the customer's tenure, balances, and counts of the types of service offerings utilized. High tenure customers and customers with more touch points with the firm will have had more opportunities to learn about the level of service offered by the firm and may, as a result, be better positioned to

evaluate whether an entrant's value proposition is more attractive. Hence, the effects of customer learning should cause high profitability customers to be *more likely* to defect following the entry or expansion of competitors offering superior service quality.

2.4.3. Direct link between service sensitivity and customer profitability Finally, there are several reasons to believe that high profitability customers are inherently more attracted by superior service quality competition. First, customers who believe they are highly profitable to the firm may wish to be treated accordingly. If so, they may be particularly sensitive to service deficiencies. Second, in absolute terms, high value customers have more at stake in the service relationship. Accordingly, they may be more selective about the quality of service offered by their provider, and more willing to pay for it. Consistently, several queuing models feature priority-pricing schemes in which customers are able to pay a higher price for expedited service (Mendelson and Whang 1990, Van Mieghem 2000). Third, to the extent that highly profitable customers are wealthier, they may also be less price sensitive. Richer consumers are often assumed to prefer higher quality products (Sutton 1986), and a deli's most price-sensitive customers have been shown to be the least averse to waiting in a queue (Lu et al. 2013). For these reasons, the service sensitivity effect should make high profitability customers *more likely* to defect in the wake of increased service quality competition.

To the extent that highly profitable customers face higher switching costs, we would predict they would be less likely to defect in general, as hypothesized above. However, the effects of customer learning and the direct link between service sensitivity and customer profitability may cause highly profitable customers to defect more than less profitable customers following the entry of superior service quality competitors. Accordingly, we hypothesize:

Hypothesis 4. *The relationship between superior service quality entry and a customer's defection from a local incumbent is positively moderated by the customer's profitability to the local incumbent.*

3. Research setting and data

3.1. Research setting

We conduct our study in the U.S. domestic retail banking industry, which is an ideal setting for studying how customers respond to service competition. First, while the offerings of retail banks tend to be functionally comparable (for example, most banks offer checking accounts, savings accounts, loans, etc.), the industry consists of thousands of local, regional, and national competitors, which vary in price and service quality. Second, while pricing and service design decisions in banking tend to be made centrally (Berger et al. 2007, Erel 2009), the relative price/quality

position of each firm varies across markets as a function of the prices and quality levels offered by the competitors it faces in each local market. In our analysis, we leverage this variation to tease apart the differential effects of service quality on customer defection between markets and customers. Third, retail banking is a useful laboratory for empirical work, due to the quantity of data that are captured by the banks themselves, the government, and third-party institutions. These data quantify customer behavior, firm performance, intra-market competition, and institution-level price and service quality. Finally, retail banking customers are a diverse group, with varying needs, preferences, and experiences. This diversity is common to a wide variety of consumer service settings, which broadens the relevance of our analysis while creating a rich environment in which to analyze the impact of operational decisions and competitive circumstances on customer behavior.

The primary market and customer-level performance data for this study are provided by a bank that is one of the largest diversified financial service firms in the country, serving millions of customers across hundreds of markets in more than 20 states. Importantly for the purposes of our paper, over the time period of our analysis, this bank offered customers a roughly median level of service quality and price, relative to the competitors it faced. In the analyses we describe throughout the remainder of this paper, we refer to this bank as the "incumbent bank."

3.2. Data collection

We utilize market-level service competition and demographic data, institution and market-level service quality data, institution-level pricing data, and account-level retention and customer attribute data to conduct our primary analysis. This section outlines the sources of these data.

3.2.1. Market definition The incumbent bank competed without interruption in 644 markets from 2002 to 2006. Its strategy group delineated each market as a block of adjoining zip codes within which customers tend to transact. We note that each market is geographically isolated, as in Olivares and Cachon (2009), which facilitates our empirical approach. These markets are located in more than 20 states, and each contained an average of 12.57 zip codes. We restrict our analyses to the customers and institutions engaging in these markets.

3.2.2. Competitive composition Within each market, we identified which institutions were competing against the incumbent bank by using the Federal Deposit Insurance Corporation (FDIC) Summary of Deposits (SOD) database. On an annual basis, the FDIC captures branch-level deposit balance data for every active commercial and savings bank, listing these data along with an institution identifier, branch street address, and zip code. We augmented these data with specific branch opening dates for de novo entry and closing dates, as well as historical institution ownership data, provided by the incumbent bank's strategy group, to pinpoint the month within which entry, exit, and changes of branch ownership occurred. On a monthly basis from 2002-2006, these data

enabled us to identify which institutions were competing in each market, how many branches each institution had, and when competitive expansion, entry, or exit events occurred.

3.2.3. Service quality Relative service quality data was captured using the 2006-2009 J.D. Power and Associates Retail Banking Satisfaction Studies^{SM}. The studies captured responses from 12,904, 20,898, 19,602, and 28,570 households regarding their experiences with their primary banking providers.[14] Over the four-year period, the annual study captured user-based perceptions of service quality from customers of 59 banks on five dimensions of service: convenience, account initiation and product offerings, fees, account statements, and transactions.

In creating the service quality metric we used for our analysis, we omitted the rating for fees in order to capture a pure service quality score that did not conflate price and service. The annual mean of the remaining four dimensions for each institution (convenience, account initiation and product offerings, account statements, and transactions) was taken to create an annual service score, and the mean of the annual service scores from each of the four years was taken to produce a relative measure of institution-level service quality, s_j.[15] This aggregated score constitutes a user-based measure of quality, which has been defined in the literature as the capacity to satisfy customer wants (Edwards 1968, Garvin 1984, Gilmore 1974). Similar user-based metrics have been used to measure service quality in numerous empirical studies (Anderson et al. 1997, Fornell et al. 1996, Oliva and Sterman 2001). Throughout our analyses, we used this metric to identify the sets of competitors that, on average, offered higher and lower levels of service quality than the incumbent bank.

3.2.4. Price Price data was collected from the FDIC Quarterly Call Reports database, which captures balance sheet entries including RCON6636, *interest-bearing deposits in domestic offices,* as

[14] Data for these studies were captured during Q4 of 2005-2008.

[15] We were able to obtain respondent-level perceived quality data from the J.D. Power and Associates Retail Banking Satisfaction Studies. Since the original studies captured each respondent's zip code, we were able to attribute individual responses to particular geographies. However, when these data were projected onto the particular markets in our study, they were too sparse to serve as a reliable measure of market-level relative service performance (for example, often zero, one or two observations would exist for a particular firm in a given market in a given year). However, we were able to use these data to test the robustness of our assertion that the relative level of service quality performance is consistent among firms across states. We calculated the means and standard deviations of service quality ratings reported by J.D. Power and Associates respondents for each institution in each state in each year. Then, for each pair of rated firms competing in each state in each year, we conducted two-sided t-tests, comparing their quality ratings, and tabulated the direction of statistically significant outcomes. In 100% of the cases for which significant pairwise differences in service quality were identified at the $p < 0.10$ level, the relative performance of the firms in question was consistent with the relative performance ordering defined by the institution-level metric we use in our analysis. Importantly, these differences were not just detected among extreme cases, but also among adjacent competitors in markets where a sufficient number of observations existed to draw statistically significant conclusions. A table of these comparisons is available in the online appendix (Appendix Tables 1 and 2). Moreover, in Section 4.3.1, we provide converging evidence in support of this modeling choice by using branch-level objective performance data from our focal firm to analyze the extent and effect of market-level differences in objective service quality across markets.

Table 1: Comparison of different types of institutions (2004)

	(1)	(2)	(3)	(4)
	Incumbent	Superior Service Entrants	Inferior Service Entrants	Unrated (Local) Entrants
Average number of states	--	4.10	4.07	1.05
Average number of zip codes	--	191.64	238.62	4.05
Average number of branches	--	231.62	301.38	4.75
Average number of branches/zip	1.41	1.21	1.26	1.17
Average number of markets	651.00	69.04	70.54	2.05
Average number of branches/market	4.35	3.35	4.27	2.32
Average deposits/branch (000)	$87,246	$82,112	$63,396	$56,680
Average branch share upon entry	11.21%	6.46%	7.22%	3.42%

To protect the identity of the incumbent bank, we have excluded summary statistics for number of states, number of zip codes, and number of branches.

well as income statement items, such as RIAD4080, *service charges on deposit accounts in domestic offices.* We calculated a fee income per deposit dollar metric, p_j, by dividing each institution's annual service charges on deposit accounts in domestic offices by their corresponding interest bearing deposits in domestic offices. We use fee income per deposit dollar as our primary measure of price throughout our analysis, owing to the salience of fees in customer evaluations of bank pricing.[16]

3.2.5. Customer-level performance We created a two-year panel of 100,000 randomly selected customers who were active with the bank as of December 31, 2003. To facilitate linking customers to specific markets, we removed customers from our sample who had home addresses that were outside the 644 markets of interest. In this study, we analyze the behavior of the remaining 82,235 customers. We chose to analyze customer behavior from 2003 to 2004, because it was a relatively stable time period for the industry, predating the financial crisis. For each customer, we tracked end-of-year balances in various types of accounts (checking accounts, loan accounts, and investment accounts), depth of cross-sell (counts of various types of products, including checking, loan, and investment accounts, as well as ATM and debit cards), breadth of cross-sell (number of product classes), and customer demographic information (customer tenure and customer age). These data are summarized in Table 2.

Notably, 12.06% of customers in the panel who were active at the end of 2003 had defected (closed all of their accounts with the bank) by the end of 2004. Due to this defection trend, average customer age and tenure years do not increment precisely from 2003 to 2004. Moreover, for the

[16] In addition to fees, interest charged on loans is a major source of revenue for retail banks. Accordingly, we also calculate the net interest margin for each institution, a metric capturing the magnitude of the spread between interest paid to depositors and dividends earned on interest-bearing assets, expressed as a percentage of earning assets. Banks with a higher net interest margin can be considered to be more expensive for consumers. Importantly, net interest margin and fees are positively correlated with one another ($\rho = 0.346$), suggesting the two tend to be complements, rather than substitutes. While fee income per deposit dollar is the primary measure of price in our analyses, in section 4.1, we confirm that both fees and net interest margin are positively associated with service quality, such that firms offering higher service quality tend also to charge higher prices.

Table 2: Summary statistics for customer panel (2003-2004)

	2003 (pre-entry year)		2004 (entry year)	
	Mean	SD	Mean	SD
Customer demographics				
Customer tenure (years)	10.93	11.11	11.33	11.16
Customer age (years)	44.05	19.01	44.43	19.08
Balance information				
Checking balance	$9,823	$58,701	$12,051	$138,596
Loan balance	$3,028	$16,988	$3,488	$18,249
Other balance	$1,294	$12,117	$875	$11,689
Depth of cross-sell				
Total product count	2.92	2.22	3.00	2.17
Count of checking products	1.29	1.08	1.38	2.17
Count of loan products	0.37	0.64	0.42	0.67
Count of investment products	0.08	0.51	0.06	0.42
Count of ATM cards	0.13	0.40	0.09	0.31
Count of debit cards	0.72	0.82	0.66	0.67
Breadth of cross sell				
Number of product classes	2.13	1.28	2.26	1.31
Has checking account	79.5%	40.4%	81.7%	38.7%
Has non-home equity loan	26.3%	44.0%	29.7%	45.7%
Has home equity loan	6.3%	24.2%	6.6%	24.8%
Has other account	4.9%	21.6%	3.6%	18.7%
Has ATM card	11.6%	32.0%	8.5%	27.9%
Has debit card	53.2%	49.9%	56.6%	49.6%
Uses online services	31.6%	46.5%	39.0%	48.8%
Customers retained at end of year	82,235		72,321	

panel, average checking account balances grew over the two-year period, as did depth and breadth of cross-sell. With regard to checking account balances, this trend suggests that we have selected a period of moderate growth, isolating the effects of the financial crisis. Furthermore, the cross-sell figures are consistent with the idea that as tenure grows, customers tend to be sold into more products per category (depth) and more product categories (breadth).

3.2.6. Market-level demographics To control for factors that could be correlated with both the propensity for customer defection and the attractiveness of a market to entrants, we incorporate market-level demographic data from ESRI, a geographic information services company, into many of our analyses. Managers at the incumbent bank identified demographic criteria that are used by banking institutions to make market entry decisions. These annual, market-level data, which are summarized in Table 3, included population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and the branch share of non-incumbent competitors in the market preceding the entry event window.

Table 3: Market Summary Statistics (2004)

	(1)	(2)	(3)
	All markets	High service quality position markets	Low service quality position markets
Population (2000)	136,244	148,015	127,075
Current year population	145,792	156,373	137,550
Median household income	$51,116	$51,843	$50,550
Household income percentile	61.66	62.17	61.26
Median age	36.13	36.16	36.10
Population growth percentile	54.20	51.38	56.41
Per capita income	$26,613	$27,894	$25,614
Median home value	$209,249	$235,136	$188,304
Household growth	1.71	1.35	1.99
Average household size	2.69	2.66	2.71
Percentage males	50.1%	50.1%	50.0%
Competitor branch share	86.0%	88.5%	84.0%
Average fee change from prior year	-1.3%	-2.1%	-0.7%
Lagged average fee change	4.3%	2.1%	6.0%
Number of markets	644	282	362

High service quality position markets are markets in which the incumbent bank branches occupied an above-median service quality position thoughout 2002 and 2003 relative to area competitors, as described in Section 4.3.1. Low service quality position markets are those in which the incumbent did not occupy an above-median service quality position for the duration of that period.

4. Primary analysis and results

4.1. Do firms trade-off price and service quality?

We test the assumption that firms trade-off price and service quality by measuring how annual fee income per deposit dollar, p_j, varied with a firm's service ratings, s_j, from 2005-2007. While J.D. Power and Associates collected service data over the 2005-2008 period, we have chosen this particular event window to pre-date the financial crisis.[17] J.D. Power and Associates rated the service quality of 42 institutions over this period, but three were classified as savings banks by the FDIC, and as such, were not required to submit call report data. Prior to the period of analysis, another bank was acquired by a larger competitor, and its pricing data was aggregated with the larger competitor for reporting purposes. We estimate the following between-effects linear model on data from the remaining 38 institutions.

$$p_j = \beta_0 + \beta_1 s_j + \epsilon_j \tag{1}$$

The β_1 coefficient reflects the degree to which service quality is associated with price in these markets. If $\beta_1 > 0$, then firms that charged customers a higher price tended also to offer higher quality service.[18] In order to deepen our understanding of the pricing dynamics in retail banking,

[17] We note, however, that all results reported in Table 4 are substantively similar if we analyze the entire 2005-2008 period during which J.D. Power and Associates collected service quality data (Appendix Table 3). The results are also robust to a fixed effect specification, which accounts for unobserved time-invariant differences among firms (Appendix Table 4).

[18] Importantly, this test is not intended to show causality, merely correlation between a firm's service quality and the prices it charges to customers for use of its services.

Table 4: Firms trade-off price and service (2005-2007)

	(1)	(2)	(3)	(4)
Dependent variable	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.
Service rating	5.6117**	6.1779**		
	[2.4377]	[2.4167]		
Total deposits (in thousands)		-0.0000		-0.0000***
		[0.0000]		[0.0000]
Branch count		0.0070*		0.0114***
		[0.0038]		[0.0016]
Nationwide retail bank			8.5773***	5.1623***
			[1.0258]	[1.3544]
Constant	-5.3230	-8.7865	5.2145***	5.1722***
	[7.3483]	[7.5712]	[0.0502]	[0.0504]
Sample selection	Rated institutions (2005-2007)	Rated institutions (2005-2007)	Rated institutions (2005-2007)	Rated institutions (2005-2007)
Observations	78	78	22686	22686
Between R-squared	0.128	0.207	0.009	0.015
Institutions	38	38	8068	8068

***, ** and, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests). Brackets contain standard errors.

we also conduct supplementary analyses, examining relative price positioning as a function of the total number of branches the institution had, the sum of all deposits it held, and whether or not the institution was a nationwide bank.

In Table 4, we scale the dependent variable by 1,000 to facilitate coefficient interpretation, such that coefficients represent the marginal effect on a firm's fee income per thousand deposit dollars. Column (1) shows that among service-rated firms, those with higher service ratings charged higher prices (coefficient = 5.61, $p < 0.05$; two-tailed), and column (2) shows that the relationship strengthens after controlling for the institution's total number of branches and total deposits (coefficient = 6.18, $p < 0.05$; two-tailed). Moreover, in column (3), our analysis reveals that nationwide retail banks, those for which a service rating was available, charged higher service fees than regional and local competitors (coefficient = 8.58, $p < 0.01$; two-tailed). In column (4), we find that this difference remains robust after controlling for a firm's total number of branches and deposits (coefficient = 5.16, $p < 0.01$; two-tailed). Taken together, these results suggest that on average, nationwide banks charged higher fees than local and regional competitors and that, among nationwide competitors, those offering high quality service charged the highest fees, which is consistent with our modeling assumptions.[19]

[19] Among nationwide banks, those offering higher service quality also earned a higher net interest margin during the period of analysis (coefficient = 0.004 $p < 0.05$; two-tailed). Net interest margin is the difference between interest and dividends earned on interest-bearing assets and interest paid to depositors and other creditors, expressed as a percentage of average earning assets. (Appendix Table 5)

4.2. Aggregate effects of service competition

We test the aggregate effects of service quality competition by modeling individual customer defection behavior in 2004 as a function of the number and relative service nature of competitive events that took place within the customer's market in that year.[20] We modeled customer defection during 2004 as a binary dependent variable, $DEFECT_i$. In our analysis, a customer has defected if he or she has closed all accounts with the bank by the end of the year. This measure of customer defection has been used in prior empirical studies conducted in retail banking (Buell et al. 2010).[21] Throughout 2004, we counted the number of competitive entry or expansion events (net of exit events) that took place in each market, categorizing events by the competitor's service position relative to the incumbent bank.

Let s_a represent the incumbent's service level and s_c represent the service level of a service-rated competitor. Entry events pertaining to competitors for which $s_c > s_a$ were defined as superior service quality entry events, and entry events pertaining to competitors for which $s_c < s_a$ were defined as inferior service quality entry events.[22] Entry events pertaining to institutions for which no service rating is available were defined as local entry events.

As detailed in Table 1, superior and inferior service institutions tend to be nationwide competitors, operating in a comparable number of states, zip codes, and markets, with similar branch share and density. Notably, superior service branches tend to have roughly 30% more deposits on hand than inferior service branches. Local (unrated) institutions, by contrast, typically operate in a single state, with far fewer branches; and lower density, share, and balances than superior and inferior service institutions. This distinction arose from the sampling scheme used by J.D. Power and Associates in conducting the Retail Banking Satisfaction Studies[SM]. Because customers were randomly selected and asked to provide feedback on the service of their primary banking institution, larger institutions, which had more customers, were more likely to be represented in the sample. Institutions for which an insufficient number of responses were collected to draw statistically significant inferences were not reported in the annual study, leading to the systematic exclusion of local and regional competitors.

[20] There is a long-standing tradition in the economics and marketing literatures of analyzing substitution patterns using a simulated methods of moments approach with market-level and aggregated consumer-level data (Berry et al. 1995), or a combination of market-level data and 'micro-level,'customer data (Berry et al. 2004). This technique has also been used in the operations management literature in the calibration of structural models that estimate full demand systems (Chen and Farias 2012). Our work differs from these streams of research in that we are not estimating a full demand system, but rather exploring the impact of competitive changes on the behavior of customers from one focal firm. Moreover, we directly observe pricing and individual-level customer behavior, which facilitates our reduced form approach.

[21] Our primary results are substantively similar if defection is instead modeled as a customer who significantly reduces non-home equity balances from one year to the next (95% or more), with or without closing their accounts (Appendix Table 6).

[22] In all cases, the service rating of the focal incumbent was distinct from those of its competitors, such that $s_c \neq s_a$.

Within a market, if the number of (superior/ inferior/ local) entry or expansion events exceeded the number of (superior/ inferior/ local) exit events, then using a binary independent variable, we classified the market as increasing in superior service (SS_m) / inferior service (IS_m) / local (L_m) competition.[23]

To separate the effects of customers departing from the incumbent bank as a result of entrant-driven changes in a market's service quality landscape from those departing in response to intra-market pricing dynamics, we directly control for the annual price changes in each market. For each year, we calculate the mean price in each market charged by firms that did not enter or exit the market, $p_{m,t}$. We calculate annual market-level percent changes in this variable, $\Delta p_{m,t} = (p_{m,t} - p_{m,t-1})/p_{m,t-1}$, which we use as a control. We also institute a lagged price change control, $\Delta p_{m,t-1} = (p_{m,t-1} - p_{m,t-2})/p_{m,t-2}$, intended to capture the effects of price changes instituted in anticipation of competitive entry (Goolsbee and Syverson 2008). To simplify notation, we characterize the vector of price change data in the following way: $\Delta p_m = \Delta p_{m,t} + \Delta p_{m,t-1}$.

As described in the previous section, we also control for a vector of market-level control variables, X_m, as well as a vector of customer-level control variables, X_i. We test the aggregate effects of service quality competition by using a logistic regression to estimate the following cross-sectional model on our random sample of 82,235 customers as of the end of 2004.

$$Pr(DEFECT_i = 1) = f(\gamma_0 + \gamma_1 SS_m + \gamma_2 IS_m + \gamma_3 L_m + \gamma_4 \Delta p_m + \gamma_5 X_m + \gamma_6 X_i) \qquad (2)$$

γ_1 and γ_2 capture the average effect of entry or expansion of superior and inferior service competitors on incumbent customer defection, respectively.[24]

Table 6, column (1) demonstrates that on a nationwide basis, entry or expansion by competitors offering superior service quality had an insignificant effect on customer defection (coefficient = 0.0112, $p = 0.751$; two-tailed). Similarly, entry or expansion by competitors offering inferior service quality had an insignificant effect on customer defection (coefficient = 0.035, $p = .240$; two-tailed). We next turn to examining whether the absence of an average effect is due to heterogeneity in the effects of service quality competition across markets and customers.

[23] We note that all primary results are substantively similar if an alternate set of binary variables is used that indicates whether any entry occurred in each category during the event period (Appendix Table 7).

[24] Technically, standard models of service quality competition such as that presented in Section 2.1 would predict that an incumbent would only face customer defection relating to the entry of a competitor that is adjacent to it on the dimension of service quality. However, from an empirical standpoint, incumbent customer defection may be affected by both adjacent and non-adjacent entry for a variety of reasons including imperfect customer sorting within markets due to the subjective and experiential nature of service quality assessments, the inability of banks to tailor service quality levels within markets, and switching costs. When defection is modeled as a function of adjacent entry, non-adjacent entry, and local entry, we observe that adjacent entry is not significantly associated with customer defection across all markets (coefficient = 0.037; $p = 0.26$; two-tailed), high service position markets (coefficient = 0.063; $p = 0.22$; two-tailed) or low service position markets (coefficient = 0.067; $p = 0.11$; two-tailed) (Appendix Table 8).

4.3. Customer sorting and market-level heterogeneity (H1 and H2)

While we detect no average effect of superior or inferior service quality entry or expansion on customer defection, we hypothesize there may be differential effects between markets that emanate from differences in the incumbent's service quality position relative to the competitors it faces locally. In particular, customers attracted and retained by the incumbent in markets where it has occupied a relatively high service quality position over time may exhibit heightened sensitivity to service quality (H1). In turn, customers in these markets may be more likely to defect following the entry or expansion of competitors offering superior service quality (H2A). In contrast, customers attracted and retained by the incumbent in markets where it has occupied a relatively low service quality position over time may exhibit less sensitivity to service quality, and in turn, be more likely to defect from the incumbent following the entry or expansion of competitors offering inferior quality service for lower prices (H2B).

4.3.1. Customer sorting We test H1 by modeling several dimensions of service quality sensitivity as a function of the incumbent's relative service quality position within the customer's market. We operationalize the incumbent's perceived relative service quality position in particular markets in the following way. As in Section 2.3, let $\bar{s}_m$ represent the median service level for all rated branches competing in a given market during a particular month. We define the incumbent, a, to hold a *high service quality position* in any month where $s_a \geq \bar{s}_m$. As a measure of the degree to which the incumbent has established a high perceived relative service quality position among customers in market m, let T_m represent the number of months that the incumbent has held a high objective service quality position in the market during the preceding two years.

In Table 5, Column (1) we model the queue time satisfaction reported by 23,928 randomly selected customers who engaged in face-to-face service with the focal incumbent during January 2004, as a function of the incumbent's service position in the customer's market. Controlling for the length of time the customer reported waiting in the queue and customer-level controls, those in high service positioned markets ($T_m = 24$) were significantly less satisfied with the length of their wait (coefficient = -0.072; $p < 0.05$; two-tailed). Indeed, the incremental dissatisfaction of customers transacting in markets with a high service quality position was the equivalent of waiting an additional 34 seconds. [25] This result suggests that the incumbent's customers are disproportionately service sensitive in markets where it maintains a relatively high service quality position, which supports H1.

[25] We further investigated whether the effect of queuing time on queuing time satisfaction depends on relative service position. We did not find a significant interaction (coefficient = 0.015; $p = .22$; two-tailed), and the negative main effect of high service position on queue time satisfaction intensified (coefficient = -0.146; $p < 0.05$; two-tailed), as did the negative main effect of queuing time (coefficient = -0.258; $p < 0.01$; two-tailed) (Appendix Table 9).

Table 5: Customer service sensitivity and objective service quality differences based on incumbent service position

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	Satisfaction with queue time	Visit satisfaction	Annoyances	Overall satisfaction	Service quality rating	Labor utilization	Total labor hours	Transaction time (seconds)
High service position market	-0.0727**	-0.0637**	0.0881***	-0.0611**	-0.1196**	0.0025*	-8.1780	1.3302*
	[0.0310]	[0.0318]	[0.0282]	[0.0284]	[0.0571]	[0.0015]	[7.6342]	[0.7343]
Queuing time (in minutes)	-0.2519***							
	[0.0078]							
Branch-level labor utilization		-4.3321***	1.8004***	-1.7567***				
		[0.3532]	[0.3170]	[0.3282]				
Number of transactions demanded							0.0665***	
							[0.0009]	
Constant			-0.6088***		7.7045***	-1.6505***	18303.3600	95.3307***
			[0.0718]		[0.2257]	[6.4155]	[29752.5700]	[11.6114]
Level of analysis	Customer level	Customer level	Customer level	Customer level	Customer level	Branch level	Branch level	Customer level
Sample selection	Focal incumbent	Focal incumbent	Focal incumbent	Focal incumbent	All rated firms	Focal incumbent	Focal incumbent	Focal incumbent
Regression model	Ordered logistic	Ordered logistic	Logistic	Ordered logistic	OLS	OLS	OLS	OLS
Customer-level control variables	Yes	Yes	Yes	Yes	No	No	No	Yes
Market-level control variables	No	No	No	No	No	Yes	Yes	No
Predicted dependent variable in high service mkts.	4.01/5.00	4.41/5.00	36.84%	4.14/5.00	7.53/10.00	16.68%	943.36	62.18
Predicted dependent variable in low service mkts.	4.06/5.00	4.44/5.00	34.82%	4.16/5.00	7.65/10.00	16.43%	952.04	60.85
Observations	23,928	23,451	23,409	23,451	20,890	2,816	2,816	21,161

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered at the market level, except Columns (6) and (7) which contains robust standard errors. Column (5) includes institution and city/state fixed effects. Additional controls for transaction type were used for columns (2) and (4). Forty-two customers did not respond to the question about annoyances and recent service problems. Additional customer-level controls include direct deposit indicator, count of loan, investment and deposit accounts, balances in loan, and investment and deposit accounts. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, and gender distribution.

As further evidence, in Columns (2-4), we model the perceptions and behaviors of 23,451 randomly selected customers during the same time period as a function of the incumbent's relative service position, and branch-level labor utilization (labor hours utilized / labor hours available) - a proxy for objective service quality differences. After controlling for labor utilization, customers in markets where the firm held a high quality service position still exhibited greater service sensitivity, reporting lower service satisfaction with their visit to the bank (coefficient = -0.064, $p < 0.05$; two-tailed) column (2), an increased likelihood of experiencing a recent problem or annoyance with their service (coefficient = 0.88, $p < 0.01$; two-tailed) column (3), and a lower overall level of satisfaction with the bank (coefficient = -0.061, $p < 0.05$; two-tailed) column (4) than customers transacting in low service quality positioned markets, where $T_m < 24$. These results offer further support for H1.

To explore whether these patterns exist among customers transacting with other banks, in Column (5) we compare the service quality ratings of 20,890 randomly selected customers surveyed for the J.D. Power and Associates Retail Banking Satisfaction Study^{SM} during late 2006. These customers transacted with 78 different banking institutions in 6,098 U.S. cities.[26] Customer ratings were aggregated to produce a mean service quality rating for each institution, which in turn was used to categorize the institution's service position relative to the median in each market.[27] Respondent's ratings were modeled as a function of the firm's relative service position in the respondent's

[26] The 2007 study was the first during which J.D. Power and Associates captured respondent-level zip code information, which facilitates this analysis (Appendix Table 10).

[27] For this analysis, markets were defined as a city/state combination.

market, as well as institution and market-level fixed effects. The results demonstrate a general tendency for customers to perceive firms to have below average service quality in markets where they have a relatively high service quality position (coefficient = -0.120; $p < 0.05$; two-tailed). On average, customers rated service in these markets to be 1.6% below average for the institution, which is consistent with the results above, and H1.

A complimentary explanation for this pattern of effects is service complacency: the idea that firms that offer a high level of quality relative to local alternatives may lack incentives to maintain high objective quality levels themselves. For example, Mazzeo (2003) observed that the prevalence and duration of flight delays are increased on routes where only one airline provides direct service. Among airlines, the presence of additional competition is correlated with better on-time performance. Likewise, to the extent that banks with a high relative service quality position in a local market face limited service quality competition, they may, in turn, provide objectively poorer service. While our interviews with banking executives emphasized the standardized nature of service quality in this industry, local managers retain some discretion, particularly with regard to staffing levels. In Column (6) we model branch-level labor utilization as a function of the incumbent's relative service quality position in each market, and market-level controls. Labor utilization is marginally higher (1.5%) in markets where the incumbent maintains a high service quality position (coefficient = 0.003; $p < 0.10$; two-tailed), suggesting that tellers are busier, and service quality is in turn objectively poorer in markets where the incumbent faces limited superior service quality competition. However, in Columns (7-8), we decompose labor utilization, noting that while, controlling for number of transactions demanded, scheduled labor hours are not significantly lower in high service positioned markets (coefficient = -8.178 $p = 0.28$; two-tailed), customers in high service positioned markets consume marginally more time per transaction (coefficient = 1.330, $p < 0.10$; two-tailed). This patterns suggests that objective service quality deficiencies in markets where the firm holds a high relative service quality position are driven by its failure to account for customer sorting, and the service-sensitive customer's tendency to consume more time per transaction.[28]

4.3.2. Market-level heterogeneity In the previous section, we found that customers transacting with the incumbent in markets where it occupies a relatively high service quality position

[28] This pattern of results suggests that our use of an aggregate measure of service quality in our primary analysis is a conservative choice. In particular, if customer sorting leads service quality to be objectively poorer in markets where the incumbent maintains a relatively high service quality position, and in turn, our aggregated measure overstates the relative service level of the incumbent, then the customers retained prior to entry in those markets should be marginally less service sensitive in equilibrium, and in turn, less attracted by the entry of competitors offering better service quality for higher prices. Similarly, if our aggregated measure of service quality under-states the relative level of service quality the focal incumbent offers in markets where we classify it to hold a low relative service quality position, then the customers attracted in those markets should be marginally more service sensitive in equilibrium, and in turn, less attracted by the entry of inferior service quality competitors, charging lower prices.

exhibit a heightened level of sensitivity to service quality. We next turn to whether these differences in service quality sensitivity translate to differential effects of service quality competition on customer defection, as we hypothesize in H2. Building on model (2), one of our tests of H2 uses a logistic regression to estimate the following cross-sectional model:

$$\begin{aligned} Pr(DEFECT_i = 1) = f(&\delta_0 + \delta_1 SS_m + \delta_2 IS_m + \delta_3 L_m + \delta_4 \Delta p_m + \\ &\delta_5 X_m + \delta_6 X_i + \delta_7 T_m + \delta_8 SS_m \times T_m + \\ &\delta_9 IS_m \times T_m + \delta_{10} L_m \times T_m) \end{aligned} \tag{3}$$

By design, this interaction model explicitly tests whether customer sorting is a continuous process, the effects of which intensify over time. If $\delta_8 > 0$, then as we predict in H2A, the longer an incumbent occupies a high service quality position, the more likely its customers will defect following the entry or expansion of competitors offering superior service quality. If $\delta_9 < 0$, then as we predict in H2B, the longer an incumbent occupies a low service quality position in the market, the more likely its customers will defect following the entry or expansion of competitors offering inferior service quality.

In Table 6, column (2), the negative coefficient on the main effect of superior service entry suggests that when the incumbent has a low service quality position, retention is *marginally higher* for its customers when superior service quality competitors enter or expand (coefficient = -0.127, $p < 0.10$; two-tailed).[29] However, the coefficient on the interaction of superior service quality entry and the number of months in the preceding two years the incumbent has occupied a high quality service position (coefficient = 0.009, $p < 0.05$; two-tailed) suggests that maintaining a high quality service position attenuates this negative effect. Our next step was to confirm that maintaining a high quality service position for a reasonable number of months overcomes this negative main effect. Given that our competitive composition data for each market began in January 2002 and the event window for competitive entry began in January 2004, in our data, $\max(T_m) = 24$. As such, we re-estimated the model using OLS regression and conducted a post-estimation linear test of the hypothesis that when an incumbent has maintained a high quality service position over the past 24 months, its customers will defect in the wake of entry or expansion by a superior service competitor (F = 4.74, $p < 0.05$). This result supports H2A.

[29] Since superior service quality competitors tend to have higher prices, their entry may make the incumbent's prices appear relatively more attractive. Moreover, consistent with prior literature (Hannan and Prager 2004, Park and Pennacchi 2009), a separate analysis reveals that average market prices rise significantly from the pre to post-event periods in markets where superior service entry or expansion occurs (Appendix Table 11). Owing to the local inflexibility of the incumbent's standardized price and service model, such market-level changes make the incumbent relatively more attractive for price-sensitive customers, reducing defection probabilities.

Table 6: Customer defection following competitive entry

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Defection	Defection	Defection	Defection	Account Closures
Superior service competitor entry	0.0112	-0.1266*	0.1094**	-0.0598	-3.4975
	[0.0353]	[0.0672]	[0.0486]	[0.0477]	[2.7078]
Inferior service competitor entry	0.0353	0.1550***	0.0302	0.0896**	1.9662
	[0.0301]	[0.0497]	[0.0379]	[0.0417]	[1.5607]
Local competitor entry	0.0117	0.1186**	-0.0579	0.0927**	1.4838
	[0.0291]	[0.0524]	[0.0410]	[0.0380]	[1.2526]
Number of months with a high service position		0.0069***			0.0189
		[0.0024]			[0 .0185]
Superior service entry x number of months		0.0087**			0.2762**
		[0.0035]			[0 .1399]
Inferior service entry x number of months		-0.0072***			-0.2325***
		[0.0025]			[0.0827]
Local service entry x number of months		-0.0071***			-0.0821
		[0.0027]			[0.0590]
Constant	-78.3286	-41.2858	75.7879	-84.0835	-100.1876
	[99.9919]	[98.5877]	[150.1256]	[131.7256]	[15.0762]
Level of analysis	Customer level	Customer level	Customer level	Customer level	Market-level panel
Sample selection	All customers	All customers	High service position markets	Low service position markets	All markets
Regression model	Logistic	Logistic	Logistic	Logistic	Fixed Effects OLS
F test (Sup. entry + 24(Number above x Sup. entry)>0		F=4.74; p<.05			
P(Defection of Focal Customers | No Entry)			12.02%	11.42%	
P(Defection of Focal Customers | Entry)			13.17%	12.31%	
Observations	82,235	82,235	34,964	47,271	16,100

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates. Variables in Column (5) are aggregated, as described in Model (4). Additional market-month level controls in Column (5) include aggregated counts of the number of new and existing customers.

Column (2) further shows that the coefficient on the interaction of inferior service quality entry and the number of months in the preceding two years the incumbent has occupied a high quality service position is negative and significant (coefficient=-0.007, $p < 0.01$; two-tailed), suggesting that holding a low service quality position for a longer period of time is associated with increased customer defection probabilities following the entry or expansion of inferior service quality firms. Moreover, after controlling for the incumbent's prior service position, the main effect of inferior service quality entry is positive and significant (coefficient $= 0.155$, $p < 0.01$; two-tailed), suggesting that when the incumbent has held a low quality service position for the prior two years (equivalently, when $T_m = 0$), its customers are more likely to defect following the entry or expansion of competitors offering inferior service quality. These results are consistent with H2B.

A related approach for testing H2 is to use logistic regression to estimate model (2) on the subset of our random sample of customers who lived and transacted in markets where T_m was sufficiently high to allow for the accumulation of service-sensitive customers by the incumbent. We estimate

model (2) on the subset of customers for which $T_m = 24$. If $\gamma_1 > 0$, then when the incumbent has occupied a high service quality position over the prior two years, its customers are more likely to defect following the entry or expansion of competitors offering superior service, which is consistent with H2A. Using similar logic, we test H2B by estimating model (2) on the subset of customers for which $T_m < 24$.[30] If $\gamma_2 > 0$, then when the incumbent has not occupied a high service quality position relative to competitors in its market for a sufficient period of time, its customers are more likely to defect following the entry or expansion of competitors offering inferior service quality, which is consistent with H2B.

In column (3), the main effect of superior service entry is significant and positive (coefficient = 0.109, $p < 0.05$; two-tailed), suggesting that in markets where the incumbent maintained a high quality service position for the preceding two years, its customers were more likely to defect following the entry or expansion of superior service competitors. Defection probabilities increased for the incumbent in these markets from 12.02% when no entry or expansion occurred to 13.17% following entry or expansion by a superior service competitor. In contrast, these same customers were no more likely to defect following the entry or expansion of inferior service quality competitors (coefficient = 0.030, $p = 0.43$; two-tailed) or local service quality competitors (coefficient = -0.058, $p = 0.158$; two-tailed). These findings offer further support for H2A.

In column (4), the main effect of the entry or expansion of inferior service quality competitors (coefficient = 0.090, $p < 0.05$; two-tailed) is significant and positive, offering further support for H2B. In these markets, where the incumbent held a low service quality position relative to competitors in its local market, average defection probabilities increased from 11.42% when no entry or expansion occurred to 12.31% following the entry or expansion of competitors offering inferior service. While superior service quality entrants had no effect on defection in these markets (coefficient = -0.060, $p = 0.21$; two-tailed), we note that entry and expansion by local and regional competitors increased incumbent customer defection in these markets as well (coefficient = 0.093, $p < 0.05$; two-tailed), a result that is consistent with our earlier findings that such competitors offer lower prices, and our account that the incumbent's customers are price-sensitive in markets where it maintains a low service quality position.

4.3.3. Addressing the endogeneity of competitive entry Our account is that competitive entry by firms offering varying service quality levels caused the defection patterns observed in this paper. However, an alternative explanation is that the propensity of customers to defect may have precipitated these competitive entry events. In particular, competitors may have specifically chosen

[30] We note the results are substantively similar if high (low) service positioned markets are defined on the basis of whether the incumbent held (did not hold) a high service position in the market for an above-median number of months (20) in the pre-entry observation period (Appendix Table 12).

to enter markets where the incumbent's customers were dissatisfied and more likely to defect. If that were the case, then the entry regressors would be correlated with the error term in Model (3), leading to biased estimators. While our findings are robust to controls for the lagged market-level satisfaction and intended loyalty of the focal incumbent's customers, we also directly test this possibility by separately modeling superior service quality entry, inferior service quality entry, and local entry as a function of the prior year intended loyalty of 27,279 customers who were randomly selected to complete a survey in these markets during the pre-entry year, aggregated to the market level, as well as market and customer-level control variables. In all models, we failed to reject the null hypothesis that competitive entry decisions are not a function of intended customer loyalty ($p > 0.22$; two-tailed). Replacing intended loyalty with overall satisfaction with the bank yielded similarly insignificant results ($p > 0.41$; two-tailed).[31]

Furthermore, to rule out unmeasured explanatory variables that may affect entry decisions and the behavior of customers in the markets being analyzed, and to test the robustness of these effects over a longer period of time, we used a panel data approach with fixed effects to model the total number of closed accounts in each of the incumbent's markets from January 2004 through December 2006, as a function of the entry of superior quality, inferior quality, or local competitors. The first 11 months of 2004 are dropped due to missing lagged variables, leaving 25 months of observations. Let $CLOSURES_{m,t}$ represent the number of customer account closures experienced by the incumbent bank in market m during month t. We use the following fixed effects linear specification, where the coefficients of interest are ϵ_5 and ϵ_6, the interactions of T_m, and the rated entry variables.

$$\begin{aligned} CLOSURES_{m,t} = f(\epsilon_0 + \epsilon_1 \sum_{k=0}^{11} SS_{m,t-k} + \epsilon_2 \sum_{k=0}^{11} IS_{m,t-k} + \epsilon_3 \sum_{k=0}^{11} L_{m,t-k} + \\ \epsilon_4 \sum_{k=0}^{11} T_{m,t-k} + \epsilon_5 \sum_{k=0}^{11} SS_{m,t-k} \times T_{m,t-k} + \\ \epsilon_6 \sum_{k=0}^{11} IS_{m,t-k} \times T_{m,t-k} + \epsilon_7 \sum_{k=0}^{11} L_{m,t-k} \times T_{m,t-k} + \\ \epsilon_8 \sum_{k=0}^{11} \Delta p_{mt} + \epsilon_9 \sum_{k=0}^{11} X_{mt} + \alpha_m + \beta_t) \end{aligned} \tag{4}$$

In Table 6, Column (5), we observe that $\epsilon_5 > 0$ (coefficient = 0.276; $p < 0.05$; two-tailed), suggesting that the longer a firm has occupied a high service quality position relative to competitors in

[31] The results of these analyses are presented in Appendix Tables 13 and 14. Consistent with these results, conversations with retail banking managers who make market entry decisions suggested that it would be infeasible to base such decisions on variations in a particular competitor's service performance across markets, owing in large part to a paucity of information concerning the banking relationships of particular customers.

its local market, the more likely its customers will close accounts following the entry or expansion of competitors offering superior service quality. This result is consistent with H2A. While we do not observe in this analysis that $\epsilon_2 > 0$ (coefficient = 1.97; $p = 0.21$; two-tailed), we do observe that $\epsilon_6 < 0$ (coefficient = -0.23; $p < 0.01$; two-tailed), which indicates that the longer a firm has occupied a low service quality position, relative to its competitors in its local market, the more likely its customers will close their accounts following the entry or expansion of competitors offering inferior service quality. This result offers further support for H2B.

4.4. Customer-level heterogeneity (H3 and H4)

As our tests of H3 and H4, we further extend model (3) to account for how a customer's reaction to service competition may depend on the profitability he or she generates for the firm. As motivated in the hypothesis development section, we use three customer characteristics that are so closely tied to profitability in retail banking that they are used for customer segmentation purposes: customer tenure, number of product classes, and checking account balances.

Along each dimension, we sort customers into deciles within their markets. We chose this strategy to account for the fact that customers in different markets may have different baseline levels for each dimension, owing to characteristics of the markets themselves. For example, it is likely that on average, markets the incumbent entered in the year 2000 would have customers with lower tenure than markets it entered ten years earlier. Assigning customers to deciles across markets, or analyzing customers in absolute terms without standardizing the profitability they generate relative to others in the markets in which they transact, would fail to account for these differences.

For each profitability dimension, we selected a decile cutoff above which customers are considered high profitability. With regard to customer tenure, we define customers in the third decile and above to be high tenure ($C_i = 1$). At a minimum, these customers have transacted with the bank for more than one year, a significant retention milestone in retail banking. We characterize customers with an above median number of product classes in their market to have a high number of product classes ($R_i = 1$). With regard to checking account balances, we define customers in the third decile and above as being high balance customers ($B_i = 1$). At a minimum, these customers have positive, non-zero balances, which is of particular relevance to the bank. Our tests of H3 and H4 use logistic regression to estimate the following cross-sectional model on the subset of 34,964 customers who transacted in markets where the firm sustained a high relative service position prior to the event window ($T_m = 24$):

$$z = f(\zeta_0 + \zeta_1 SS_m + \zeta_2 IS_m + \zeta_3 L_m + \zeta_4 P_{mt} + \zeta_5 X_m + \zeta_6 X_i + \zeta_7 HP_i + \zeta_8 HP_i \times SS_m) \qquad (5)$$

Where $z = Pr(DEFECT = 1)$, and HP_i represents a proxy for high profitability on the three dimensions of interest described above. When $HP_i = C_i$ or $HP_i = R_i$, if $\zeta_8 > 0$, then attraction to

Table 7: Customer-level heterogeneity in high service position markets

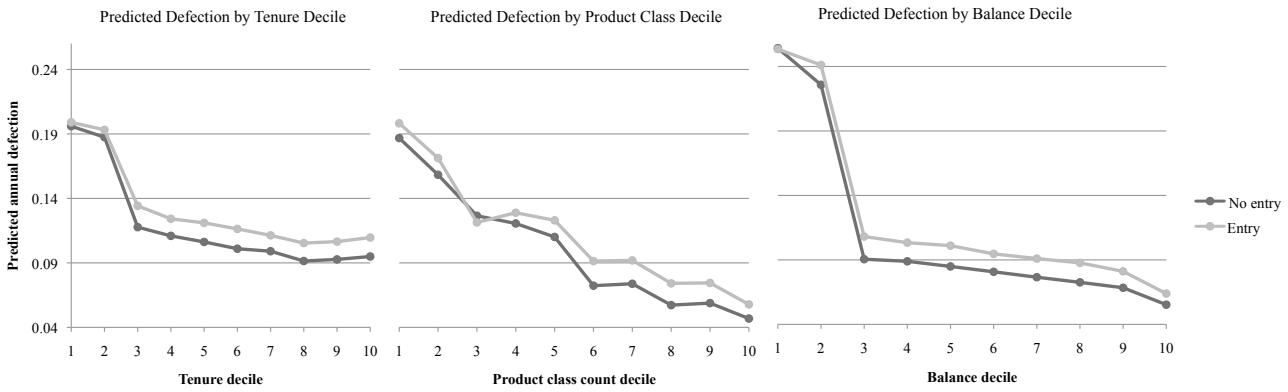
	(1)	(2)	(3)
Dependent variable	Defection	Defection	Defection
High tenure customer (more than 1 year)	-0.5230***		
	[0.0436]		
Superior service entry x high tenure	0.1581*		
	[0.0943]		
High product customer (above median)		-0.4629***	
		[0.0636]	
Superior service entry x high product		0.2051**	
		[0.1016]	
High balance customer (positive balances)			-1.0940***
			[0.0515]
Superior service entry x high balance			0.1779**
			[0.0878]
Constant	78.3152	85.0662	35.6284
	[154.4906]	[152.6555]	[150.3961]
P(Defection of Focal Customers | No Entry)	10.18%	6.50%	7.66%
P(Defection of Focal Customers | Entry)	11.62%	8.34%	9.03%
Observations	34,964	34,964	34,964

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests). All specifications use a logistic regression model. Brackets contain robust standard errors, clustered by market. To conserve space, coefficients for superior, inferior and local competitor entry, mean service fee change in the market, lagged mean service fee change, and incumbent competitor share are not displayed. None of these coefficients are statistically significant, except lagged mean fee change, which is signifciant at a 10% level. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates.

service competition is greater for high tenure or high product class customers, respectively. Since such customers have the opportunity to experience more transactions with the firm (either over a lengthier period of time, or through a more multi-faceted relationship with the firm), such findings would be consistent with the theory that customer learning attenuates the effects of switching costs in the face of increased service competition. Alternatively, if $\zeta_8 < 0$ when $HP_i = C_i$ or $HP_i = R_i$, then high tenure and high product class customers are less likely to defect following the entry or expansion of superior service competitors. Such a finding would suggest that switching costs dominate customer learning, inhibiting customers from seizing superior service experiences when they become available. Furthermore, if $\zeta_8 > 0$ when $HP_i = B_i$, then high balance customers are more attracted by superior service entrants, whereas, if $\zeta_8 < 0$ when $HP_i = B_i$, then high balance customers are less attracted by them.

In Table 7, column (1), we demonstrate that while high tenure customers are significantly less likely to defect than low tenure customers (coefficient = -0.523, $p < 0.01$; two-tailed), the coefficient on the interaction term of superior service entry and high tenure suggests that this effect is marginally attenuated when superior quality competitors enter or expand in the market (coefficient = .158, $p < 0.10$; two-tailed). Indeed, for high tenure customers, the annual defection probability increases from 10.18% (with no entry) to 11.62% (following an increase in service competition). Consistently, in column (2), we show that when a customer possesses an above median number of

Figure 1: Predicted defection in service-positioned markets following superior service entry by customer type



product classes, they are considerably less likely to defect in general (coefficient = -0.463, $p < 0.01$; two-tailed), but they are disproportionately attracted by superior service competitors (coefficient = 0.205, $p < 0.05$; two-tailed). The annual defection probability for high product class customers increased from 6.50% (with no entry) to 8.34% (following an increase in service competition).

While high tenure and high product class customers have generally low defection probabilities, they are disproportionately attracted to competitors offering superior service quality. These results are consistent with the account that experiences with the firm, increased through relationship duration (tenure) or relationship intensity (product breadth), engender switching costs that, on average, inhibit customer defection. However, having a high number of experiences with the firm makes these same customers more attuned to its service deficiencies, heightening defection when opportunities to receive better service avail themselves.

In column (3), we show that high balance customers exhibit a pattern of relationships that is similar to those of the other high value customers described above. Customers with high balances are less likely to defect from the bank (coefficient = -1.09, $p < 0.01$; two-tailed), but this effect is attenuated in the wake of increased service competition (coefficient = 0.178, $p < 0.05$; two-tailed). Annual defection probabilities of high balance customers rose from 7.66% when no entry occurred to 9.03% following an increase in superior service quality competition.

The predicted annual defection probabilities for each tenure, product class and balance decile are depicted graphically in Figure 1. The direction and significance of these relationships are consistent with H3 and H4. While high profitability customers are less likely to defect from the incumbent in general (H3), they are also more likely to defect from the incumbent following the entry or expansion of competitors offering superior service quality (H4).[32]

[32] We note that results are consistent if an index-based measure of a customer's value is substituted, rather than relying on individual dimensions of value (Appendix Table 15).

5. Long-run effects of service positioning

Our primary results to this point have been derived by estimating models of customer defection as a function of a single year of competitive entry or expansion. As such, they can be characterized as the short-run effects of service competition. Given the direction of these short run effects, it stands to reason that if a firm can sustain a superior service position within a local market, it should be able to attract and retain more profitable customers and achieve superior performance outcomes in the long run.

One market-level measure of retail bank performance is average deposit balance per customer, a metric that ties directly to market-wide revenue potential. The incumbent bank provided us with the aggregated monthly balances for all of its active customer accounts in each of its markets from 2004-2006. In this section, we compare the average deposit balance per customer transacting in markets where the firm has sustained a high service quality position relative to its competitors with the average deposit balance per customer transacting in a matched sample of markets where it has not sustained such a position. In so doing, we test the proposition that sustaining a high service quality position in a market leads to superior performance outcomes.

For each of the 644 markets represented in our sample, we counted the total number of months the incumbent held an above median (high) service quality position relative to its competitors for the five-year period from 2002 through 2006. Markets in which the incumbent maintained a high service quality position for an above median number of months (more than 54) were designated treatment markets. Our set of control markets consisted of the remaining markets, where the incumbent failed to sustain a high service quality position for an above-median number of months. We pair treatment and control markets using nearest-neighbor propensity score matching (without replacement) on market-level characteristics that co-vary with the balance levels held by customers in each market. Markets are matched on market-level characteristics from 2004 (see Table 3 for a complete list).

Our goal in conducting the propensity score matching is to pair treatment and control markets that are similar on as many observable dimensions as possible, excluding the relative service quality position of the incumbent. To improve the balance of our matched treatment and control markets, we trim the 15% of treatment observations for which the available control markets offer the poorest support, leaving us with 544 paired markets. Using this strategy, we significantly improve balance across the covariates (Unmatched R-squared = 0.102, $p < .01$; Matched R-squared = 0.017, $p = 0.998$).[33]

Notably, we excluded the competitor branch share variable from the matching procedure described above, because it is highly correlated with the incumbent's service position. Owing to the

[33] Balance statistics are provided in Appendix Table 16.

Table 8: Service position and account quality (customer balances)

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Average active balance	Average active balance	Average active balance	Average active balance	Average active balance	Average active balance
High service position market (Treatment)	765.8778*	926.5778**	969.6787**			
	[441.4468]	[434.7106]	[433.1254]			
Count of months with above-median position				19.5441**	19.6449**	20.5897***
				[7.8484]	[7.8048]	[7.8773]
Competitor branch share		-4,343.8720***	-4,455.3572***		145.2139	957.5963
		[1,524.4688]	[1,536.9329]		[1,523.1905]	[1,529.2081]
Mean service fee in market			-41,797.5357			-176,854.2245
			[37,209.2080]			[48,314.4272]
Constant	7,890.4283***	11,621.5353***	12,068.6599***	6,853.9464***	6,729.0333***	7,581.3586***
	[208.9859]	[1,353.9428]	[1,468.1158]	[86.6135]	[1,292.1922]	[1,333.1279]
Market fixed effects	No	No	No	Yes	Yes	Yes
Period (month) fixed effects	No	No	No	Yes	Yes	Yes
Years	2004-2006	2004-2006	2004-2006	2002-2006	2002-2006	2002-2006
Observations	19,584	19,584	19,584	32,096	32,096	32,096
Markets	544	544	544	544	544	544

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors.

fact that the incumbent bank faces a higher number of rated institutions offering inferior service, markets in which the incumbent has a high service quality position tend to have higher levels of competitor branch share. While we control for competitor branch share in our earlier analyses, including it in the matching procedure would necessitate trimming a significant number of control markets to achieve reasonable balance, thereby diminishing the power of our analysis. Instead, we directly control for competitor branch share post-matching.

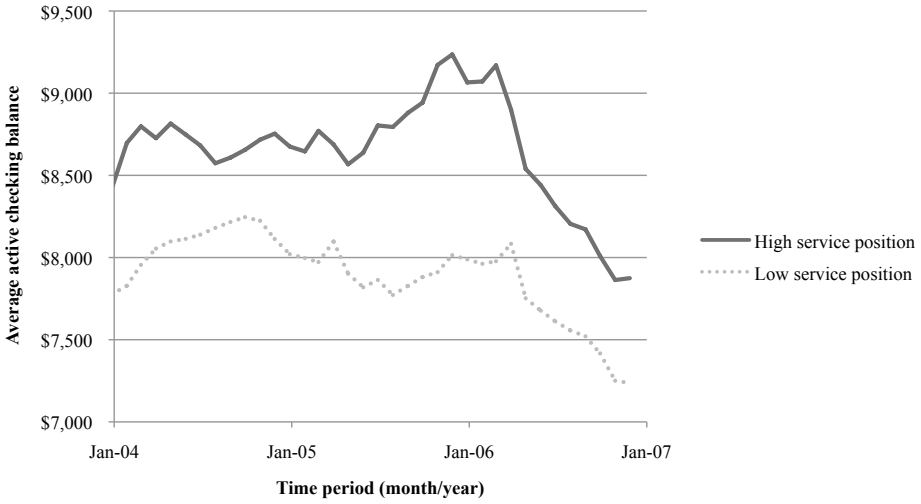
We test the proposition that the incumbent exhibits superior performance in markets where it sustains a high quality service position by using random effects GLS panel regression to estimate the following model on the average balances of customers transacting in treatment and control markets from 2004-2006. Standard errors are clustered by market:

$$AB_{mt} = \eta_0 + \eta_1 TR_m + \eta_2 BS_{mt} \tag{6}$$

Where AB_{mt} and BS_{mt} represent the average deposit balance per customer and the branch share of competitors respectively, in market m during month t. TR_m is an indicator variable used to distinguish treatment markets. If $\eta_1 > 0$, then maintaining a high quality service position relative to market competitors leads to higher average balances.

In Table 8, column (1), we show that over the period of analysis, average balances of customers were 9.71% higher in markets where the firm sustained an above median service position, which is a marginally significant difference (coefficient = \$765.88, $p = 0.083$; two-tailed). In column (2) we control for competitor branch share as detailed in model (6), which strengthens the effect (coefficient = \$926.58, $p < 0.05$; two-tailed). In column (3), we further refine our model by controlling for

Figure 2: Matched comparison of market performance by service position



average service fees in the market (coefficient = \$969.68, $p < 0.05$; two-tailed). These results suggest that sustaining a high quality service position relative to competitors in one's local market may lead to superior performance outcomes. Monthly deposit balances per customer in treatment and control markets are graphed in Figure 2.

In Table 8, columns (4-6), we replicate the analysis for the entire 2002-2006 time period using a continuous measure of service quality position, the count of the number of months the incumbent has held an above-median service quality position. In this analysis, we are able to leverage market and time-based fixed effects, which account for unobserved factors that are market-invariant across time, and time-invariant across markets. The results provide converging evidence. In the fully-specified model, each additional month with a high quality service position is associated with a \$20.59 increase in average balances (coefficient=\$20.59, $p < 0.01$; two-tailed).

6. Discussion and conclusions

One of the key dimensions upon which a firm competes is the quality of service it chooses to deliver to its customers. In this paper, we explore the links between a firm's service quality and the defection of its customers in the wake of increased service quality competition. Aspects of these relationships have been modeled in the operations management literature, but empirical evidence regarding the conditions under which customers defect in response to service competition is lacking.

While our results suggest that on a nationwide basis, increased service competition in a local market has no effect on customer defection, we show that competing firms trade-off price and service quality, and when the incumbent has sustained a high relative service quality position in the market prior to the entry event, its customers are disproportionately service sensitive and systematically attracted to competitors offering superior service quality. Conversely, when the firm

fails to maintain a high service quality position within the market, its customers are more likely to defect in the wake of entry or expansion by inferior service quality (price) competitors. We provide evidence that these results are driven by a sorting effect, whereby customers endeavor to select the firms within their local markets that best fit their preferences for price and service quality. In turn, when a competing firm enters a market offering a service/price bundle that better meets the needs of particular customers, those customers are more likely to defect.

Moreover, while the incumbent's most profitable customers - those with the longest tenure, most product classes, and highest balances - are less likely to defect in general, we demonstrate that in markets where the incumbent holds a high relative service quality position, its most profitable customers are disproportionately attracted by the entry or expansion of superior service quality competitors. Consistently, controlling for market-level demographic differences, we show that over the long-term, the incumbent retains customers with significantly higher balances in markets where it sustains a high relative service quality position.

These findings have several implications for operations management research and practice. First, firms that make the strategic decision not to compete on service quality may not need to be concerned about the entry or expansion of competitors offering superior service quality. Consistent with prior analytical literature on customer switching behavior, our analyses lend support to the account that customers and firms trade-off service quality and price, such that over time, low quality service firms attract and retain price sensitive customers who are not attracted by high quality service competitors. In fact, depending on the pricing dynamics in the industry and market, increased service competition may counterintuitively make the incumbent relatively *more* attractive to price-sensitive customers.

Second, our results highlight the risks of complacency for service positioned firms. Our analysis suggests that the entry or expansion of competitors offering superior service can have sizable short-term implications - increasing defection in our analysis by an average of 9.6% in a single year over baseline defection rates. We further show that these short-term effects have important long-term performance consequences, resulting in substantial differences in account quality between markets in which the firm maintains a high or low service position. Firms differentiating themselves on the basis of service must remain vigilant about the relative level of service they provide in order to defend against an erosion of the quality of accounts they attract and retain.

Finally, the positive association we demonstrate between service sensitivity and customer value suggests that models assuming the two are independent will underestimate the importance of service quality, and prescribe suboptimally low service levels. Initiatives to optimize a firm's service level must weigh the long-term costs of losing a firm's most valuable customers against the costs of perpetuating a level of relative service quality that is sufficient to retain them.

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Appendix Tables

		Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Bank 7
Lowest quality	Bank 1		42%	40%	46%	54%	42%	39%
	Bank 2	42%		50%	55%	66%	44%	64%
	Bank 3	40%	50%		46%	57%	42%	59%
	Bank 4	46%	55%	46%		49%	61%	61%
	Bank 5	54%	66%	57%	49%		56%	59%
	Bank 6	42%	44%	42%	61%	56%		12%
Highest quality	Bank 7	39%	64%	59%	61%	59%	12%	

Appendix Table 1: Out of all pairwise comparisons in market-level service quality made, percentage which were significant in either direction ($\alpha = .10$; two-tailed)

		Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Bank 7
Lowest quality	Bank 1		100%	100%	100%	100%	100%	100%
	Bank 2	100%		100%	100%	100%	100%	100%
	Bank 3	100%	100%		100%	100%	100%	100%
	Bank 4	100%	100%	100%		100%	100%	100%
	Bank 5	100%	100%	100%	100%		100%	100%
	Bank 6	100%	100%	100%	100%	100%		100%
Highest quality	Bank 7	100%	100%	100%	100%	100%	100%	

Appendix Table 2: Out of the market-level service quality pairwise comparisons that were significant ($\alpha = .10$; two-tailed), percentage which were significant in anticipated direction

Notes: Banks in tables above are listed from lowest to highest service quality scores based on J.D. Power and Associates 2006-2009 Retail Bank Satisfaction Surveys. To prepare the tables above, we calculated the means and standard deviations of service quality ratings reported by survey respondents in each year for each institution in each state for which data existed. Then, for each pair of rated firms competing in each state in each year, we conducted two-sided t-tests, comparing their quality ratings ($\alpha = .10$; two-tailed). Appendix Table 1 tabulates the percentage of pairwise comparisons that were significant in either direction. Owing to a limited number of observations in each state, many pairwise comparisons were not significant. However, Appendix Table 2 tabulates the percentage of significant pairwise comparisons that were significant in the anticipated direction. In 100% of the cases for which significant pairwise differences in service quality were identified, the relative performance of the firms being compared was consistent with the relative performance ordering defined by the institution-level metric we use in our analysis. Importantly, these differences were not just detected among extreme comparisons (i.e. the highest quality firm vs. the lowest quality firm), but also among adjacent competitors in markets for which a sufficient number of observations existed to draw statistically significant conclusions.

	(1)	(2)	(3)	(4)
Dependent variable	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.
Service rating	3.8128**	3.9227**		
	[1.8311]	[1.8201]		
Total deposits (in thousands)		-0.0000		-0.0000***
		[0.0000]		[0.0000]
Branch count		0.0056		0.0113***
		[0.0035]		[0.0015]
Nationwide retail bank			7.9800***	4.4983***
			[0.9291]	[1.2388]
Constant	8.5066	3.6673	6.3554***	6.2595***
	[16.0388]	[18.7381]	[0.2385]	[0.2382]
Sample selection	Rated institutions (2005-2008)	Rated institutions (2005-2008)	All institutions (2005-2008)	All institutions (2005-2008)
Observations	119	119	29973	29973
Between R-squared	0.160	0.209	0.024	0.031
Institutions	50	50	8223	8223

Appendix Table 3: Firms tradeoff price and service quality (2005-2008)

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain standard errors. Also included in the models above were time-based fixed effects for 2006, 2007, and 2008 (2005 excluded).

	(1)	(2)	(3)	(4)
Dependent variable	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.
Service rating	5.6117**	3.8818*	6.1779**	4.0478*
	[2.4377]	[1.9579]	[2.4167]	[2.0416]
Total deposits (in thousands)			-0.0000	-0.0000
			[0.0000]	[0.0000]
Branch count			0.0070*	0.0045
			[0.0038]	[0.0040]
Constant	-5.3230	0.0809	-8.7865	-0.4211
	[7.3483]	[5.7915]	[7.5712]	[6.1038]
Sample selection	Rated institutions (2005-2007)	Rated institutions (2005-2007)	Rated institutions (2005-2007)	Rated institutions (2005-2007)
Model	Between effects	Fixed effects	Between effects	Fixed effects
Observations	78	78	78	78
Between R-squared	0.128	0.092	0.207	0.122
Institutions	38	38	38	38

Appendix Table 4: Firms tradeoff price and service (2005-2007, between and fixed effects models)

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain standard errors. 78 observations represent 38 institutions. The average institution was represented by 2.1 observations, with a minimum of 1 observation and a maximum of 3. R-square figures represent the between R-square calculation for the between-effects models and the within R-square calculation for the fixed effects models.

	(1)	(2)	(3)	(4)
Dependent variable	Fee income per 1,000 dep. dol.	Fee income per 1,000 dep. dol.	Net interest margin	Net interest margin
Service rating	5.6117**	6.1779**	0.0033*	0.0037**
	[2.4377]	[2.4167]	[0.0017]	[0.0016]
Total deposits (in thousands)		-0.0000		-0.0000**
		[0.0000]		[0.0000]
Branch count		0.0070*		0.0000**
		[0.0038]		[0.0000]
Constant	-5.3230	-8.7865	0.0168***	0.0150***
	[7.3483]	[7.5712]	[0.0052]	[0.0051]
Sample selection	Rated institutions (2005-2007)	Rated institutions (2005-2007)	Rated institutions (2005-2007)	Rated institutions (2005-2007)
Model	Between effects	Between effects	Between effects	Between effects
Observations	78	78	78	78
Between R-squared	0.128	0.207	0.095	0.245
Institutions	38	38	38	38

Appendix Table 5: Firms tradeoff price and service quality; fee income per deposit dollar and net interest margin

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Fee income per thousand deposit dollars is total deposits/ service charges on deposits, service ratings from the JD Power and Associates Retail Bank Survey, total deposits include all deposits held by the institution across all markets, and number of branches is the branch count for the institutions branch network. Net interest margin is the difference between interest and dividends earned on interest-bearing assets and interest paid to depositors and other creditors, expressed as a percentage of average earning assets. Net interest margin and fee income per deposit dollar are positively correlated with one another ($\rho = 0.346$).

	(1)	(2)	(3)	(4)
Dependent variable	Defection or significant balance reduction (95%)	Defection or significant balance reduction (95%)	Defection or significant balance reduction (95%)	Defection or significant balance reduction (95%)
Superior service competitor entry	0.0285	-0.0696	0.0686*	-0.0138
	[0.0271]	[0.0547]	[0.0407]	[0.0424]
Inferior service competitor entry	0.0537**	0.1401***	0.0392	0.0991***
	[0.0254]	[0.0400]	[0.0356]	[0.0352]
Local competitor entry	0.0275	0.0993**	-0.0269	0.1103***
	[0.0245]	[0.0419]	[0.0361]	[0.0327]
Number of months with a high service position		0.0046**		
		[0.0019]		
Superior service entry x number of months		0.0062**		
		[0.0028]		
Inferior service entry x number of months		-0.0053***		
		[0.0020]		
Local service entry x number of months		-0.0048**		
		[0.0022]		
Constant	-139.4670	-113.7274	-48.0801	-117.4321
	[88.4662]	[88.6142]	[145.3952]	[111.1238]
Level of analysis	Customer level	Customer level	Customer level	Customer level
Sample selection	All customers	All customers	High service position markets	Low service position markets
Regression model	Logistic	Logistic	Logistic	Logistic
F test (Sup. entry + 24(Number above x Sup. entry)>0		F=6.87; $p<.01$		
P(DV of Focal Customers | No Entry)			17.38%	16.75%
P(DV of Focal Customers | Entry)			18.35%	18.13%
Observations	82,235	82,235	34,964	47,271

Appendix Table 6: Customer defection or significant balance reduction (of more than 95%) following competitive entry

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Dependent variable is coded 1 for customers who defected in 2004 or for customers whose balances in checking, non home equity loan, and other accounts reduced by 95% or more from the previous year. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates. Variables in Column (5) are aggregated, as described in Model (4). Additional market-month level controls in Column (5) include aggregated counts of the number of new and existing customers.

	(1)	(2)	(3)	(4)
Dependent variable	Defection	Defection	Defection	Defection
Any superior service competitor entry	0.0103	-0.1489**	0.1180**	-0.0577
	[0.0354]	[0.0699]	[0.0487]	[0.0486]
Any inferior service competitor entry	0.0322	0.1178**	0.0454	0.0656
	[0.0288]	[0.0474]	[0.0370]	[0.0408]
Any local competitor entry	0.0202	0.1232***	-0.0752*	0.1031***
	[0.0278]	[0.0446]	[0.0413]	[0.0376]
Number of months with a high service position		0.0071***		
		[0.0023]		
Any superior service entry x number of months		0.0099***		
		[0.0036]		
Any inferior service entry x number of months		-0.0049**		
		[0.0024]		
Any local service entry x number of months		-0.0074***		
		[0.0024]		
Constant	-81.8007	-46.7426	79.7406	-111.8372
	[100.0064]	[97.3751]	[148.9688]	[132.9752]
Level of analysis	Customer level	Customer level	Customer level	Customer level
Sample selection	All customers	All customers	High service position markets	Low service position markets
Regression model	Logistic	Logistic	Logistic	Logistic
F test (Sup. entry + 24(Number above x Sup. entry)>0		F=5.67; $p<.05$		
P(DV of Focal Customers | No Entry)			12.01%	11.35%
P(DV of Focal Customers | Entry)			13.25%	12.38%
Observations	82,235	82,235	34,964	47,271

Appendix Table 7: Customer defection following any competitive entry

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Focal independent variables are coded 1 if any entry or expansion occurred in the category, and 0 otherwise. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates. Variables in Column (5) are aggregated, as described in Model (4). Additional market-month level controls in Column (5) include aggregated counts of the number of new and existing customers.

	(1)	(2)	(3)
Dependent variable	Defection	Defection	Defection
Adjacent competitor entry	0.0366	0.0630	0.0674
	[0.0323]	[0.0515]	[0.0420]
Non-adjacent competitor entry	0.0245	0.0559	0.0337
	[0.0298]	[0.0423]	[0.0409]
Local competitor entry	0.0104	-0.0540	-0.0893
	[0.0289]	[0.0409]	[0.0382]
Constant	-79.1588	109.9478	-110.9365
	[99.2919]	[149.2144]	[131.7441]
Level of analysis	Customer level	Customer level	Customer level
Sample selection	All customers	High service position markets	Low service position markets
Regression model	Logistic	Logistic	Logistic
Observations	82,235	34,964	47,271
Pseudo R-squared	0.059	0.063	0.059

Appendix Table 8: Customer defection following the entry of adjacent competitors

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Focal independent variables are coded 1 if entry occurred by a competitor with a service quality rating that was adjacent to the focal incumbent in the local market, and 0 otherwise. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates. Variables in Column (5) are aggregated, as described in Model (4). Additional market-month level controls in Column (5) include aggregated counts of the number of new and existing customers.

	(1)	(2)
Dependent variable	Satisfaction with queue time	Satisfaction with queue time
High service position market	-0.0727**	-0.1465**
	[0.0310]	[0.0603]
Queuing time (in minutes)	-0.2519***	-0.2582***
	[0.0078]	[0.0092]
High service position market x queuing time		0.0154
		[0.0125]
Level of analysis	Customer level	Customer level
Sample selection	Focal incumbent	Focal incumbent
Regression model	Ordered logistic	Ordered logistic
Customer-level control variables	Yes	Yes
Observations	23,928	23,928

Appendix Table 9: Customer sensitivity to waiting based on incumbent service position

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered at the market level. Additional customer-level controls include direct deposit indicator, count of loan, investment and deposit accounts, balances in loan, and investment and deposit accounts.

In Column (1), we model the queue time satisfaction reported by 23,928 randomly selected customers who engaged in face-to-face service with the focal incumbent during January 2004, as a function of the incumbent's service position in the customer's market. Controlling for the length of time the customer reported waiting in the queue, and customer-level controls, those in high service positioned markets ($T_m = 24$) were significantly less satisfied with the length of their wait (coefficient = -0.072; $p < 0.05$; two-tailed). Indeed, the incremental dissatisfaction of customers transacting in markets with a high service quality position was the equivalent of waiting an additional 34 seconds. In Column (2), we further investigated whether the effect of queuing time on queuing time satisfaction depends on relative service position. We did not find a significant interaction (coefficient = 0.015; $p = .22$; two-tailed), and the negative main effect of high service position on queue time satisfaction intensified (coefficient = -0.146; $p < 0.05$; two-tailed), as did the negative main effect of queuing time (coefficient = -0.258; $p < 0.01$; two-tailed). These results suggest that customers in markets where the incumbent has a high service quality position are less satisfied with the length of their wait than customers in markets where the incumbent has a low service quality position, across wait times (i.e. the effect of wait time on wait time satisfaction does not depend on the incumbent's relative service position, but controlling for wait time, customers are consistently less satisfied with the length of their wait in markets where the incumbent has a high relative service quality position.)

	(1)
Dependent variable	Perceived quality
High service position market	-0.1196**
	[0.0571]
Constant	7.7045***
	[0.2257]
Level of analysis	Customer level
Sample selection	JDPA rated firms
Regression model	OLS
Firm fixed effects	Yes
Market fixed effects	Yes
Firms	78
Markets	6,098
Observations	20,890

Appendix Table 10: Customers of firms with a high relative service position perceive lower service quality

***, **, and * denote significance at the 1%, 5% and 10% level. Robust standard errors, clustered by market, in brackets. Data collected from 2007 J.D. Power and Associates Annual Retail Bank Satisfaction Study. Data were collected during late 2006. The 2007 study was the first during which J.D. Power and Associates captured respondent-level zip code information, which facilitates this analysis. These customers transacted with 78 different banking institutions in 6,098 U.S. cities. Customer ratings were aggregated to produce a mean service quality rating for each institution, which in turn was used to categorize the institution's service position relative to the median in each market. For this analysis, markets were defined as a city/state combination. Respondent's ratings were modeled as a function of the firm's relative service position in the respondent's market, as well as institution and market-level fixed effects. The results demonstrate a general tendency for customers to perceive firms to have below average service quality in markets where they have a relatively high service quality position (coefficient = -0.120; $p < 0.05$; two-tailed). On average, customers rated service in these markets to be 1.6% below average for the institution, which is consistent with H1.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Mean Fee Change	Mean Fee Change	Mean Fee Change	Mean Fee Change	Mean Fee Change	Mean Fee Change
Superior service competitor entry	0.0760***	0.0752***	0.0729***	0.0658***	0.0750***	0.0758***
	[0.0154]	[0.0152]	[0.0197]	[0.0198]	[0.0212]	[0.0213]
Inferior service competitor entry	0.0214*	0.0228*	0.0108	0.0109	0.0259	0.0260
	[0.0122]	[0.0122]	[0.0191]	[0.0194]	[0.0178]	[0.0178]
Local competitor entry	0.0265**	0.0274**	-0.0137	-0.0106	0.0561***	0.0563***
	[0.0114]	[0.0114]	[0.0171]	[0.0170]	[0.0157]	[0.0159]
Prior year market-level average overall satisfaction		0.0148		0.0375		-0.0168
		[0.0396]		[0.0564]		[0.0571]
Prior year market-level intended loyalty		0.0435		0.0335		0.0311
		[0.0388]		[0.0506]		[0.0634]
Constant	56.2846	55.9027	7.3753	-0.1133	128.1620	129.7083
	[52.2260]	[53.3668]	[52.6097]	[53.2307]	[79.6808]	[80.5706]
Level of analysis	Market level	Market level	Market level	Market level	Market level	Market level
Sample selection	All markets	All markets	High service position markets	High service position markets	Low service position markets	Low service position markets
Regression model	OLS	OLS	OLS	OLS	OLS	OLS
Observations	644	644	282	282	362	362
R-squared	0.390	0.396	0.290	0.301	0.510	0.511

Appendix Table 11: Effect of competitive entry on changes in market prices

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Note that Columns (2), (4), and (6) replicate Columns (1), (3), and (5), adding controls for prior year satisfaction and intended loyalty. The results are substantively similar. In all cases, and across all market types, the entry of a superior service quality competitor is associated with an increase in the average fee income per deposit dollar among competitors in that market. From results reported in the paper, fee increases of this nature are associated with a decrease in defection among the price sensitive customers engaging with the incumbent in markets where it has a low relative service quality position.

	(1)	(2)	(3)	(4)
Dependent variable	Defection	Defection	Defection	Defection
Superior service competitor entry	0.0112	-0.1266*	0.1105**	-0.0966**
	[0.0353]	[0.0672]	[0.0459]	[0.0492]
Inferior service competitor entry	0.0353	0.1550***	0.0451	0.1169***
	[0.0301]	[0.0497]	[0.0356]	[0.0433]
Local competitor entry	0.0117	0.1186**	-0.0247	0.1061**
	[0.0291]	[0.0524]	[0.0374]	[0.0417]
Number of months with a high service position		0.0069***		
		[0.0024]		
Superior service entry x number of months		0.0087**		
		[0.0035]		
Inferior service entry x number of months		-0.0072***		
		[0.0025]		
Local service entry x number of months		-0.0072***		
		[0.0027]		
Constant	-78.3286	-41.2859	76.7651	-113.0376
	[99.9920]	[98.5879]	[138.7723]	[140.4368]
Level of analysis	Customer level	Customer level	Customer level	Customer level
Sample selection	All customers	All customers	High service position markets (count above median >20)	Low service position markets (count above median <=20)
Regression model	Logistic	Logistic	Logistic	Logistic
F test (Sup. entry + 21(Number above x Sup. entry)>0		F=3.15; p<.10		
P(DV of Focal Customers | No Entry)			12.10%	11.15%
P(DV of Focal Customers | Entry)			13.27%	12.31%
Observations	82,235	82,235	40,643	41,592

Appendix Table 12: Customer defection following competitive entry (alternate specification for high service quality position)

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates. Variables in Column (5) are aggregated, as described in Model (4). Additional market-month level controls in Column (5) include aggregated counts of the number of new and existing customers.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	Defection	Defection	Defection	Defection	Defection	Defection	Defection	Defection
Superior service competitor entry	0.0112	0.0115	-0.1266*	-0.1303*	0.1094**	0.1028**	-0.0598	-0.0630
	[0.0353]	[0.0355]	[0.0672]	[0.0672]	[0.0486]	[0.0502]	[0.0477]	[0.0468]
Inferior service competitor entry	0.0353	0.0336	0.1550***	0.1490***	0.0302	0.0217	0.0896**	0.0753*
	[0.0301]	[0.0300]	[0.0497]	[0.0493]	[0.0379]	[0.0390]	[0.0417]	[0.0410]
Local competitor entry	0.0117	0.0104	0.1186**	0.1173**	-0.0579	-0.0592	0.0927**	0.0879**
	[0.0291]	[0.0291]	[0.0524]	[0.0519]	[0.0410]	[0.0410]	[0.0380]	[0.0375]
Number of months with a high service position			0.0069***	0.0067***				
			[0.0024]	[0.0024]				
Superior service entry x number of months			0.0087**	0.0089**				
			[0.0035]	[0.0035]				
Inferior service entry x number of months			-0.0072***	-0.0070***				
			[0.0025]	[0.0025]				
Local service entry x number of months			-0.0071***	-0.0072***				
			[0.0027]	[0.0027]				
Prior year market-level average overall satisfaction		-0.1290		-0.1188		0.2190		-0.4575***
		[0.1108]		[0.1093]		[0.1536]		[0.1481]
Prior year market-level intended loyalty		0.0451		0.0303		-0.1710		0.2374
		[0.1112]		[0.1086]		[0.1531]		[0.1564]
Constant	-78.3286	-70.5532	-41.2858	-34.4270	75.7879	55.0357	-84.0835	-72.7734
	[99.9919]	[100.5566]	[98.5877]	[98.6803]	[150.1256]	[153.1949]	[131.7256]	[131.6463]
Level of analysis	Customer level	Customer level	Customer level	Customer level	Customer level	Customer level	Customer level	Customer level
Sample selection	All customers	All customers	All customers	All customers	High service position markets	High service position markets	Low service position markets	Low service position markets
Regression model	Logistic	Logistic	Logistic	Logistic	Logistic	Logistic	Logistic	Logistic
F test (Sup. entry + 24(Number above x Sup. entry)>0			F=4.74; p<.05	F=4.90; p<.05				
P(Defection of Focal Customers | No Entry)					12.02%	12.03%	11.42%	11.50%
P(Defection of Focal Customers | Entry)					13.17%	13.11%	12.31%	12.26%
Observations	82,235	82,235	82,235	82,235	34,964	34,964	47,271	47,271

Appendix Table 13: Customer defection following competitive entry (controlling for prior year satisfaction and loyalty)

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Logistic regression model. Brackets contain robust standard errors, clustered by market. Coefficients for mean service fee change in the market, lagged mean service fee change, and competitor branch share were not significant and have been hidden to conserve space. Additional market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards and deposit certificates. Note that Columns (2), (4), (6) and (8) replicate Columns (1), (3), (5), and (7), adding controls for prior year satisfaction and intended loyalty, and the results are substantively similar.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Superior entry	Inferior entry	Local entry	Superior entry	Inferior entry	Local entry
Prior year overall satisfaction				0.6010	-0.3764	-0.2809
				[0.8411]	[0.4577]	[0.4751]
Prior year intended loyalty	0.2775	-0.2765	-0.2097			
	[0.7905]	[0.4829]	[0.4907]			
Lagged competitor share	0.6939	3.5901***	2.1850*	0.6201	3.6068***	2.2007*
	[2.1506]	[1.2092]	[1.2558]	[2.1310]	[1.2028]	[1.2554]
Household income percentile	0.0395**	0.0048	-0.0189*	0.0408***	0.0047	-0.0188*
	[0.0158]	[0.0105]	[0.0101]	[0.0156]	[0.0105]	[0.0100]
Median age	0.1130	0.0538	0.0228	0.1105	0.0536	0.0228
	[0.0936]	[0.0686]	[0.0690]	[0.0930]	[0.0682]	[0.0690]
Per capita income	0.0000	0.0001**	-0.0000	0.0000	0.0001***	-0.0000
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Median home value	0.0000	-0.0000***	0.0000*	0.0000	-0.0000***	0.0000*
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Household growth rate	-0.1993	2.1358***	-0.8789*	-0.2441	2.1459***	-0.8765*
	[0.7230]	[0.5358]	[0.5150]	[0.7237]	[0.5329]	[0.5154]
Average household size	-0.2912	1.2019	-0.5336	-0.3534	1.2485	-0.5042
	[1.3679]	[0.9188]	[0.8315]	[1.3634]	[0.9240]	[0.8358]
Incumbent growth	1.1699	11.2277	-18.7278***	1.1625	11.2998	-18.7114***
	[7.9901]	[7.9920]	[7.2202]	[8.0146]	[7.9594]	[7.2114]
Constant	693.0061	190.3576	178.5143	686.2330	223.2971	199.7451
	[989.4397]	[727.9245]	[768.7110]	[988.4263]	[734.1927]	[769.5164]
Level of analysis	Market level	Market level	Market level	Market level	Market level	Market level
Regression model	Logistic	Logistic	Logistic	Logistic	Logistic	Logistic
Observations	644	644	644	644	644	644
Pseudo R-squared	0.226	0.223	0.133	0.227	0.224	0.133

Appendix Table 14: Entry as a function of prior year intended loyalty and overall satisfaction

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Logistic regression model. Brackets contain robust standard errors. Market-level controls include population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. The results of these analyses are not supportive of the hypothesis that the prior year intended loyalty and overall satisfaction of the incumbent's customers is predictive of the competitive entry of superior, inferior or local competitors.

	(1)
Dependent variable	Defection
High value indicator	-0.6305***
	[0.0314]
Superior service entry x high value indicator	0.1478***
	[0.0455]
Superior entry	-0.1180
	[0.0881]
Inferior entry	0.0432
	[0.3988]
Local entry	-0.0463
	[0.0431]
Constant	69.6755
	[159.723]
Level of analysis	Customer level
Sample selection	High service position markets
Regression model	Logistic
Observations	34,964

Appendix Table 15: Customer-level heterogeneity in high service position markets: Aggregated high value customer metric

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively (two-tailed tests). Brackets contain robust standard errors, clustered by market. High value indicator represents an overall index-based measure of high value: the sum of the separate indicator variables (high value = high tenure + high product + high balance). These results offer additional support for H3 and H4. While high value customers are less likely to defect in general, in high service positioned markets, the relationship between superior service quality entry and a customer's defection from a local incumbent is positively moderated by the customer's profitability to the local incumbent. Additional market-level controls include lagged mean fee change, population, median household income, median age, population growth, per capita income, median home value, household growth, average household size, gender distribution, and incumbent branch growth. Customer-level controls include customer tenure (in years), prior year checking, loan and investment account balances, and counts of checking, loan accounts, investment accounts, credit cards, debit cards, and deposit certificates.

Variable	Sample	Treatment	Control	% Bias	*t*	*p* > | *t* |
Population (2000)	Unmatched	150,000	120,000	36.7%	4.66	0.00
	Matched	140,000	130,000	13.5%	1.65	**0.10**
Current year population	Unmatched	160,000	130,000	33.8%	4.29	0.00
	Matched	150,000	140,000	12.9%	1.56	**0.12**
Median household income	Unmatched	52,621	49,640	17.3%	2.20	0.03
	Matched	50,958	50,188	4.5%	0.56	**0.58**
Household income percentile	Unmatched	63.24	60.12	12.1%	1.53	0.13
	Matched	62.53	60.87	6.4%	0.77	**0.44**
Median age	Unmatched	36.15	36.10	1.1%	0.14	0.89
	Matched	36.31	36.42	-2.2%	-0.28	**0.78**
Population growth percentile	Unmatched	52.68	55.70	13.0%	-1.65	0.09
	Matched	54.36	54.46	-0.4%	-0.05	**0.96**
Per capita income	Unmatched	28,131	25,122	26.7%	3.39	0.00
	Matched	26,960	25,847	9.9%	1.19	**0.24**
Median home value	Unmatched	240,000	180,000	32.8%	4.17	0.00
	Matched	210,000	190,000	11.1%	1.37	**1.72**
Household growth	Unmatched	1.56	1.86	-19.3%	-2.45	0.02
	Matched	1.66	1.72	-3.8%	-0.45	**0.65**
Average household size	Unmatched	2.66	2.72	-14.7%	-1.86	0.06
	Matched	2.66	2.68	-5.6%	-0.70	**0.48**
Percentage males	Unmatched	50.12	49.99	7.9%	1.00	0.32
	Matched	50.05	50.09	-2.2%	-0.26	**0.79**
Percentge females	Unmatched	49.89	50.02	-7.8%	-0.99	0.32
	Matched	49.96	49.92	2.2%	0.27	**0.79**
Population growth	Unmatched	1.48	1.73	-15.6%	-1.98	0.05
	Matched	1.56	1.59	-2.3%	-0.28	**0.78**
Population growth	Unmatched	1.48	1.73	-15.6%	-1.98	0.05
	Matched	1.56	1.59	-2.3%	-0.28	**0.78**

Appendix Table 16: Balance statistics from market-level propensity score matching in long-term effects of service positioning analysis

The pseudo R-squared before matching was 0.102; $p < 0.01$. The pseudo R-squared post matching was 0.017; $p = 0.998$, suggesting strong balance between the matched treatment and control markets. In addition to the covariates listed above, we also match on the percentage of each population that was within various age buckets during the time of our analysis. For parsimony, we have excluded those balance statistics, though no significant differences were present between the matched markets on these dimensions.