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A Basic Analysis of Entry and Exit in the US Broadband Market, 2005-2008

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Abstract: We conduct a basic yet thorough analysis of entry and exit in the US broadband market, using a complete FCC census of providers from 2005 to 2008. There is a tremendous amount of (simultaneous) entry and exit in the US broadband market. Most entry is from existing providers expanding into new geographic areas. Entry and exit vary widely across the various modes of provision, which argues against treating broadband as a homogenous service in theoretical or empirical work. The highest entry rates also generally have the highest entrant shares. Entry rates display positive autocorrelation, and the same is true for exit. There is also positive correlation between the entry and exit rates at various leads and lags, suggesting that there are systematic differences among the broadband types in the height of entry and exit barriers. We discuss some implications these results may have for both policy purposes and future work in the broadband market.

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Contents

I.	Introduction.....	3
II.	Measuring the Entry and Exit Broadband Providers	6
A.	Data Construction.....	6
1.	Broadband provider data	6
2.	ZIP code data	8
3.	Limitations of the data	8
B.	Entry and Exit Measures	10
1.	Market definition	11
2.	Measures of entry	12
3.	Measures of exit.....	14
4.	Sources of entry and exit.....	15
5.	Adjustment to exclude single-round entry and exit.....	16
III.	Basic Analysis of Entry and Exit	16
A.	Entry and Exit Rates	17
B.	Variation in Entry and Exit across Broadband Types	22
1.	Variation across types of service.....	22
2.	Variation across geographic regions	25
C.	Correlation in Entry and Exit.....	25
1.	Autocorrelation of entry and of exit	25
2.	Correlation between entry and exit	26
IV.	Conclusions.....	28
	References	31

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I. Introduction

The importance of broadband to modern life as consumers, citizens, students, producers of goods and services, and providers of public safety is well established. The entire edifice of the market for broadband rests on the foundation of its infrastructure. Since demand for broadband service cannot be satisfied and the enjoyment of the benefits of broadband usage cannot begin until supply is available, it is critical to monitor and explore the evolution of the market on the supply side. The broadband market is also of particular interest given the importance of broadband for local economic development, labor productivity, and GDP growth (Gillett et al., 2006; Kolko, 2010; Greenstein and McDevitt, 2009; Prieger, forthcoming). Broadband markets are also a potentially fertile laboratory for the economist to develop and test theories about market dynamics.

Despite the importance of the broadband market, however, little work has been done on the dynamics of the market. Most studies of entry in the market for broadband service provision are static in nature. In a typical such study, a cross-section of either the number of broadband firms or an indicator for the presence of at least one firm in the local area is regressed on various market and demographic characteristics (Prieger, 2003; Grubestic and Murray, 2004; Flamm, 2005, Prieger and Church, 2012). These studies of broadband availability in the US show that firms' decisions to deploy network resources and offer service in a local area depend on economic and regulatory considerations. Demand factors such as the size of the local market, average income in the area, and other demographic characteristics such as the education and age profile of the area have all been shown to affect broadband penetration (Prieger, 2003; Grubestic and Murray, 2004; Flamm, 2005; Flamm and Chaudhuri, 2007; Prieger and Hu, 2008b).¹ Some of these studies also show that variables that are proxies for cost factors, such as population density, terrain, etc., also influence broadband penetration in the expected ways. Due to low population density and generally rougher topography than urban areas, rural areas are less likely to have broadband available at all, or more likely to be served only with lower-speed broadband or by few providers (Stenberg et al., 2009; Li et al., 2011; Prieger, forthcoming). Intramodal and intermodal competition among providers, both actual and potential, also affects the incentives to enter the local broadband markets (Denni and

¹ See also the review of broadband demand studies in Hauge and Prieger (2010).

Gruber, 2007; Prieger and Hu, 2008a; Wallsten and Mallahan, 2010). Regulatory policy that alters the expected return on broadband network investment, such as mandated unbundling of network elements for use by competitors, can also impact the deployment decision by (Prieger and Lee, 2008). Almost all these results have been gleaned from cross-sectional, static studies of current market participants.

This paper examines the FCC's data on where broadband service was offered from June 2005 to June 2008. By linking broadband service providers' data submissions over time, we are able to measure and investigate the sources and determinants of entry and exit in the US broadband market. We define markets four ways for purposes of study: the geographical extent of the market is either the nation or a ZIP code area, and the product market extent is either a single broadband type or all types.

Instead of jumping directly to regressions or structural modeling of the industry, we instead conduct a more basic empirical investigation of entry and exit in this paper. In the terms of Geroski (1995), our aim is to set out "stylized facts" coming from basic descriptions of the data, instead of stylized (or specific) results from regressions. In taking this approach, we apply the lessons from recent decades in the IO literature that establishing basic descriptive facts about industry entry and exit can motivate better theoretical and empirical modeling. As an example, Einav and Levin (2010) cite the findings of Dunne, Roberts, and Samuelson (1988) (hereafter denoted DRS) and others that there is a great deal of heterogeneity between firms' entry and exit patterns. DRS's findings motivated a wave of new theoretical and empirical models of industry dynamics including firm heterogeneity, simultaneous entry and exit, and other "real world" features (e.g., Jovanovic, 1982; Hopenhayn, 1992; Ericson and Pakes 1995). These models were better able to account for the stylized facts the literature had accumulated, including that a great deal of exit can coexist with entry, and that entry and exit rates are highly correlated across industries (Geroski, 1995), so that industry-specific factors appear to be important in explaining market dynamics.

Toward the goal of building a set of basic facts about market dynamics in broadband markets, we address several questions in this paper. How do the market dynamics compare with what is known about other markets? How much entry in the local markets comes from truly new entrants, and how much is from expansion of existing firms? Are there substantial differences in entry and exit across geographic and product-type markets? And finally, how much turnover of firms is there? We close this section with a preview of our findings regarding these questions.

First, how do entry and exit in the broadband market compare with that in other markets? The striking conclusion is that there is a tremendous amount of dynamic activity in the US broadband market. In the national market, the entry rate averages 14-19% annually, which is greater than the entry rates the economic literature has found for many other industries. The exit rate for broadband is also higher than for other industries, but not as high as the entry rate, so that net entry averages 3.1% annually. With narrower geographic or service type market definitions, the entry rates average from 24% to an astounding 49% per annum. Thus, the dynamic element in the market is huge.

The second question, whence comes entry, has policy relevance to questions regarding competition and mergers in the telecommunications and broadband industry. While the FCC pays great attention to potential dominance by large providers at the national level (e.g., their denial of the recently proposed AT&T/T-Mobile merger), what matters for consumers is the number of options available where they live.² We demonstrate that at least three in four entrants at the ZIP code level expand geographically into the area. When the local markets are delineated by service type, another one in every five entrants is a firm already operating in the area that diversifies its product mix by offering another type of broadband access. These entrants are also much larger than de novo entrants on average. Thus, most entry and much of the dynamism in the market, along with the new options that entry provides for consumers, comes from large, existing firms.

The third question of heterogeneity in dynamics among areas and broadband service types also has policy relevance. Since the main form of competition in broadband markets at the time was between the incumbent DSL provider and the local franchise cable company offering cable modem service, it is important to understand how the dynamics among those types of firms may differ. We show that average entry and exit rates mask much variation among different types of broadband service; entry is much more prominent in some broadband types than others. In particular, in the local markets there is five times as much entry in the DSL than in the cable modem markets. There is also great variation in exit rates. Thus, analyses that lump together all broadband types in a market, as most of the previous work cited above had to do, may miss much interesting variation and strategic interaction via intermodal competition.

The final question of turnover of firms in the marketplace impinges directly on previous work done in this area. Only one paper of which we are aware has attempted directly to address dynamics in the broadband marketplace. Xiao and Orazem (2011) extend Bresnahan and Reiss's (1991, 1994) model of local oligopoly to allow firms to enter and exit the ZIP code-level markets. Their work makes creative use of the publicly available data from the FCC, which (at the time) consists only of counts of firms offering service in the ZIP code, undifferentiated by type. The data do not reveal the identities of market participants, and so true longitudinal data on the firms in the local markets is unavailable. They find that once the market has one to three firms, the fourth and succeeding entrants have little effect on competitive conduct, which they infer from their findings regarding the role of sunk costs in determining entry conditions. A key assumption, which the authors are forced to hold out of necessity given the available data, is that there is no simultaneous entry and exit. In other words, when net entry is zero in a market/period, it is assumed that there is no churn. Our investigation here shows this assumption is untenable. In fact, using the same FCC data (but for our later time period, 2005-

² And, in the case of mobile broadband, where they travel.

2008), we find that in ZIP codes with no net entry in a period, a full 41.2% of the time there was simultaneous entry and exit (i.e. within the prior six months).³

In the next section, we describe the FCC data and our measures of entry and exit. In section III, we present results for entry and exit rates, in the form of averages, variation across types of broadband, autocorrelation, and correlation with each other. A concluding section gathers the results into a set of stylized facts for the industry.

II. Measuring the Entry and Exit Broadband Providers

A. Data Construction

1. Broadband provider data

The FCC has collected data from providers of end-user broadband service since 1999. Broadband providers complete the semi-annual Form 477, which until 2009 required them to list each five-digit ZIP code in which they provide service.⁴ The firms provide separate ZIP code lists for each type of broadband service offered. During the period June 2005 to June 2008, the years we study here,⁵ the broadband types were categorized as asymmetric DSL (ADSL), broadband over power line (BPL), cable modem, fiber, satellite, fixed terrestrial wireless (also known as wireless Internet service providers, WISPs), mobile terrestrial wireless, symmetric DSL (SDSL), and a residual “other” category.⁶ The lists do not include information on the number of subscribers served within the ZIP code area.

Given our interest in marketplace dynamics—the entry and exit of broadband providers—we linked firms’ Form 477 filings over time.⁷ Thus, a major task in the project was to link firms’ filings over time, accounting for variation in company names, mergers, acquisitions, spin-offs, cable system area swaps and other asset sales and transfers, and other phenomena affecting matching.⁸

³ For comparability with Xiao and Orazem (2005), we group different service types within the ZIP code for this calculation.

⁴ In 2009, the providers began reporting local service at the Census tract level.

⁵ The FCC provided the Form 477 data to the authors under a confidentiality agreement.

⁶ The “other” category in the FCC ZIP code lists includes traditional wireless services such as T1 (1.544 Mbit/s) and T3 (44.736 Mbit/s) dedicated lines (non-fiber high-capacity digital lines, also known as DS-1 and DS-3). For reasons of consistent data quality that we describe below, we drop the “other” category from our empirical investigation.

⁷ Due to some violations we found of the FCC’s rule that providers should file one form combining the information for all service companies in a state under the same holding company, our final count of providers differs a bit from the official FCC reports.

⁸ Within each round, we examined the lists of firms that disappeared from many ZIP codes to determine if a merger, name change, or major sales of assets explained the apparent exit. Similarly, we examined the

After creating a common set of identification codes for the broadband providers, we set out to account for as many mergers and other forms of corporate reorganization as feasible. Within each round, we examined the lists of firms that disappeared from many (or all) ZIP codes to determine if a merger, name change, or major sales of assets explained the apparent exit. Similarly, we examined the lists of firms that newly showed up in many ZIP codes to determine if a name change or major purchase of assets explained the apparent entry. We collected information on as many mergers, etc., as we could find. Nevertheless, it is important to note that we undoubtedly missed some corporate reorganizations and (particularly) asset sales. To the extent that we missed some forms of corporate reorganization, our measures of entry and exit may be overstated.

We now explain how we treat entry and exit due to mergers and other reorganizations. Our aim was to adhere to existing practice in the academic literature on empirical studies of firm dynamics, most particularly *DRS*.⁹ First, straightforward asset sales and swaps are not treated as exit of the old owner followed by entry of the new owner, whenever we had information on the transactions. For example, as part of the Adelphia acquisition that was effective in August 2006, Comcast and Time Warner swapped system ownership in various areas. Any apparent exit of Comcast in a market followed by subsequent apparent entry of Time Warner (or vice versa) was thus not treated as actual exit or entry. We note (again) that we undoubtedly missed some asset transfers among firms, leading to overstated measures of turnover within some markets.

For mergers and acquisitions, when the two merging firms already compete in the same market, we treat the combination of the firms in the market as resulting in one continuing firm and one exit.¹⁰ (As we explain below in section B.1, we consider various definitions of market in the study.) When the acquired firm offered service in a market in one period and the new entity appears in the market in the next period after the merger, we treat it as a continuing firm.

For reverse mergers and corporate spin-offs, when the involved parties go from one firm to two firms within a market, we treat only one of the firms as entering the market. For example, consider the case when ALLTEL spun off its wired broadband service business as Windstream in 2006. If ALLTEL was in a market before the spinoff, and both ALLTEL and

lists of firms that newly appeared in many ZIP codes to determine if a name change or major purchase of assets explained the apparent entry. We collected information on as many mergers, etc., as we could find from newspapers, the trade press, SEC filings, and Internet sources. Nevertheless, it is important to note that we likely missed some corporate reorganizations and (particularly) asset sales among smaller firms.

⁹ *DRS*, the seminal empirical study of firm entry and exit in the modern industrial organization literature, study entry and exit in the manufacturing sector of the US economy during the years 1963-1982.

¹⁰ The decision of which firm we treat as the exiting company matters in some of the measures of exit we consider below (namely, the measures of exiters' market share and relative size). In the case of acquisitions, we treat the acquired firm as the exiter. For mergers, we judged which firm appeared to be the dominant partner in the merger (e.g., we treated SBC as the continuing firm and AT&T as the exiting firm in the SBC-AT&T merger, despite the fact that the new firm kept the AT&T moniker). In one case, three firms merged (Choice One Communications, CTC Communications, and Conversent Communications merged to form One Communications Corp. in July 2006), and so in markets where all three competed, two were marked as exiting.

Windstream are in the same market after, then Windstream alone is counted as an entrant. On the other hand, if ALLTEL is in a market before the spinoff but only Windstream is in the same market afterward, then Windstream is treated as a continuing firm.¹¹

2. ZIP code data

The second issue involved with creating a dynamic picture of the market is that the universe of ZIP codes changes over time. The US Postal Service constantly creates new codes and removes obsolete codes from use. Since ZIP code areas change over time, we use ZIP Code Tabulation Areas (ZCTAs) defined for the 2000 Census for our geographical market boundaries. We mapped the reported ZIP codes in the FCC data each year to the (stable) ZCTA's.¹² Despite our actual use of ZCTA's, we will continue to refer to "ZIP code areas" below.

3. Limitations of the data

There are several limitations in the data, some of which are common to all studies of entry and exit. The primary task in creating any panel dataset of market participants is the linking the firms over time, which can be difficult due to name and ownership changes. In the Form 477 data, we linked holding companies over time by name as we described above in section A. While we cannot guarantee that we properly connected all variants of the firms' names correctly over rounds, we spent much time on this task and attempted to investigate all occurrences of possibly related names. This task was no more difficult with the Form 477 data than it would have been for any other arbitrary set of firms. However, the FCC data do not contain unique firm identifiers that are consistent over the years, as are available in typical US Census longitudinal datasets on firms and plants.

Other limitations appear to be specific to (or at least exacerbated in) the Form 477 data. A major concern is that there is a great amount of apparent one-round entry and exit. That is, there appears to be an inordinate number of firms that enter a ZIP code in one round but are missing again the next ("one-round entry"). Similarly, there are many instances of firms that exit a ZIP code in one round, only to return in the next round ("one-round exit"). In the ZIP-BB market, 20.4% of all entry is one-round entry. Over half (52%) of these one-round entrants may have exited legitimately due to some sort of merger event, leaving about one-tenth of all entry

¹¹ For the few unwindings of 50-50 partnerships we found (e.g., the Comcast-Insight Communications Company partnership unwinding in 2007), we treat any name change in a market (e.g., an Insight system in Illinois changing to a Comcast system after the unwinding) as exit followed by entry, under the assumption that the holding company that filed the area in its Form 477 probably had the upper hand in its management under the partnership.

¹² We mapped ZIP's to ZCTA's with the crosswalk files provided by The U.S. Department of Health & Human Resources (see Goodman (2005) for methodology). By far the most common substantive change in USPS ZIP code areas is splitting a ZIP code into two areas, one of which will be designated with a new number. In such cases both new areas are mapped back into the original ZCTA and combined in our methodology.

as unexplained one-round entry. A similar amount of all exit is one-round exit. Taken at face value, these figures indicate a remarkably dynamic and contestable market,¹³ with firms perhaps hopping in and out of the various local markets to take advantage of transient profit opportunities (what is sometimes called “hit-and-run entry” in the market contestability literature).¹⁴

Upon closer examination, however, it seems nearly certain that the amount of entry and exit is exaggerated in these data. Consider the various reasons for one-round exit, for instance:

1. The firm did not offer the particular broadband type in the ZIP code that round, because the firm stopped offering the service in the ZIP code temporarily.
2. The firm continued to offer service that round, but had no customers. This situation is most likely to occur when only a small part of a ZIP code is covered in the service footprint of the broadband provider.
3. The firm mistyped a ZIP code in Form 477 that round. Not only does this create one-round exit, it may also create (erroneous) one-round entry in the ZIP code that was erroneously entered (if the firm did not already offer service there).¹⁵ We found instances of obviously mistyped ZIP codes (e.g., those smaller than 00500 and those where the ZIP code does not match the state to which the firm’s Form 477 purportedly pertains. We dropped the former but could not check for all the latter (and it appears that the FCC IATD may not have corrected for the latter, either).¹⁶
4. The firm did not file Form 477 at all that round, even though it should have. This appears to have happened with some smaller firms, although we cannot be sure the firm did not have a legitimate reason for not filing.
5. The firm filed Form 477 that round, but we treated it as a different firm than in the rounds before and after because of an error linking the firms’ name variants over time. Given our extensive checking of the names, we expect errors of this type to be rare. Furthermore, if such errors exist, they will pertain to relatively small providers only, because we verified all instances of significant entry or exit (i.e., entry or exit occurring by the same firm in many markets).

¹³ In a *contestable market*, the threat of hit-and-run entry leads to outcomes sharing certain properties (such as zero long-run profit) with competitive markets, even though industry structure is non-competitive (for example, there is only a single firm actually supplying the market). See W. Baumol, J. Panzar, and R. Willig (1982).

¹⁴ See sections 10.3 and 10.4 of Train (1991).

¹⁵ Consequently, positive correlation would be induced between one-round entry and exit within a round. The correlation in the sample between these two measures is indeed positive (around 0.3), but is not statistically significant due to the small number of round from which the correlation is calculated.

¹⁶ We checked a few ZIP codes with obviously mistyped numbers and looked at how the raw data compare to the final (publicly available) count of providers in the ZIP code. Take the hypothetical example of ZIP code 97222 showing up in a Form 477 ostensibly for Virginia. It appears that the official FCC count of broadband providers *includes* such entries in the count for 97222 (which also means that the Virginia count would be artificially small).

It is clear that only case 1 meets the definition of “exit” as the term is normally used in the industrial organization literature. It is interesting to note that one-round entrants and exiters appear to be very small. Whereas the average entrant or exiter in the *ZIP-BB* market is much larger than incumbents and remaining firms (as we describe in section below), one-round entrants are only one-quarter the size of incumbents on average, and one-round exiters are 12% smaller than surviving firms.¹⁷

A second idiosyncratic feature of our data has to do with the “other” broadband category. We drop the “other” category from the dataset for the analysis, due to apparently incomplete data in some rounds. In the rounds analyzed, there are about 250 firms offering broadband service of type “other” in rounds 12-13 and 17-18, but only about 75 in the intervening rounds 14-16.¹⁸ Clearly, this is an artifact of the data at our disposal, but we were not able to discern what caused the apparent error in the counts. Because of the inconsistency in the count of providers of “other” broadband, and also because the category may be the least interesting of itself (unless one’s interest is in the business market for T1 lines), we deleted all appearances of this category within each ZIP code.¹⁹

B. Entry and Exit Measures

We analyze several measures of entry and exit in the market for broadband provision. To allow comparison and to follow best practice in the academic literature on market dynamics, we define our measures as in *DRS*. We analyze gross entry and exit (i.e., counts of entering and exiting firms separately) rather than net entry (i.e., the net change in the number of firms in a market, where net exit is counted as negative net entry). The economic literature on market dynamics (such as *DRS*) points out that gross measures are appropriate to examine industry dynamics, since gross entry and exit may be high even when net entry is low.²⁰

¹⁷ We cannot infer whether the apparent entry and exit is spurious directly from the fact that the suspicious one-round entrants and exiters are small. Small firms may potentially be more prone to make mistakes in filling out the ZIP code lists, but (since they have fewer customers) they are also more likely to be susceptible to case 2.

¹⁸ In particular, our count of unique holding companies offering service of type “other” is: June 2005 (round 12)—238; Dec. 2005 (round 13)—243; June 2006 (round 14)—74; Dec. 2006 (round 15)—77; June 2007 (round 16)—73; Dec. 2007 (round 17)—241; June 2008 (round 18)—246.

¹⁹ If the “other” category is left in the data, then (as one would expect) the exit rates are spuriously skewed upward in round 14 and the entry rates are spuriously skewed upward in round 17.

²⁰ It is worth noting that with the publicly available Form 477 data, in which company identities are not revealed, only net entry can be studied (as in Xiao and Orazem (2005)). Even then, not all net entry is observable, given that the FCC censors the publicly available data when one to three providers are in the ZIP code.

1. Market definition

To begin with, the market must be defined, since entry and exit must be quantified with reference to a precisely defined market. From the household's perspective, the market consists of all broadband providers able to serve the household's location. Thus, the geographic extent of the market in this perspective is no larger than the walls of the house. The same is true for business subscribers. Using the logic of the familiar SSNIP test from antitrust law and economics,²¹ for example, one can see that the prices offered to households adjacent to our original "market of one" household are irrelevant in the original household's demand decision. Thus, starting with a market of one household, the SSNIP test never increases the size of the market. That is, the household can never "go next door" to buy broadband service at a better price.²² In the product space, however, different modes of broadband provision are substitutable to some degree. Thus, it may make sense to put cable modem service in same market as DSL, even though they are not perfectly substitutable, as argued by Cardona *et al.* (2009). It may make less sense to put mobile wireless broadband in the same market as DSL, given that DSL service does not "travel" with the user.²³ Nonetheless, in some parts of the world DSL and mobile broadband have been found to be close substitutes (Vogelsang, 2010; Srinuan, Srinuan, and Bohlin, 2012). In other areas fixed and mobile broadband may be complements, at least in the nascence of mobile broadband service (Lee, Marcu, and Lee, 2011).

Some economists argue that the mechanical application of traditional antitrust definitions such as SSNIP to technologically dynamic settings results in markets that are inappropriately small (Pleatsikas and Teece, 2001).²⁴ In the geographical dimension of the market, we do not have household-level data to work with anyway. It also may be inappropriate to think of market definition in purely antitrust terms. On the supply side, a broadband provider clearly does not enter a market household by household, due to the economies of scale that make it economic to begin offering service with a footprint covering many households or businesses. At the small end of the geographical entry decision may be fiber, where entry into the broadband market may mean deploying the optical carrier

²¹ "A Small but Significant and Non-transitory Increase in Price (SSNIP) test asks whether a hypothetical monopolist could profitably impose a small increase in price. If sufficient numbers of buyers would switch to alternative products or to suppliers at other locations such that the price increase is unprofitable, then the market definition must be expanded to include at least some of those substitute products or locations" (Connolly and Prieger, 2009).

²² We recognize this statement is subject to falsification by *reductio ad absurdum*. Clearly if the price of broadband service were \$1000 in Household A and \$10 in neighboring Household B, there would be ways for the households to mutually benefit from "trade," (for example, through Household A piggybacking off the wireless home network of Household B).

²³ For a discussion of how traditional market definition may proceed for the broadband industry, see U.S. Department of Justice, *Ex Parte Comments in the Matter of Economic Issues in Broadband Competition: A National Broadband Plan for Our Future* (GN Docket No. 09-51), section III.A, available at <http://www.justice.gov/atr/public/comments/253393.htm> (accessed November 19, 2010).

²⁴ See also the discussion of the issue of market definition in Connolly and Prieger (2009), section 2.4.1.

infrastructure to serve a small group of office buildings in a dense urban center. At the other end of the geographic spectrum are the satellite firms, who upon enter can serve any location in the US with a clear view of the southern sky. The relevant geographic markets on the supply side for DSL, cable modem service, and wireless services fall between these extremes.

In the end, our choice of market definition is driven by what is available in the Form 477 data. In this initial work, we present results for three markets that are feasible to define with the data at hand. The largest market we examine, the *US* market, is the entire US (the 50 states plus Washington, DC)²⁵ and includes all forms of broadband without differentiation. The smallest market we investigate has the geographic extent of a ZIP code area and is restricted to a single type of broadband in product space. We call this market *ZIP-BB*, since markets are distinguished by ZIP code and type of broadband. Widening the geographic extent of the market to the nation but still differentiating among broadband types gives us the *US-BB* market. While there is only one market per round with the *US* definition, there are eight markets per round with the *US-BB* definition (one each for ADSL, BPL, cable modem, fiber, satellite, fixed terrestrial wireless, mobile terrestrial wireless, and SDSL). The *ZIP-BB* definition leads to 253,648 markets per round (31,706 ZCTA areas times eight service types).

2. *Measures of entry*

We use the following notation to measure the amount and scale of entry:²⁶

$NT_i(t)$ = total number of firms; the count of broadband providers present in market i (however defined) in period t . All firms under the same holding company count as a single firm.

$NE_i(t)$ = number of entrants; the count of broadband providers that enter market i in period t . In particular, the count of providers present in the Form 477 data in period t that were not present in the Form 477 data from period $t-1$.

$QT_i^k(t)$ = quantity produced by a firm; the number of broadband lines that provider k (one of those present in market i) serves in period t . For market *ZIP-BB*, only lines of the same type of broadband service are counted. For the ZIP level markets, the line counts are those for the state level and thus are only a proxy for ZIP level quantities.

²⁵ Although the FCC data includes Puerto Rico, we exclude those observations from our study.

²⁶ This section and the next follow *DRS* closely.

$QT_i(t)$ = total quantity produced; the sum of the number of lines served in period t by each of the broadband providers present in market i in period t : $QT_i(t) = \sum_k QT_i^k(t)$.

$QE_i^k(t)$ = quantity produced of an entrant; the number of lines broadband provider k (one of the entrants in market i) serves in period t ; constructed as for $QT_i^k(t)$.

$QE_i(t)$ = total quantity produced by entrants; the sum of the number of lines served in period t by each of the broadband entrants present in market i in period t : $QE_i(t) = \sum_k QE_i^k(t)$.

Using these definitions, the entry rate ER in market i in period t is:

$$ER_i(t) = NE_i(t)/NT_i(t-1)$$

Following the convention of *DRS* and other authors, the denominator is the number of firms present in the previous period. In the absence of exit, $ER_i(t)$ is thus the percentage increase in the number of firms between periods t and $t-1$. Note that the entry rate is undefined for previously “empty” markets, for which $NT_i(t-1) = 0$. This is problematic for new markets, where $NE_i(t) > 0$ and $NT_i(t-1) = 0$. For the *ZIP-BB* market definition, which (we will see) includes many instances of new markets, we may instead be interested in the alternative entry rate ER^{alt} , defined as

$$ER_i^{alt}(t) = NE_i(t) / NT_i(t)$$

which is the fraction of firms present in period t that are entrants. Unlike $ER_i(t)$, $ER_i^{alt}(t)$ is defined for new markets.²⁷

To examine how the size of entrants compares with that of existing providers in the market, we define ESH , the entrants’ share of the ZIP codes served by all the firms active in market i as

$$ESH_i(t) = QE_i(t)/QT_i(t)$$

The interpretation for the national level markets is straightforward. However, care must be taken in interpreting $ESH_i(t)$ for the geographically delineated markets, for in such cases ESH

²⁷ Furthermore, ER^{alt} is bounded between 0 and 1, inclusive. In markets that are growing, $ER > ER^{alt}$.

is not the market share of output in market i that is produced by entrants. Market share within the ZIP code is known since providers were not required to report lines by ZIP code (i.e., we have no measure of broadband subscribership at the ZIP code level). Instead, for the ZIP markets $ESH_i(t)$ is the number of lines across the state served by the entrants in market i , expressed as the ratio to the sum of the number of lines in the state served by all firms in market i .²⁸ Thus for the ZIP markets ESH measures the proportion of the *state-level* scale of firms in market i (which may not offer service everywhere in the state) due to entrants.

We define the average size of entering firms (measured as the state-level scale of their operations, in the case of the ZIP markets) relative to that of incumbents, ERS , as

$$ERS_i(t) = \frac{QE_i(t)/NE_i(t)}{[QT_i(t) - QE_i(t)]/[NT_i(t) - NE_i(t)]}$$

ERS allows us to compare the relative scale of entrants to incumbents at a point in time. In the denominator, the measures appropriate to the incumbents are calculated by removing the entrants' measures from the totals. ERS is undefined when there is no entry.

3. Measures of exit

Similarly, we measure exit using the following:

$NX_i(t)$ = number of exiting firms ("exiters"); count of the broadband providers that exit market i between periods $t-1$ and t . In particular, $NX_i(t)$ is the count of providers present in the Form 477 data in period $t-1$ that were no longer present in the Form 477 data from period t .

$QX_i^k(t)$ = quantity produced by an exiter; the number of lines broadband served in period $t-1$ by broadband provider k (one of the providers exiting market i between periods $t-1$ and t); constructed as for $QT_i^k(t)$.

$QX_i(t)$ = the total quantity produced by exiters; the sum of the number of lines served in period $t-1$ by each of the broadband firms exiting market i between periods $t-1$ and t : $QX_i(t) = \sum_k QX_i^k(t)$.

Note the convention for the timing: an "exiter" in period t exited the market between periods $t-1$ and t , and the quantities associated with the exiters pertain to the last period in which they provided service. Using these definitions, the exit rate XR in market i in period t is:

²⁸ Since the latter includes the former, ESH is bounded between 0 and 1, inclusive.

$$XR_i(t) = NX_i(t)/NT_i(t-1)$$

In the absence of entry, $XR_i(t)$ is thus the percentage decrease in the number of firms between periods t and $t-1$. Note that the exit rate is undefined for empty markets (those for which $NT_i(t-1) = 0$).

To examine how the size of exiting firms compares with that of existing providers in the market, we define the exiters' share (XSH) of the ZIP codes served by all the firms active in market i as

$$XSH_i(t) = QX_i(t)/QT_i(t-1)$$

Similar to ESH , for the ZIP level markets $XSH_i(t)$ is the number of lines in the state served by the firms that exited market i just prior to period t , expressed as the ratio to the state-aggregated line count for all firms in market i are present (also in period $t-1$).²⁹ Thus, for the ZIP markets XSH measures the proportion of the state-level scale of firms in market i due to exiters.

Finally, the average size of exiting firms (measured as the state-level scale of their operations, in the case of the ZIP markets) relative to that of incumbents, XRS , is:

$$XRS_i(t) = \frac{QX_i(t)/NX_i(t)}{[QT_i(t-1) - QX_i(t)]/[NT_i(t-1) - NX_i(t)]}$$

XRS allows us to compare the scale of exiting firms relative to incumbents at a point in time. In the denominator, the measures appropriate to the incumbents are calculated by removing the exiters' measures from the totals. XRS is undefined when there is no exit.

4. Sources of entry and exit

We also investigate from where entry arises in the *ZIP-BB* market. A *de novo* entrant in period t is a firm appearing somewhere in the Form 477 data in period t but nowhere in the data in period $t-1$. Such entry is also called "greenfield" entry in the literature). *De novo* entrants are new firms (labeled NF in the following) that did not previously offer any type of broadband in the US.³⁰ We assume that the new firm uses new infrastructure to provide service, which will be the case to the extent that we have properly accounted for asset sales.

Entry can also occur through geographic expansion: the first appearance of the firm in the ZIP code with *any* broadband type. In this case, the geographically expanding (GE) firm previously offered service in other ZIP codes. Although new ZIP codes may be served by existing

²⁹ Since the latter includes the former, ESH is bounded between 0 and 1, inclusive.

³⁰ At least, they were not in the market in the previous period. They may have served the market in period $t-2$ or earlier.

telecommunications infrastructure in some cases, typically *GE* entry requires new plant. Finally, a firm can enter through diversifying its product mix (labeled *DF*, for “diversifying firm”). For example, a firm offering ADSL in period 15 in the ZIP area who expands its service offerings to include SDSL in period 16 is counted as an entrant of type *DF* in the period 16 SDSL market in the same ZIP area.

The nomenclature for exit is similar. Exit of type *EF* (for “exiting firm”) means the disappearance of the firm from all markets. Exit of type *GC* (for “geographic contraction”) is the disappearance of the firm from the ZIP code, while continuing to serve customers elsewhere. *CF* exit, for “consolidating firm,” means the firm stops offering one type of broadband while continuing to offer other modes in the geographic market. In other words, exit of type *CF* means the consolidating firm is reducing its product mix.

5. Adjustment to exclude single-round entry and exit

One concern with taking the measures of entry and exit proposed above to the data is that there is a great amount of apparent one-round entry and exit in the ZIP market. This feature of the data was discussed above in section II.A.3. Using the ZIP-BB market, 20.3% of all entry is one-round entry. About half (48%) of these one-round entrants may have legitimately exited due to some sort of merger event, leaving at least one-tenth of all entry as unexplained one-round entry. There is similarly a nontrivial amount of one-round exit.

To avoid overstating the amount of entry and exit in the raw data, we also calculate statistics for entry and exit excluding the one-rounders. In the tables and discussion to follow, when one-round entry and exit remains in the data we call the statistic at issue “unadjusted.” When one-round entry and exit has been removed before calculating the statistic, we call the result “adjusted.” To the extent that an unknown amount of one-round entry and exit is spurious, the adjusted and unadjusted figures will bracket the true level.

III. Basic Analysis of Entry and Exit

We now turn to the analysis of entry and exit in the market for broadband service provision. Throughout this section we will compare our results with those of *DRS* and other studies of entry and exit (Koski and Sierimo, 2003; Bartelsman, Scarpetta and Schivardi, 2005; Lotti, 2007).

We begin by examining the average levels of entry and exit in the broadband market, breaking each down into specific modes of entry and exit. In subsection B, we consider how entry and exit rates are distributed within markets, to give a sense of how the industry dynamics vary both within and across markets. In subsection C, we look at how the entry and exit rates are correlated with themselves and with each other, which sheds additional light on the dynamics of the broadband market.

A. Entry and Exit Rates

a) Average entry and exit statistics

We begin our description of entry and exit in the broadband market by measuring the average levels. Unlike *DRS*, who drop the smallest firms from their analysis, we include all firms in our calculations.³¹

For the national broadband market including all types of broadband (the *US* market), the entry and exit rates measure the turnover in firms that show up at least once in the Form 477 data. The figures are given in Table 1. The first fact that is apparent is the great amount of entry and exit that occurs. The semi-annual entry rate varies from 5.6% (June 2008) to 15.2% (December 2005), and has an annualized average rate of 19.2%. Even the adjusted rates (Table 2) are high, varying from 4.6% to 11.6%, yielding a 13.6% annualized average entry rate. Entry is thus higher than many yearly entry rates found in the literature, for example a 9.8% entry rate for manufacturing firms from *DRS*³² or 7-10% for the Italian services industry (Lotti, 2007). The broadband figures are closer to entry rates found for ICT firms, for example a 14.5% entry rate for Finnish ICT firms (Koski and Sierimo, 2003; one of the very few studies looking specifically at the ICT sector). Koski and Sierimo (2003) also find that ICT industries have higher entry rates than other industries, although not to the degree found here and they did not focus on Internet service providers. The high-end adjusted broadband entry rate (from December 2005, annualized to 23%) is more than twice the rate from *DRS*. Thus, as is to be expected in a rapidly growing industry,³³ entry is relatively high. There is an overall slowing in the entry rate over the years, but the period-to-period variation is high and the reduction in the entry rate is not smoothly decreasing. While the variation in the entry rate may point to some underlying incompleteness in the data,³⁴ it may also merely reflect the volatile nature of the market.

Entrants are small in the national market, compared both to the entire market and to incumbents. The entrants' share of the market (*ESH*, also shown in Table 1 and Table 2; refer to section II.B.2 for its definition) is only 0.1-0.3% across most of the periods. This is much smaller

³¹ *DRS* drop small manufacturing firms since the geographic extent of their market definition is the entire US and small firms are not very important in that context. The nature of broadband service provision, however, means that even small firms may be very important to subscribers within the area they serve. Subscribers cannot go to larger firms offering service in other areas, and the relevant options for the household or business include all market participants, no matter how small. Furthermore, excluding smaller firms would exclude virtually all rural telecommunication carriers, which are important providers of broadband in many rural areas.

³² The simple average of the manufacturing entry rates reported over 1963-1982 in *DRS* (for firms of all sizes) is 9.8%.

³³ See Siegfried and Evans (1994), p. 127.

³⁴ One unanswered question is why is the entry rate is always higher in the December filings. One possibility is that some firms did not actually update their mid-year data as they were supposed to, but instead submitted the same ZIP code list as for the previous December filing. If that were so, however, then the exit rates should always be substantially higher in the June periods, which is not the case.

than *DRS'* figures for manufacturing, but at least some of the difference is accounted for by their five-year periods, which gives entrants more time to grow their market share. Entrants are also seen to be small by considering their relative size (*ERS*), which is always well below one (*ERS* equal to one would imply that the entrants are just as large as incumbents). In fact, *ERS* is typically in the range 1.2-3.0%, which implies that incumbents as a group are 33-83 times larger than entrants are in a typical round. *DRS* also find that entrants are smaller in terms of market share and relative size to incumbents, although not to this degree.

The exit rate (*XR*) also generally trends downward, from the highest unadjusted rate of 11.1% (June 2006) to the lowest rate of 5.4% at the end of the sample (see Table 1). The average unadjusted exit rate is 16.5% per annum. This is about twice as high as the yearly exit rate for manufacturing firms from *DRS*, about three times as high as for the services industry (Lotti, 2007), and 1.8 times as high as for ICT firms (Koski and Sierimo, 2003). Even the adjusted annualized average exit rate of 11% (Table 2) is higher than in these other industries. The turnover rates (the sum of the entry and exit rates) of about 35% (unadjusted) and 25% (adjusted) are both higher than the turnover rates found by Bartelsman, Scarpetta, and Schivardi (2005) in 10 OECD countries for the manufacturing, business, and business services sectors.

Comparison with the entry rate reveals two interesting facts. First, the exit rate is lower on average than the entry rate, which reflects that the number of firms in the market is growing during 2005 to 2008. More interesting, however, is how much of the dynamism of the market one would miss if only net entry were examined. Net entry in the *US* market is about 3.1% per year during this period.³⁵ The gross entry and exit rates, which are in the range 11-30% per year (unadjusted) or 8-23% per year (adjusted), contrast markedly with the slower net growth rate. Any entry analysis conducted on the publicly available FCC data, which provides only the count of firms operating each period, would miss much of the action.³⁶

As with the entrants, exiting broadband providers are also smaller than other firms in general. However, they are usually larger than entrants, which is in accord with the findings of *DRS*. The share of the exiting firms (*XSH*) is less than one-ninth in all periods, and averages 1.6% in the adjusted data. Exiting providers are also small relative to surviving firms (*XRS*), which is always less than one except for December 2006, which has an outlier of 157%. The December 2006 figure is abnormally high because of the Verizon acquisition of MCI; the latter was much larger than the typical exiting firm. Except for December 2006, *XRS* is in the range of 3-8%, which implies that surviving firms as a group are 13 to 36 times as large as exiting firms in typical periods.

Changing our focus to the *US-BB* market, in which each broadband type is treated as a distinct market, we see from Table 3 (unadjusted data) and Table 4 (adjusted) that the entry and exit rates are even higher than they are in the *US* market. Table 3 and Table 4 report the simple

³⁵ By our count, there were 1,226 distinct holding companies offering some sort of broadband service in June 2005, and 1,344 in June 2008 (for a continuous growth rate of 3.1% per year).

³⁶ See footnote 20.

average of the figures for each broadband type for a round. When markets are delineated by broadband type a more dynamic picture of the market emerges than is shown by the *US* market. The unadjusted entry rate averages an annualized 32.4%, with 23.6% for the adjusted rate, and both decline over time as the market matures. The entry rates are more than two to three times the entry rate of manufacturing firms found by *DRS*.³⁷ The exit rates of 23.2% (unadjusted) and 14.5% (adjusted) are also higher than the exit rates for the *US* market or for manufacturing firms from *DRS*.

In the *ZIP* market, we must confront a difficulty in our data. With such a narrow definition of the market, there are some markets in which no broadband is offered. Since the count of service providers in the market appears in the denominator of the entry rate (see section II.B.2 for the definition of *ER*), the entry rate for the first entrant is infinite. Following *DRS*, any of our statistics that are undefined are not included in the averages appearing in the tables. Accordingly, we include a second measure of entry in Table 7, ER^{alt} , which gives the fraction of firms in the market in the present round that are new entrants. This measure has the advantage of being defined in the case of the first entrant (but see section II.B.2 for its different interpretation).³⁸

In the *ZIP* market (Table 5 and Table 6), the narrower market definition (which is closer to the set of services available at a single household or business location) leads to a more dynamic picture of entry and exit. At annualized average rates of 37% (adjusted) to 49% (unadjusted), there is far more entry than in the *US*, *US-BB*, or manufacturing markets. Similar patterns are discerned as found above: declining entry and exit rates as time passes, and more entry than exit. The *ZIP* entry rates tend to be higher than the national-scope figures because the denominators are so much smaller—there were typically only a few providers in each *ZIP* code at the time. The exit rates are lower than in the *US-BB* market. Coupled with the higher entry rates, this implies that the net geographic expansion of broadband during the period proceeded at a faster pace than the growth of the national (*US* and *US-BB*) markets.

Comparison of the *ZIP* market entry rates with other studies is difficult, because most studies use national-level markets and aggregate entry across local establishments to the firm level. However, with some recalculations we can compare our data with entry rates of establishments in the *US* for the same years calculated from the *US* Census Bureau's Business Dynamics Statistics (*BDS*). Counts of establishments reflect the local presence of firms, which may have numerous establishments. In this sense, each appearance of a service provider in a *ZIP* code is roughly analogous to an establishment. Treating appearance in the *ZIP* code as an establishment, the broadband establishment entry rate in the *US* averages 18.3% (unadjusted) to 13.6% (adjusted). This range is higher than the *BDS* entry rates for establishments in the

³⁷ *DRS* delineate product markets at the four-digit SIC level, which is an intermediate level of aggregation between the *US* and *US-BB* markets. Mobile and wireline communications services have different four-digit SIC codes, but all types of wired communications have the same code.

³⁸ Of course, ER^{alt} is still undefined when there are no firms in the market (for then its formula calls for dividing zero by zero).

manufacturing (7.5%), services (12.2%), and transportation, communications, and utilities (13.2%) sectors. The only sector in the BDS data approaching the level of entry we find for broadband is finance, insurance, and real estate, with a 13.2% entry rate.

We now turn to the smallest market definition, the *ZIP-BB* market, which draws narrower boundaries around the market in both geographic and product space. Each broadband type within a ZIP code area is treated as a distinct market. With this narrowest definition of the market, *ER* is undefined for half of the markets due to the problem discussed above. Naturally enough, *ER* is undefined most often for the least-common broadband types: BPL and fixed wireless.³⁹ For the *ZIP-BB* market, the alternative entry measure ER^{alt} may therefore be of particular interest, and it is reported in Table 7 and Table 8.

For the *ZIP-BB* market, we see from Table 7 and Table 8 that the entry and exit rates are quite a bit higher than in the *US* market. The narrower market definition, which is closer to the set of services available at a single household or business location, leads to a more dynamic picture of entry and exit. The semi-annual entry rate (whether measured by *ER* or ER^{alt}) generally declines over time, similar to the *US* market. The entry rate *ER* is highest in June 2006 (21.4% unadjusted, 19.7% adjusted) and lowest in December 2007 (13.2% unadjusted, 7% adjusted), and averages an annualized rate of 34.2% unadjusted (25.7% adjusted). ER^{alt} ranges from 12.6% to 24.9% unadjusted (averaging 36.9% per annum), meaning that between one in seven to one out of every four firms in a typical market is an entrant.

The market share of entrants in the *ZIP-BB* market is about the same as the semi-annual entry rates, implying that the scale of entry in the market is similar whether measured by counting firms or their market share. *ESH* ranges from 5.2% to 17.1%, and averages 12.0% in the adjusted data. However, the average relative size of entrants is much larger than that of incumbents: *ERS* averages 29, which is much higher than *DRS* found for manufacturing firms. The distribution of relative sizes of entrants is highly skewed, however, due to the entry of large firms like Verizon and AT&T into new ZIP codes. The median *ERS*, which is affected little by the few huge entrants, ranges from 0.09 to 1.4.

The trend in the exit rate (*XR*) is generally downward. The highest exit rate of 16.8% (unadjusted, or 14.3% adjusted) is at the beginning and the lowest rate of 5.0% (unadjusted, or 3.9% adjusted) is at the end of the sample. The average annualized exit rate is 12% if adjusted, 23% if not. Exiting broadband providers are larger than non-exiting firms on average, as shown by the figures for *XRS* in Table 7 and Table 8, although as with the entrant relative size the median *XRS* is usually below one. Thus the typical exiting firm is relatively small, as may be expected. Excluding December 2007, surviving firms in the median markets are anywhere from 2 to 19 times the size of exiting firms.

³⁹ *ER* is undefined for BPL in 99.9% of ZIP code-rounds, and is undefined for TFW in 79% of ZIP code-rounds. Other modes of service with a large number of ZIP codes-rounds with undefined *ER* are fiber (63%) and SDSL (61%). At the other end of the spectrum, *ER* is undefined for satellite service in only 13% of markets, since it is available (and has customers) in most ZIP code areas.

b) Disaggregating the sources of entry

Entry is broken down by source in Table 9 and Table 10 for the *US-BB* market, Table 11 and Table 12 for the *ZIP* market, Table 13 and Table 14 for the *ZIP-BB* market (refer to section II.B.4 for the definitions of entry types). In the *US-BB* market, more entry comes from new firms than from providers offering a new service type. In this section, only results for the adjusted data (Table 10, Table 12, and Table 14) are discussed for the sake of brevity. About 59% of the total entry rate comes from *de novo* entry, which is about the same as *DRS* found for manufacturing firms. The *de novo* entrants have about the same market share and relative size as do the diversifying firms.

Most entry in the *ZIP* and *ZIP-BB* markets is from geographic expansion. In the *ZIP* market, 92% of entry is of type *GE*, and the rest is *de novo*. For the *ZIP-BB* market, 74% of entry is of type *GE*, 20% is of type *DF*, and the remaining entry is *de novo*. So, from the consumer's point of view, most entry in these markets takes the form of an existing provider beginning to offer service in the area. The same is true when measuring entrants by their market share.

In the *ZIP* and *ZIP-BB* markets, the relative size of entrant to incumbent (*ERS*) is much larger for geographically expanding than for completely new firms. In the *ZIP-BB* market, diversifying firms have the largest relative size of all. For that market, on average, geographically expanding firms are 26 times as large as incumbents, product diversifiers are 42 times as large, and completely new entrants are 3 times as large. The average entry rates are highly skewed by firms with large service footprints and many existing customers expanding into an area previously served only by smaller providers. The median figures for *ERS* in Table 12 and Table 14 are all below 1 except for diversifying entrants in the *ZIP-BB* market, which are about the same size as existing firms in the overall average. The median *ERS* of type *NF* averages 0.02 in the *ZIP-BB* market, indicating that a typical *de novo* entrant faces incumbents that are about 40 times larger than the entrant.

c) Disaggregating the sources of exit

By categorizing the modes of exit, we are able to examine where firms go or remain when they exit a market. The disaggregation of the exit rates is in Table 15 and Table 16 Table 10 for the *US-BB* market, Table 17 and Table 18 for the *ZIP* market, Table 19 and Table 20 for the *ZIP-BB* market. Again, we focus on the adjusted statistics. In the *US-BB* market, a firm can exit by completely disappearing (exit type *EF*) or by reducing its product mix (type *CF*). The exit rates show that two-thirds of exit coincides with the withdrawal of the firm from all modes of provision. Coupled with the results for the entry rates, we find that diversification into and consolidation out of other service types together account for the minor part of the dynamics in the *US-BB* market.

In addition to exit type *EF*, in the *ZIP* market a firm can also exit by contraction in the geographic dimension (exit type *GC*). The lion's share of exit is of the latter type. The figures for the exit rates for the *ZIP* market in Table 18 show that just as most entry stems from geographic expansion, most exit reflects geographic contraction. The importance of geographic consolidation in exit is even larger in terms of market share. The relative size of consolidating

firms is also greater than the relative size of completely disappearing firms, whether looking at mean or median *XRS*. This finding seems to imply that larger firms are engaged in more dynamic geographic behavior overall than are smaller firms. The small incumbent ILEC offering service in a few rural ZIP codes may never exit, but neither may it expand to other areas. In summary, most entry and exit in the *ZIP* market comes from geographic movement, and much expansion and consolidation comes from larger firms.

In the *ZIP-BB* market a firm can exit by all three routes. As in the *ZIP* market, most exit in the *ZIP-BB* market reflects geographic contraction. On average, 55% of exiting firms are of type *GC*, 26% are of type *CF*, and the remaining 19% completely exit all markets (Table 20). Measuring exit by market shares instead does not change the relative importance of the three modes of exit.

The relative size of consolidating firms, whether by geography or product mix, average or median, is generally greater than the relative size of completely disappearing firms. This appears to indicate that firms shrink (or never grew) before they die. From the statistics for *XRS* in Table 20, the disappearing firms are on average 2.5 times larger than remaining firms, whereas by the median completely exiting firms are only 16% as large as are firms continuing in the market. Geographic consolidators are 28 times larger on average than firms remaining in the market, but only 15% as large when looking at the median (the one statistic that is about the same as for *EF* exit). Product mix reducers are 15 times larger than remaining firms on average, but only 60% as large by median. The comparisons of mean to median again reflect that a few large firms are engaged in more dynamic behavior overall than are smaller firms.

B. Variation in Entry and Exit across Broadband Types

1. Variation across types of service

The average statistics in the previous section mask a great amount of variation in the entry and exit rates among different types of broadband service. In this section, we distinguish between modes of provision to examine how the measures of entry and exit vary across time and (for the *ZIP-BB* market) geography. By doing so, we can compare both the mean and variance of entry and exit across types of broadband.

Table 21 (unadjusted data) and Table 22 (adjusted) present the average, median, and first-to-ninth decile spread in the entry rates for the *US-BB* and Figures for the *ZIP-BB* markets are in Table 23 (unadjusted data) and Table 24 (adjusted). In the *US-BB* market, variation occurs only across periods. Looking at the statistics for the mean entry rates in Table 21 and Table 22, it appears that some types of broadband experienced much more entry than others. At one extreme, there was no entry at all in the satellite broadband market at the national level, a

symptom of the entry barriers from the risk and huge sunk costs of deploying satellites.⁴⁰ The highest entry rate is for mobile wireless, with a mean entry rate with the adjusted data of 38%. From the greatest to the least average entry rate, the order is mobile wireless, fiber, BPL, fixed wireless, cable modem, SDSL, ADSL, and satellite. The most mature markets, those for DSL and cable modem, show up with relatively lower growth rates, as may be expected.⁴¹ In addition to being a relatively new market, mobile wireless may also have a high entry rate due to the lower entry barriers from sunk costs.⁴² For some broadband types, there is a lot of variation in the entry rate across time in the *US-BB* market, as seen from the range of *ER* (also in Table 21 and Table 22). For example, adjusted mobile broadband entry rates range from 5% to 75% across the first to ninth decile range. The range of entry rates is much narrower for some other types such as ADSL and fiber (and, in the extreme with no entry at all, satellite).

In the *ZIP-BB* market, variation occurs not only across the six rounds of data but also across ZIP code areas. It is apparent from the statistics in Table 23 and Table 24 that the local markets are highly dynamic, and that there is a great variety of outcomes within each broadband type. In particular, comparison to the comparable statistics for the *US-BB* market shows that the local markets are much more dynamic than the national market, and also that there is a greater variety of outcomes within each broadband type in the *ZIP-BB* market. These results follow in part from the small geographic scale of the *ZIP-BB* market and the small number of providers in a ZIP code.⁴³

Table 23 and Table 24 also show that, similar to the *US-BB* market, entry is much more prominent in some broadband types than others at the ZIP code level. In the adjusted data (Table 24), the entry rate is highest for mobile wireless (as in the national market), at 27%, and lowest for cable modem. The ranking of the entry rates is similar but not identical to that in the national market (the Spearman correlation between the rankings is positive). From the greatest to the least average entry rate, the order is: mobile wireless, fiber, satellite, ADSL, SDSL, fixed wireless, cable modem, and BPL.⁴⁴ Entry in the satellite market looks quite different in the *ZIP-BB* market, compared to the national level. While there are no new satellite broadband providers at the national level during this period, there are many local markets where the

⁴⁰ There are four satellite providers who remain in the data throughout all rounds, one of which offers service only in Alaska.

⁴¹ In many theoretical models of industry dynamics, the entry rate falls as the industry matures. See Prieger (2007) and Klepper (1996).

⁴² For the argument that wireless broadband has lower sunk cost than wired broadband, see U.S. Department of Justice, *Ex Parte Comments, op. cit.*, section II.E. For a review of the confirmatory empirical evidence on the importance of sunk cost as an entry barrier, see Siegfried and Evans (1994), at section II.B.1.a, and references cited therein.

⁴³ A firm beginning to offer ADSL may be the first, second, or third entrant in a given ZIP code in which it offers service, which explains both the higher entry rates in the *ZIP-BB* market as well as the great variance in the entry rate.

⁴⁴ Since there is only one BPL provider at most in a market, the entry rate for BPL is always either zero or undefined, which is why it is ranked last in terms of *ER*.

satellite firms enter by picking up customers where they formerly had none.⁴⁵ So, while the entry rate for satellite is zero in the national market, it is ranked fifth in the *ZIP-BB* market.

The distribution of the exit statistics in the *US-BB* market are in Table 25 and Table 26. As there is with the entry rates, there is great variation among types. Nevertheless, except for satellite broadband, the average exit rate is smaller than the entry rate for the same type of service, implying that there was net entry into each type of broadband service. In order from the greatest to the least average exit rate, we have mobile wireless, SDSL, fixed wireless, satellite, fiber, cable modem, ADSL. There is no exit at all in the *US-BB* market for BPL. The ranges for the exit rates (shown below the mean and median in column one of Table 25 and Table 26) show less variation than there was in entry. The distributions of the exit statistics in the *ZIP-BB* market are in Table 27 and Table 28. With the adjusted data, in order from the greatest to the least average exit rate the order is SDSL with a 16.5% exit rate, fiber, fixed wireless, mobile wireless, ADSL, BPL, cable modem and satellite (with the latter two tied at 2.6%).⁴⁶

Comparing the time-averaged entry and exit rates in the *US-BB* market, we see that types with high entry rates also tend to have high exit rates. The correlation between the time-averaged entry rates (shares) in Table 22 and the exit rates (shares) in Table 26 is 0.66 (0.20) for the *US-BB* market. Thus, similar patterns emerge for entry and exit across markets: when entry is high or has a large share for a broadband type, exit does too. *DRS* also found large positive correlation between entry and exit in manufacturing as well. Positive correlation between time- (and geography-) averaged entry and exit rates, shares, and relative sizes is also present in the *ZIP-BB* market: 0.11 for the rates, 0.40 for the shares, and 0.60 for the relative sizes (all with the adjusted data in Table 24 and Table 28). Thus, as *DRS* (p. 507) conclude, “while there is substantial variation in entry and exit patterns across [markets] within a sector [which is the broadband type, in our application], there are also some systematic relationships between entry and exit....” Positive correlation between entry and exit implies that there is less variation in the *net* entry rate across markets than there is in the gross entry and exit rates, yet another indication that examining net entry alone leaves would fail to uncover much of the market dynamics. We examine the systematic relationships between entry and exit in more detail in the following section.

⁴⁵ It is important to note that “entry” for the satellite firms mainly reflects changes in demand, not supply, since the firms do not deploy new infrastructure to “enter” a new ZIP code. That is not to say that the firms did not perhaps engage in targeted marketing efforts in certain areas.

⁴⁶ The small exit rate for satellite service comes from fact that only two firms exited the national market during the period, and that the service footprints of the other providers did not change. Exit in the satellite *ZIP-BB* market nearly always comes from losing all customers in a ZIP code, not from making the service physically unavailable.

2. Variation across geographic regions

The average statistics in section A above also mask differences in the entry and exit rates among different regions of the US. In this section, we examine how the entry and exit vary by geography in the ZIP markets. Table 29 for the unadjusted data shows that the entry rate is much higher in some areas than others. Entry is greatest in the West North Central region,⁴⁷ where the entry rate is 50% higher than in the Pacific states of California, Oregon, and Washington, which have the lowest entry rate. The Pacific region exhibits the lowest growth rate because the broadband market there was the most mature at the beginning of the period. The Pacific ZIP codes had an average of 6.7 broadband service providers in 2005, whereas the West North Central ZIP codes averaged only 3.3 providers. Entrants also have the largest shares in the West North Central states and the lowest shares in New England. The relative size of entrants also varies widely across the regions. Roughly similar patterns are found with the adjusted data in Table 30.

There is proportionally much less variation in average exit rates across the regions (see Table 31 for the unadjusted statistics and Table 32 for the adjusted figures). The exiter shares are also mostly similar across regions, particular with the adjusted data.

C. Correlation in Entry and Exit

To look at market-specific differences in entry and exit, we follow *DRS* and ask two questions. First, are the measures of entry and exit positively autocorrelated? If so, then the implication is that high entry (for example) in one period is likely to be followed by high entry in succeeding periods. Second, do high entry rates correspond with high exit rates? If so, then there would appear to be underlying factors causing the “churn rate” of firms in a market to be more stable within markets than across markets. We deal with these two questions in turn in this section.

1. Autocorrelation of entry and of exit

In Table 33 through Table 38, we present the autocorrelations for entry and exit in the *US-BB*, *ZIP*, and *ZIP-BB* markets.⁴⁸ Here we focus on the adjusted figures for the *ZIP-BB* market, presented in Table 38 Both the entry and exit rates show positive autocorrelation for all measures and at all lags, excepting only the fifth autocorrelation for the entry rate. *DRS* interpreted their similar finding for the manufacturing industry as suggesting that there are persistent market-specific factors that affect both entry and exit. In other words, when entry is

⁴⁷ The West North Central states are IA, KS, MN, MO, ND, NE, ND, and SD.

⁴⁸ By conventional measures, the correlations are all highly statistically significant except in a few cases. However, since the data are a census of the entire population, from the viewpoint of finite population statistics the correlations are *descriptive population quantities* (Pfeffermann, 1993), not estimates, and thus have no variance. The significance levels reported in the tables are for the interpretation, more familiar to econometricians, of the data as a finite population drawn from an infinite superpopulation.

higher in, say, the mobile wireless market in an area in a period than the average entry rate for all markets, then it is likely that the entry rate will continue to be higher in that mobile wireless market. Thus, there is evidence for factors unique to each mode of broadband provision or each location that determine the dynamics of the market. The autocorrelations for the entry and exit rates in the *ZIP-BB* market are generally smaller than in the *ZIP* market, where all types of broadband are grouped (refer to Table 36 for comparison). The comparison indicates that broadband type-specific determinants of market dynamics are more persistent and important than are location-specific determinants.

2. Correlation between entry and exit

The second question regarding market-specific differences in entry and exit is whether high entry and exit tend to occur together in a market. To address this, we calculate the correlation between each entry measure and its counterpart on the exit side, at various leads and lags. We already noted in section B above that the time-averaged entry and exit measures for the broadband types were positive correlated, which suggests that entry and exit are systematically and positive related within markets. *DRS* and several other empirical studies of market dynamics find that entry and exit rates are positively correlated across industries.⁴⁹ Geroski (1995) refers to this result as the third stylized fact about entry in the manufacturing sector, which has been found in other sectors as well (Lotti, 2007).

In this section, we refine that conclusion in three ways. First, we look at how entry is correlated with exit at other periods, as well as contemporaneously, to be able to answer (for example) how entry today correlates with exit six months or a year later. Second, we now consider the correlation between entry and exit in a single market over time, not just how entry relates to exit when both are first averaged across time and all ZIP codes (the latter only in the case of the *ZIP* and *ZIP-BB* markets). Third, we also see whether the apparent positive correlation we find between entry and exit is due solely to unobserved, fixed market-specific factors. Removing such factors allows us to examine whether periods with entry that is high *relative to that market* correspond to high (or low) exit in the same market.

The results are in Table 39 for *US-BB* market, Table 40 for the *ZIP* market, and Table 41 for the *ZIP-BB* market. The correlation between the contemporaneous entry and exit rates in the *US-BB* market is positive, at 0.47 (unadjusted) or 0.17 (adjusted; for both, see the entries for the XR_t row in the first and third columns of Table 39), which means that broadband types with higher than average entry rates also tend to have higher than average exit rates. The correlation of the entry rate with previous and future exit rates is also positive (see the other figures in the first and third columns of Table 39), demonstrating that there is persistence in the association between entry and exit. Thus, broadband types with high entry rates in general over time also have high exit rates, and broadband types with low entry rates have low exit rates.

⁴⁹ The theoretical model of Asplund and Nocke (2006) shows that entry and exit rates may rise together in response to an increase in fixed costs.

With a few exceptions, the entry and exit rates are also positively correlated in the *ZIP* (first and third columns of Table 40) and *ZIP-BB* markets (first and third columns of Table 41), although the correlations are smaller than for the *US-BB* market. All these results also hold when looking at shares instead of rates (see the bottom halves of the tables).

One possible cause for the positive correlation between entry and exit—that is, the existence of “churn” in the market—may be that there are systematic differences in the height of entry and exit barriers among the broadband types. Economic theory suggests many reasons why entry and exit barriers may be positively related within a market, and two may apply to the broadband service market in particular.⁵⁰ First, exit barriers are themselves entry barriers to forward looking firms. An exit barrier such as regulatory pressure to continue operating in a market even with losses makes it less likely that firms would want to enter.⁵¹ Second, when incumbents have cost advantages over potential entrants, creating an entry barrier, the advantages often come from specific assets with little scrap value. When a large portion of capital costs are sunk (i.e., non-recoverable), as may be the case particularly with wired broadband,⁵² then (conditional on entry having occurred) exit is discouraged because the opportunity cost of remaining in the market is lower.⁵³

In the second and fourth columns of the tables, the time-averages within each market (the market fixed effects) have been removed before computing the correlations between the measures of entry and exit. Correcting for the market fixed effects allows us to address the question of whether periods of relatively high entry (where “high” means relative only to other periods within the same market) in a market are also periods of relatively high exit.⁵⁴ If firms were homogeneous, we would expect the opposite, at least in the *ZIP* and *ZIP-BB* markets. Since

⁵⁰ See Siegfried and Evans (1994), p.147, and references cited therein.

⁵¹ The pressure to remain in an unprofitable market need not take the form of formal designation as a broadband carrier of last resort. Regulators in some states, and the FCC itself, have pushed telecommunications firms for many years to expand their broadband offerings, especially in areas labeled “disadvantaged.” For example, the FCC approved the SBC acquisition of Ameritech in 1999 only subject to an agreement by the company to promote broadband Internet access (among other conditions). In particular, SBC was required to locate at least 10% of their advanced service facilities in low-income areas in the Ameritech region. State regulators in Ameritech’s operating region (Illinois, Indiana, Michigan, Ohio, and Wisconsin) also pushed the merged firm to accelerate broadband deployment. Presumably neither the federal nor the state regulators would have been satisfied to see the firm begin to offer broadband in low-income areas only to have the service offerings cease after a short period. See Prieger and Hu (2008).

⁵² See U.S. Department of Justice, *Ex Parte Comments, op. cit.*, section II.E.

⁵³ See Siegfried and Evans (1994), p.145: “Tangible barriers to exit may include sunk costs in durable, industry-specific assets, which discourage exit because such assets do not have valuable alternative uses....” These authors conclude the balance of the empirical evidence supports this assertion.

⁵⁴ The correlations without correcting for market fixed effects (in the first and third columns of Table 39 for *US-BB* market, Table 40 for the *ZIP* market, and Table 41 for the *ZIP-BB* market) mostly picks up differences among markets in entry and exit. Once the time averages are removed from each market, then all (average) differences among markets are removed, and the remaining correlation isolates how entry and exit *within each market* are related.

firms present in these local markets are likely to be in head-to-head competition with each other, homogeneity would imply entrants and exiters would respond inversely to changes in expected market profits. When expected profitability is high, perhaps due to increased demand in the market, firms would be more likely to enter and less likely to leave (Siegfried and Evans, 1994). We find mild negative correlation in the *ZIP* and *ZIP-BB* markets: periods with higher entry than average within a market are also periods of relatively *low* exit, although the level of the association is quite small. The small magnitude of the correlation may be due to substantial heterogeneity among the firms' profit functions, resulting in little correlation between the entry and exit decisions of the various players in the market.

It is also interesting to examine how entry in one period relates to exit in another. For example, the correlation in the *US-BB* market between the entry rate in period t and the exit rate in period $t+1$ is positive in the unadjusted data. This means that periods of high entry tend to be followed immediately by relatively high exit. While this may be an artifact of spurious "hit and run" entry, this pattern could also arise either because firms were overoptimistic in entering the market and are shortly forced to exit, or because the arrival of entrants forces incumbents who cannot compete to exit. Similarly, in the *US-BB* market the correlation between the entry rate in period t and the exit rate the previous period is also positive (whether looking at the unadjusted or adjusted data). Thus, periods of high exit tend to be followed by a period of relatively high entry. This could happen because of the "vacuum effect," where exiting firms create opportunities for more efficient entrants to enter and pick up the stranded subscribers.⁵⁵ However, these patterns found in the national level market do not carry over to the local (*ZIP* and *ZIP-BB*) markets, where it would be easiest to interpret such findings as due to direct competition. The correlations in the *ZIP* and *ZIP-BB* markets are generally quite small.

DRS found that there was negative correlation between the contemporaneous entry and exit rates but not with the market shares. We have a similar result in, for example, the adjusted data for the *US-BB* market. *DRS* discuss that result:

In this case the entrants' market share is positively correlated with the exiters' share after [market fixed] effects have been removed. Periods of higher than average entrant shares are thus periods of higher than average exiter shares. Since these are periods with relatively low exit rates, the exiting firms in these periods must tend to be unusually large (*DRS*, p.508).

IV. Conclusions

We collect the findings of our work here, and conclude by discussing some avenues for future work.

⁵⁵ Siegfried and Evans (1994) discuss the vacuum effect and related literature on p.147.

Finding 1: There is a tremendous amount of (simultaneous) entry and exit in the US broadband market, however the market is defined.

The large amount of entry is particularly striking considering that the provision of broadband has several economic characteristics that are typically associated with barriers to entry. There are large fixed or sunk costs that create absolute cost disadvantages for entrants. The technology also leads to economies of scale, network economies, and economies of scope in the provision of multiple modes of broadband (e.g. ADSL and SDSL) that create relative cost disadvantages for entrants.⁵⁶ Apparently the dominant factor in the market, the growing demand for broadband service, trumped all other considerations during the period of study.

Furthermore, the fact that there is a high “churn rate” of firms in broadband markets has interesting implications for research analyzing entry decisions. The presence of simultaneous entry and exit implies that structural models for entry assuming homogeneous firms (Breshnahan and Reiss, 1991) or models relying on the number of firms in the market as sufficient statistics (e.g., Xiao and Orazem (2011) for broadband markets and Greenstein and Mazzeo (2006) in the closely related industry of competitive local telephone services) may not be the most appropriate for the US broadband market. Instead, models incorporating heterogeneity among firms’ profit functions (POB), private information (Doraszelski and Satterthwaite, 2010), differing levels of strategic sophistication or rationality (Goldfarb and Xiao, 2011) or learning (Hanazono and Yang, 2009) may be more promising.

Finding 2: Most entry is from existing providers expanding into new geographic areas. Existing firms diversifying their service offerings is the next most common form of entry.

In the *ZIP-BB* market, 71% of entry (75% by share) is from geographic expansion of established service providers, and 21% is from product diversification within the area. Entrants into a market average 64% of the size of the incumbents combined, and thus are relatively large. Thus, notwithstanding potential antitrust concerns about the dominance of large broadband providers, as evinced by the DOJ and FCC in the recent review of the proposed merger of AT&T and T-Mobile USA, it appears that a large share of new options provided to consumers has come from these firms.

Finding 3: Entry and exit varies widely across the various modes of provision, and the highest entry rates also generally have the highest entrant shares.

The markets for some modes of provision are more stable than others, and this suggests future work explicitly modeling asymmetric competition among intermodal competitors, as in the work by Loomis and Swann (2005).

Finding 4: Entry rates, entrant shares, and the relative sizes of entrants display positive autocorrelation in the US-BB market. The same is true for exit.

⁵⁶ Siegfried and Evans (1994), section II.B.

The implication is that there are persistent factors specific to both the broadband mode and the ZIP code area that cause high entry (or exit) in one period to be followed by high entry (exit) in succeeding periods. The type-specific factors appear to be more important than the location-specific factors, but both appear to be present.

Finding 5: Without controlling for market-specific factors, there generally is positive correlation between the entry and exit rates at various leads and lags.

Broadband markets with higher than average entry rates also tend to have higher than average exit rates, whether contemporaneously or at other leads and lags, demonstrating that there is persistence in the association between entry and exit. This persistence suggests that there are systematic differences in the height of entry and exit barriers among the broadband types. There appear to be underlying factors causing the “churn rate” of firms in a market to be more stable within than across markets.

We intend that these findings can both stimulate and guide future empirical and theoretical work in the broadband market. Although the FCC data examined here are confidential, the new National Broadband Map has publicly available data on which companies offer specific types of broadband service in fine geographic detail. Thus, as new rounds of the semiannual National Broadband Map data become available, the dynamics of the US broadband market can be studied by all.

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Appendix

This data appendix explains more about how entry and exit were determined in the data. To begin with, recall that broadband provided in a ZCTA is first linked to the relevant holding company, and all service providers held by the same holding company are grouped and treated as a single firm. This is the same method used by the FCC for its own statistics. Then, in a first pass through the data, we mark entry and exit as described in sections II.B.2 and II.B.3. Here we describe the procedures for the *ZIP* and *ZIP-BB* markets; the process is similar for the *US* and *US-BB* markets.

Each firm present in each ZCTA and broadband type is marked with one of the following entry codes:

1. The same firm offered service of the same type in the same ZCTA in the previous round: no entry.
2. The same firm offered service of any type nowhere in the previous round: counts as *de novo* entry in the *ZIP* and *ZIP-BB* markets (see section II.B.4 for the nomenclature for the various types of entry and exit).
3. The same firm offered service of some type elsewhere but not in the same ZCTA in the previous round: counts as entry through *geographic expansion* in the *ZIP* and *ZIP-BB* markets.
4. The same firm offered service of some other type in the same ZCTA in the previous round: counts as entry through *diversification* in the *ZIP-BB* market but does not count as entry in the *ZIP* market.

Each firm present in each ZCTA and broadband type is marked with one of the following exit codes:

1. The same firm offers service of the same type in the same ZCTA in the next round: no exit.
2. The same firm offers no service of any type anywhere in the next round: counts as an *exiting firm* in the *ZIP* and *ZIP-BB* markets (see section II.B.4 for the nomenclature for the various types of entry and exit).
3. The same firm offers no service of any in the same ZCTA, but continues to offer service of some sort elsewhere in the next round: counts as exit by *geographic contraction* in the *ZIP* and *ZIP-BB* markets.
4. The same firm offers service of some other type in the same ZCTA in the next round, but does not continue to offer service of the same type: counts as exit through *consolidation* in the *ZIP-BB* market but does not count as exit in the *ZIP* market.

After this initial marking of entry and exit, we modified the entry and exit category assignments to account for corporate reorganization such as mergers and spinoffs. We identified seven types of corporate reorganization events in the data:

(1) Acquisition of one holding company by another

The identification number (HoCo ID) of the acquiring firm is used to identify the holding company after the acquisition. Any entry of types 2-4 (refer to the list above) that result from a nominal change in the HoCo ID due to the acquisition are recoded accordingly. Some examples, when firm A acquires firm B:

Example	Pre-merger (round <i>N</i> -1)	Post-merger (round <i>N</i>)	Final entry code in round <i>N</i>
1	Firm A, BB type 1	Firm B, BB type 1	1
2	Firm A, BB type 1	Firm B, BB type 2 (only)	4
3	Firm A, BB type 1	Firm B, BB type 1	1
		Firm B, BB type 2	4
3	Firm A, BB type 1	Firm B, BB type 1	1
	Firm B, BB type 1	Firm B, BB type 2	4

Any exit of types 2-4 (refer to the list above) that result from a nominal change in the HoCo ID due to the acquisition are recoded accordingly. Some examples, when firm A acquires firm B:

Example	Pre-merger (round <i>N</i> -1)	Post-merger (round <i>N</i>)	Final exit code in round <i>N</i> -1
1	Firm A, BB type 1	Firm B, BB type 1	1
2	Firm A, BB type 1	Firm B, BB type 2 (only)	4
3	Firm A, BB type 1	Firm B, BB type 1	1
		Firm B, BB type 2	4
4	Firm A, BB type 1	Firm B, BB type 1	1
	Firm A, BB type 2		4
5	Firm A, BB type 1	Firm B, BB type 1	2
	Firm B, BB type 1		1
6	Firm A, BB type 1	∅	3

(2) Two to one mergers of holding companies.

The identification number of the dominant partner (HoCo ID) in the merger is used to identify the holding company after the merger. Any entry or exit of types 2-4 (refer to the list above) that result from a nominal change in the HoCo ID due to the merger are recoded

accordingly. The examples for the previous case above also apply to this case, when firm B acquires firm A.

(3) Three to one mergers of holding companies.

There is one instance of a three to one merger during the time studied. Choice One Communications, CTC Communications, and Conversent Communications merged to form One Communications Corp. in July 2006. Choice One Communications Inc. is (somewhat arbitrarily) treated as the dominant partner in this merger. Some examples of the recoding of entry required in this case (in addition to recoding as in the examples for acquisitions above when only two of the three firms are present in the local market in rounds $N-1$ and N) are:

Example	Pre-merger (round $N -1$)	Post-merger (round N)	Final entry code in round N
1	Choice One, BB type 1 CTC Comm., BB type 1 Conversent, BB type 1	One Comm., BB type 1	1
2	Choice One, BB type 1 CTC Comm., BB type 2 Conversent, BB type 1	One Comm., BB type 1 One Comm., BB type 2	1 1
3	Choice One, BB type 1 CTC Comm., BB type 1 Conversent, BB type 1	One Comm., BB type 1 One Comm., BB type 2	1 4
3	CTC Comm., BB type 1 Conversent, BB type 1	One Comm., BB type 1 One Comm., BB type 2	1 4

Any exit of types 2-4 (refer to the list above) that result from a nominal change in the HoCo ID due to the acquisition are recoded accordingly. Some examples (again in addition to recoding as in the examples for acquisitions above):

Example	Pre-merger (round <i>N</i> -1)	Post-merger (round <i>N</i>)	Final exit code in round <i>N</i> -1
1	Choice One, BB type 1 CTC Comm., BB type 1 Conversent, BB type 1	One Comm., BB type 1	1 2 2
2	Choice One, BB type 1 CTC Comm., BB type 2 Conversent, BB type 1	One Comm., BB type 1 One Comm., BB type 2	1 1 2
3	CTC Comm., BB type 1 Conversent, BB type 1	One Comm., BB type 1	1 2
4	Choice One, BB type 1 CTC Comm., BB type 2 Conversent, BB type 1	One Comm., BB type 2	2 1 2

(4) Complex acquisitions (three to two merger).

There is one complex acquisition in the data. Comcast and Time Warner Cable acquired the assets of Adelphia Cable in 2005, and at the same time unwound Comcast's interests in Time Warner Cable and Time Warner Entertainment. In some markets where Adelphia held assets, after the acquisition both Comcast and Time Warner Cable appear as entrants after the first-round pass through the data. This may reflect that there were two separate Adelphia cable systems in the area, one of which went to each company. In such cases, only Time Warner Cable is (arbitrarily) marked as an entrant. Other than this case, the procedures for acquisitions and mergers outlined above are followed.

(5) Reverse mergers and spin-offs.

When a firm splits into two firms or spins off some of its assets to another corporation, any apparent entry or exit due only to the nominal change in the owner of the assets is not treated as entry or exit. Examples of this sort of corporate reorganization include the Sprint-Nextel spinoff of its local landline telecommunications business as Embarq in May 2006 and the ALLTEL spinoff of landline assets as Windstream, which merged with Valor Communications Group, in July 2006. The examples for recoding of entry and exit from case (1) above (acquisitions), interpreting firm A as the firm spinning off assets to firm B, also apply here.

(6) The unwinding of a 50-50 partnership.

In cases where an equal partnership is dissolved and the assets are converted to wholly owned status by one or the other of the partners, the new status is not treated as entry or exit, even though the holding company of record may change in the data. This case applies to the

division of jointly owned cable systems in the Midwest by Comcast and Insight Communications in 2007.

Tables

Table 1: Entry and Exit Statistics for the <i>US</i> Broadband Market (Unadjusted Data).....	42
Table 2: Entry and Exit Statistics for the <i>US</i> Broadband Market (Adjusted Data).....	43
Table 3: Entry and Exit Statistics for the <i>US-BB</i> Broadband Market (Unadjusted Data, Averages over Broadband Types).....	44
Table 4: Entry and Exit Statistics for the <i>US-BB</i> Broadband Market (Adjusted Data, Averages over Broadband Types).....	45
Table 5: Entry and Exit Statistics for the <i>ZIP</i> Broadband Market (Unadjusted Data, Averages over All ZIP Codes).....	46
Table 6: Entry and Exit Statistics for the <i>ZIP</i> Broadband Market (Adjusted Data, Averages over All ZIP Codes).....	47
Table 7: Entry and Exit Statistics for the <i>ZIP-BB</i> Broadband Market (Unadjusted Data, Averages over All ZIP Codes and Broadband Types).....	48
Table 8: Entry and Exit Statistics for the <i>ZIP-BB</i> Broadband Market (Adjusted Data, Averages over All ZIP Codes and Broadband Types).....	49
Table 9: Entry Statistics for the <i>US-BB</i> Broadband Market by Method of Entry (Unadjusted Data, Averages over Broadband Types).....	50
Table 10: Entry Statistics for the <i>US-BB</i> Broadband Market by Method of Entry (Adjusted Data, Averages over Broadband Types).....	51
Table 11: Entry Statistics for the <i>ZIP</i> Broadband Market by Method of Entry (Unadjusted Data, Averages over All ZIP Codes).....	52
Table 12: Entry Statistics for the <i>ZIP</i> Broadband Market by Method of Entry (Adjusted Data, Averages over All ZIP Codes).....	53
Table 13: Entry Statistics for the <i>ZIP-BB</i> Broadband Market by Method of Entry (Unadjusted Data, Averages over All ZIP Codes and Broadband Types).....	54

Table 14: Entry Statistics for the <i>ZIP-BB</i> Broadband Market by Method of Entry (Adjusted Data, Averages over All ZIP Codes and Broadband Types)	55
Table 15: Exit Statistics for the <i>US-BB</i> Broadband Market by Method of Entry (Unadjusted Data, Averages over Broadband Types)	56
Table 16: Exit Statistics for the <i>US-BB</i> Broadband Market by Method of Entry (Adjusted Data, Averages over Broadband Types).....	57
Table 17: Exit Statistics for the <i>ZIP</i> Broadband Market by Method of Entry (Unadjusted Data, Averages Over All ZIP Codes)	58
Table 18: Exit Statistics for the <i>ZIP</i> Broadband Market by Method of Entry (Adjusted Data, Averages Over All ZIP Codes)	59
Table 19: Exit Statistics for the <i>ZIP-BB</i> Broadband Market by Method of Exit (Unadjusted Data, Averages Over All ZIP Codes and Broadband Types)	60
Table 20: Exit Statistics for the <i>ZIP-BB</i> Broadband Market by Method of Exit (Adjusted Data, Averages Over All ZIP Codes and Broadband Types)	61
Table 21: The Distribution of Entry Statistics for the <i>US-BB</i> Broadband Market by Broadband Types (Unadjusted Data, Distribution across Years)	62
Table 22: The Distribution of Entry Statistics for the <i>US-BB</i> Broadband Market by Broadband Types (Adjusted Data, Distribution across Years)	63
Table 23: The Distribution of Entry Statistics for the <i>ZIP-BB</i> Broadband Market by Broadband Types (Unadjusted Data, Distribution across ZIP Codes and Years).....	64
Table 24: The Distribution of Entry Statistics for the <i>ZIP-BB</i> Broadband Market by Broadband Types (Adjusted Data, Distribution across ZIP Codes and Years).....	65
Table 25: The Distribution of Exit Statistics for the <i>US-BB</i> Broadband Market by Broadband Types (Unadjusted Data, Distribution across Years)	66
Table 26: The Distribution of Exit Statistics for the <i>US-BB</i> Broadband Market by Broadband Types (Adjusted Data, Distribution across Years)	67

Table 27: The Distribution of Exit Statistics for the <i>ZIP-BB</i> Broadband Market by Broadband Types (Unadjusted Data, Distribution across ZIP Codes and Years).....	68
Table 28: The Distribution of Exit Statistics for the <i>ZIP-BB</i> Broadband Market by Broadband Types (Adjusted Data, Distribution across ZIP Codes and Years).....	69
Table 29: The Distribution of Entry Statistics for the <i>ZIP</i> Broadband Market by Census Region (Unadjusted Data).....	70
Table 30: The Distribution of Entry Statistics for the <i>ZIP</i> Broadband Market by Census Region (Adjusted Data)	71
Table 31: The Distribution of Exit Statistics for the <i>ZIP</i> Broadband Market by Census Region (Unadjusted Data).....	72
Table 32: The Distribution of Exit Statistics for the <i>ZIP</i> Broadband Market by Census Region (Adjusted Data)	73
Table 33: Correlations between Market Entry and Exit Measures across Time (Unadjusted Data, <i>US-BB</i> Market)	74
Table 34: Correlations between Market Entry and Exit Measures across Time (Adjusted Data, <i>US-BB</i> Market)	75
Table 35: Correlations between Market Entry and Exit Measures across Time (Unadjusted Data, <i>ZIP</i> Market)	76
Table 36: Correlations between Market Entry and Exit Measures across Time (Adjusted Data, <i>ZIP</i> Market)	77
Table 37: Correlations between Market Entry and Exit Measures across Time (Unadjusted Data, <i>ZIP-BB</i> Market).....	78
Table 38: Correlations between Market Entry and Exit Measures across Time (Adjusted Data, <i>ZIP-BB</i> Market).....	79
Table 39: Correlations between Market Entry and Exit Measures (<i>US-BB</i> Market)	80
Table 40: Correlations between Market Entry and Exit Measures (<i>ZIP</i> Market)	81
Table 41: Correlations between Market Entry and Exit Measures (<i>ZIP-BB</i> Market)	82

Table 1: Entry and Exit Statistics for the US Broadband Market (Unadjusted Data)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.152	0.084	0.137	0.063	0.083	0.056	0.192
Entrant Share (<i>ESH</i>)	0.003	0.038	0.006	0.001	0.001	0.002	0.009
Entrant Relative Size (<i>ERS</i>)	0.019	0.420	0.039	0.019	0.011	0.025	0.089
Exit Rate (<i>XR</i>)	0.100	0.110	0.081	0.085	0.064	0.054	0.165
Exiter Share (<i>XSH</i>)	0.022	0.010	0.084	0.003	0.002	0.002	0.021
Exiter Relative Size (<i>XRS</i>)	0.205	0.080	1.041	0.032	0.023	0.028	0.235

Table notes: The entry and exit rates are annualized (only) in the final column. The US market has the geographic extent of the entire US and groups all broadband types together. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 2: Entry and Exit Statistics for the US Broadband Market (Adjusted Data)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.116	0.056	0.085	0.047	0.057	0.046	0.136
Entrant Share (<i>ESH</i>)	0.003	0.021	0.002	0.001	0.001	0.001	0.005
Entrant Relative Size (<i>ERS</i>)	0.022	0.356	0.020	0.016	0.012	0.029	0.076
Exit Rate (<i>XR</i>)	0.085	0.055	0.055	0.048	0.045	0.042	0.110
Exiter Share (<i>XSH</i>)	0.003	0.004	0.083	0.002	0.001	0.002	0.016
Exiter Relative Size (<i>XRS</i>)	0.028	0.076	1.569	0.050	0.029	0.036	0.298

Table notes: The entry and exit rates are annualized (only) in the final column. The *US* market has the geographic extent of the entire US and groups all broadband types together. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 3: Entry and Exit Statistics for the US-BB Broadband Market (Unadjusted Data, Averages over Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.283	0.180	0.166	0.123	0.124	0.096	0.324
Entrant Share (<i>ESH</i>)	0.032	0.050	0.024	0.010	0.011	0.007	0.022
Entrant Relative Size (<i>ERS</i>)	0.118	0.198	0.134	0.083	0.074	0.081	0.115
Exit Rate (<i>XR</i>)	0.183	0.175	0.107	0.112	0.078	0.042	0.232
Exiter Share (<i>XSH</i>)	0.035	0.052	0.050	0.014	0.023	0.006	0.030
Exiter Relative Size (<i>XRS</i>)	0.230	0.350	0.866	0.116	0.294	0.107	0.327

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The US-BB market has the geographic extent of the entire US and differentiates among broadband types. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 4: Entry and Exit Statistics for the US-BB Broadband Market (Adjusted Data, Averages over Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.161	0.189	0.092	0.072	0.106	0.089	0.236
Entrant Share (<i>ESH</i>)	0.022	0.035	0.011	0.007	0.008	0.006	0.015
Entrant Relative Size (<i>ERS</i>)	0.120	0.155	0.093	0.102	0.079	0.085	0.106
Exit Rate (<i>XR</i>)	0.170	0.058	0.052	0.069	0.053	0.033	0.145
Exiter Share (<i>XSH</i>)	0.028	0.030	0.040	0.009	0.020	0.005	0.022
Exiter Relative Size (<i>XRS</i>)	0.194	0.454	1.240	0.140	0.453	0.112	0.432

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The *US-BB* market has the geographic extent of the entire US and differentiates among broadband types. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 5: Entry and Exit Statistics for the ZIP Broadband Market (Unadjusted Data, Averages over All ZIP Codes)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.339	0.309	0.204	0.259	0.153	0.193	0.486
Alternate Entry Rate (<i>ER^{alt}</i>)	0.234	0.218	0.147	0.193	0.129	0.142	0.354
Entrant Share (<i>ESH</i>)	0.097	0.185	0.138	0.320	0.155	0.271	0.194
Entrant Relative Size (<i>ERS</i>)	2.433	3.631	6.014	26.598	5.961	40.527	14.194
Exit Rate (<i>XR</i>)	0.117	0.096	0.071	0.099	0.135	0.038	0.185
Exiter Share (<i>XSH</i>)	0.079	0.046	0.049	0.098	0.245	0.016	0.089
Exiter Relative Size (<i>XRS</i>)	7.997	3.666	3.006	3.817	24.863	1.089	7.406

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP market has the geographic extent of a single ZIP code area and groups all broadband types together. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 6: Entry and Exit Statistics for the ZIP Broadband Market (Adjusted Data, Averages over All ZIP Codes)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.299	0.274	0.144	0.230	0.088	0.082	0.372
Alternate Entry Rate (<i>ER^{alt}</i>)	0.208	0.191	0.105	0.162	0.068	0.065	0.266
Entrant Share (<i>ESH</i>)	0.079	0.145	0.110	0.287	0.044	0.059	0.121
Entrant Relative Size (<i>ERS</i>)	1.750	2.460	6.218	23.396	2.403	3.141	6.561
Exit Rate (<i>XR</i>)	0.100	0.045	0.046	0.026	0.033	0.026	0.092
Exiter Share (<i>XSH</i>)	0.043	0.018	0.026	0.011	0.003	0.005	0.018
Exiter Relative Size (<i>XRS</i>)	1.466	1.870	1.696	1.396	0.228	0.236	1.149

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP market has the geographic extent of a single ZIP code area and groups all broadband types together. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 7: Entry and Exit Statistics for the ZIP-BB Broadband Market (Unadjusted Data, Averages over All ZIP Codes and Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.189	0.214	0.146	0.190	0.132	0.154	0.342
Alternate Entry Rate (<i>ER^{alt}</i>)	0.249	0.230	0.177	0.190	0.134	0.126	0.369
Entrant Share (<i>ESH</i>)	0.203	0.204	0.170	0.192	0.122	0.144	0.173
Entrant Relative Size (<i>ERS</i>)							
average	21.03	19.85	19.12	96.80	14.61	282.6	75.67
median	0.090	0.251	0.376	0.624	0.332	2.043	0.619
Exit Rate (<i>XR</i>)	0.168	0.114	0.091	0.127	0.142	0.050	0.231
Exiter Share (<i>XSH</i>)	0.158	0.101	0.068	0.121	0.157	0.038	0.107
Exiter Relative Size (<i>XRS</i>)							
average	6.859	69.566	6.673	32.87	59.30	7.102	30.40
median	0.502	0.226	0.051	0.406	2.488	0.090	0.627

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP-BB market has the geographic extent of a single ZIP code area and differentiates among broadband types. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 8: Entry and Exit Statistics for the ZIP-BB Broadband Market (Adjusted Data, Averages over All ZIP Codes and Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
Entry Rate (<i>ER</i>)	0.157	0.197	0.112	0.163	0.070	0.073	0.257
Alternate Entry Rate (<i>ER^{alt}</i>)	0.214	0.193	0.118	0.143	0.066	0.070	0.268
Entrant Share (<i>ESH</i>)	0.171	0.169	0.112	0.156	0.052	0.062	0.120
Entrant Relative Size (<i>ERS</i>)							
average	20.23	18.76	18.08	64.80	12.37	40.1	29.06
median	0.085	0.254	0.327	1.418	0.250	0.320	0.442
Exit Rate (<i>XR</i>)	0.143	0.050	0.056	0.033	0.050	0.039	0.124
Exiter Share (<i>XSH</i>)	0.134	0.039	0.039	0.028	0.045	0.029	0.052
Exiter Relative Size (<i>XRS</i>)							
average	6.009	81.548	3.228	6.48	8.97	7.600	18.97
median	0.526	0.156	0.054	0.133	0.182	0.121	0.195

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP-BB market has the geographic extent of a single ZIP code area and differentiates among broadband types. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.3 for definitions of statistics.

Table 9: Entry Statistics for the US-BB Broadband Market by Method of Entry (Unadjusted Data, Averages over Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Entry Rate</u>							
Total (<i>ER</i>)	0.283	0.180	0.166	0.123	0.124	0.096	0.324
<i>NF</i>	0.195	0.104	0.093	0.077	0.068	0.061	0.199
<i>DF</i>	0.089	0.076	0.072	0.046	0.055	0.035	0.124
<u>Entrant Share</u>							
Total (<i>ESH</i>)	0.032	0.050	0.024	0.010	0.011	0.007	0.022
<i>NF</i>	0.020	0.023	0.017	0.009	0.007	0.005	0.014
<i>DF</i>	0.013	0.027	0.007	0.001	0.004	0.001	0.009
<u>Entrant Relative Size (average)</u>							
Total (<i>ERS</i>)	0.118	0.198	0.134	0.083	0.074	0.081	0.115
<i>NF</i>	0.083	0.228	0.131	0.138	0.093	0.100	0.129
<i>DF</i>	0.371	0.165	0.124	0.028	0.079	0.033	0.133
<u>Entrant Relative Size (median)</u>							
Total (<i>ERS</i>)	0.034	0.177	0.052	0.02	0.038	0.025	0.058
<i>NF</i>	0.041	0.025	0.056	0.026	0.063	0.026	0.040
<i>DF</i>	0.038	0.117	0.033	0.015	0.010	0.021	0.039

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The US-BB market has the geographic extent of the entire US and differentiates among broadband types. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.4 for definitions of statistics.

Table 10: Entry Statistics for the US-BB Broadband Market by Method of Entry (Adjusted Data, Averages over Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Entry Rate</u>							
Total (ER)	0.161	0.189	0.092	0.072	0.106	0.089	0.236
NF	0.113	0.103	0.053	0.041	0.055	0.054	0.140
DF	0.049	0.086	0.038	0.031	0.051	0.035	0.097
<u>Entrant Share</u>							
Total (ESH)	0.022	0.035	0.011	0.007	0.008	0.006	0.015
NF	0.010	0.011	0.010	0.006	0.006	0.004	0.008
DF	0.012	0.023	0.002	0.001	0.003	0.001	0.007
<u>Entrant Relative Size (average)</u>							
Total (ERS)	0.120	0.155	0.093	0.102	0.079	0.085	0.106
NF	0.073	0.187	0.126	0.183	0.105	0.110	0.131
DF	0.389	0.122	0.051	0.023	0.078	0.033	0.116
<u>Entrant Relative Size (median)</u>							
Total (ERS)	0.028	0.120	0.029	0.055	0.036	0.026	0.049
NF	0.038	0.031	0.030	0.109	0.041	0.023	0.045
DF	0.018	0.060	0.032	0.017	0.020	0.022	0.028

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The US-BB market has the geographic extent of the entire US and differentiates among broadband types. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.4 for definitions of statistics.

Table 11: Entry Statistics for the ZIP Broadband Market by Method of Entry (Unadjusted Data, Averages over All ZIP Codes)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Entry Rate</u>							
Total (<i>ER</i>)	0.339	0.309	0.204	0.259	0.153	0.193	0.486
<i>NF</i>	0.025	0.052	0.013	0.017	0.012	0.014	0.044
<i>GE</i>	0.314	0.257	0.191	0.242	0.141	0.179	0.441
<u>Entrant Share</u>							
Total (<i>ESH</i>)	0.097	0.185	0.138	0.320	0.155	0.271	0.194
<i>NF</i>	0.006	0.047	0.002	0.001	0.000	0.000	0.009
<i>GE</i>	0.092	0.138	0.136	0.319	0.155	0.271	0.185
<u>Entrant Relative Size (average)</u>							
Total (<i>ERS</i>)	2.433	3.631	6.014	26.598	5.961	40.527	14.194
<i>NF</i>	0.874	6.202	0.209	0.037	0.012	0.023	1.226
<i>GE</i>	2.517	3.308	6.400	28.762	6.401	44.041	15.238
<u>Entrant Relative Size (median)</u>							
Total (<i>ERS</i>)	0.013	0.347	0.134	1.907	0.443	2.677	0.920
<i>NF</i>	0.004	0.706	0.016	0.002	0.001	0.005	0.122
<i>GE</i>	0.013	0.304	0.147	2.530	0.585	3.629	1.201

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP market has the geographic extent of a single ZIP code area and groups all broadband types together. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.4 for definitions of statistics.

Table 12: Entry Statistics for the ZIP Broadband Market by Method of Entry (Adjusted Data, Averages over All ZIP Codes)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Entry Rate</u>							
Total (<i>ER</i>)	0.299	0.274	0.144	0.230	0.088	0.082	0.372
<i>NF</i>	0.017	0.030	0.008	0.011	0.007	0.012	0.028
<i>GE</i>	0.281	0.245	0.136	0.219	0.081	0.071	0.344
<u>Entrant Share</u>							
Total (<i>ESH</i>)	0.079	0.145	0.110	0.287	0.044	0.059	0.121
<i>NF</i>	0.005	0.019	0.002	0.000	0.000	0.000	0.004
<i>GE</i>	0.074	0.126	0.108	0.287	0.044	0.058	0.116
<u>Entrant Relative Size (average)</u>							
Total (<i>ERS</i>)	1.750	2.460	6.218	23.396	2.403	3.141	6.561
<i>NF</i>	1.123	1.736	0.276	0.029	0.004	0.017	0.531
<i>GE</i>	1.777	2.530	6.602	25.297	2.674	3.825	7.118
<u>Entrant Relative Size (median)</u>							
Total (<i>ERS</i>)	0.013	0.321	0.184	2.271	0.074	0.041	0.484
<i>NF</i>	0.004	0.540	0.023	0.001	0.001	0.005	0.096
<i>GE</i>	0.013	0.296	0.208	2.873	0.129	0.157	0.613

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP market has the geographic extent of a single ZIP code area and groups all broadband types together. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.4 for definitions of statistics.

Table 13: Entry Statistics for the ZIP-BB Broadband Market by Method of Entry (Unadjusted Data, Averages over All ZIP Codes and Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Entry Rate</u>							
Total (<i>ER</i>)	0.189	0.214	0.146	0.190	0.132	0.154	0.342
<i>NF</i>	0.015	0.013	0.008	0.013	0.008	0.010	0.022
<i>GE</i>	0.132	0.153	0.097	0.140	0.102	0.110	0.245
<i>DF</i>	0.042	0.047	0.042	0.037	0.021	0.034	0.074
<u>Entrant Share</u>							
Total (<i>ESH</i>)	0.203	0.204	0.170	0.192	0.122	0.144	0.173
<i>NF</i>	0.013	0.028	0.011	0.008	0.005	0.007	0.012
<i>GE</i>	0.154	0.143	0.109	0.145	0.095	0.104	0.125
<i>DF</i>	0.037	0.032	0.050	0.039	0.021	0.032	0.035
<u>Entrant Relative Size (average)</u>							
Total (<i>ERS</i>)	21.03	19.85	19.12	96.80	14.61	282.59	75.67
<i>NF</i>	7.561	10.318	1.761	0.647	0.477	1.157	3.654
<i>GE</i>	25.45	22.44	15.96	112.84	15.25	362.2	92.36
<i>DF</i>	4.314	11.37	27.05	74.83	26.80	137.70	47.01
<u>Entrant Relative Size (median)</u>							
Total (<i>ERS</i>)	0.090	0.251	0.376	0.624	0.332	2.043	0.619
<i>NF</i>	0.003	0.090	0.038	0.009	0.002	0.004	0.024
<i>GE</i>	0.073	0.242	0.327	0.669	0.439	2.228	0.663
<i>DF</i>	0.236	0.239	0.680	1.284	0.241	2.204	0.814

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP-BB market has the geographic extent of a single ZIP code area and differentiates among broadband types. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.4 for definitions of statistics.

Table 14: Entry Statistics for the ZIP-BB Broadband Market by Method of Entry (Adjusted Data, Averages over All ZIP Codes and Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Entry Rate</u>							
Total (<i>ER</i>)	0.157	0.197	0.112	0.163	0.070	0.073	0.257
<i>NF</i>	0.010	0.009	0.003	0.009	0.005	0.009	0.015
<i>GE</i>	0.117	0.149	0.072	0.129	0.056	0.049	0.191
<i>DF</i>	0.030	0.040	0.037	0.026	0.009	0.015	0.052
<u>Entrant Share</u>							
Total (<i>ESH</i>)	0.171	0.169	0.112	0.156	0.052	0.062	0.120
<i>NF</i>	0.008	0.012	0.006	0.005	0.004	0.006	0.007
<i>GE</i>	0.135	0.131	0.068	0.124	0.037	0.040	0.089
<i>DF</i>	0.028	0.026	0.038	0.028	0.011	0.015	0.024
<u>Entrant Relative Size (average)</u>							
Total (<i>ERS</i>)	20.23	18.76	18.08	64.80	12.37	40.12	29.06
<i>NF</i>	8.513	4.206	1.740	0.725	2.010	1.178	3.062
<i>GE</i>	22.98	21.03	16.18	77.94	8.27	11.4	26.31
<i>DF</i>	5.835	10.40	21.45	31.98	44.80	140.42	42.48
<u>Entrant Relative Size (median)</u>							
Total (<i>ERS</i>)	0.085	0.254	0.327	1.418	0.250	0.320	0.442
<i>NF</i>	0.003	0.097	0.032	0.004	0.002	0.004	0.024
<i>GE</i>	0.063	0.227	0.278	1.330	0.293	0.436	0.438
<i>DF</i>	0.223	0.289	0.680	4.394	0.352	0.458	1.066

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP-BB market has the geographic extent of a single ZIP code area and differentiates among broadband types. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 and II.B.4 for definitions of statistics.

Table 15: Exit Statistics for the US-BB Broadband Market by Method of Entry (Unadjusted Data, Averages over Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Exit Rate</u>							
Total (XR)	0.183	0.175	0.107	0.112	0.078	0.042	0.232
EF	0.122	0.104	0.087	0.076	0.052	0.025	0.155
CF	0.061	0.071	0.020	0.036	0.025	0.017	0.077
<u>Exiter Share</u>							
Total (XSH)	0.035	0.052	0.050	0.014	0.023	0.006	0.030
EF	0.023	0.033	0.043	0.013	0.021	0.003	0.023
CF	0.012	0.019	0.006	0.001	0.001	0.003	0.007
<u>Exiter Relative Size (average)</u>							
Total (XRS)	0.230	0.350	0.866	0.116	0.294	0.107	0.327
EF	0.246	0.427	0.876	0.165	0.475	0.079	0.378
CF	0.159	0.289	1.263	0.032	0.038	0.098	0.313
<u>Exiter Relative Size (median)</u>							
Total (XRS)	0.084	0.166	0.356	0.057	0.059	0.076	0.133
EF	0.156	0.166	0.525	0.070	0.065	0.058	0.173
CF	0.029	0.033	0.102	0.008	0.002	0.116	0.048

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The US-BB market has the geographic extent of the entire US and differentiates among broadband types. Single-round entrants and exiter have not been removed from the data (refer to section II.B.5). See section II.B.3 and II.B.4 for definitions of statistics.

Table 16: Exit Statistics for the US-BB Broadband Market by Method of Entry (Adjusted Data, Averages over Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Exit Rate</u>							
Total (XR)	0.170	0.058	0.052	0.069	0.053	0.033	0.145
EF	0.105	0.040	0.036	0.044	0.040	0.021	0.095
CF	0.065	0.019	0.016	0.026	0.013	0.012	0.050
<u>Exiter Share</u>							
Total (XSH)	0.028	0.030	0.040	0.009	0.020	0.005	0.022
EF	0.016	0.019	0.037	0.008	0.019	0.003	0.017
CF	0.011	0.010	0.004	0.001	0.001	0.002	0.005
<u>Exiter Relative Size (average)</u>							
Total (XRS)	0.194	0.454	1.240	0.140	0.453	0.112	0.432
EF	0.207	0.596	1.292	0.197	0.770	0.084	0.524
CF	0.173	0.199	1.174	0.042	0.050	0.099	0.290
<u>Exiter Relative Size (median)</u>							
Total (XRS)	0.038	0.216	0.407	0.081	0.050	0.063	0.143
EF	0.044	0.157	0.555	0.099	0.055	0.071	0.164
CF	0.024	0.034	0.037	0.019	0.002	0.032	0.025

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The US-BB market has the geographic extent of the entire US and differentiates among broadband types. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.3 and II.B.4 for definitions of statistics.

Table 17: Exit Statistics for the ZIP Broadband Market by Method of Entry (Unadjusted Data, Averages Over All ZIP Codes)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Exit Rate</u>							
Total (XR)	0.117	0.096	0.071	0.099	0.135	0.038	0.185
EF	0.028	0.036	0.027	0.007	0.006	0.006	0.037
GC	0.089	0.059	0.044	0.092	0.129	0.032	0.148
<u>Exiter Share</u>							
Total (XSH)	0.079	0.046	0.049	0.098	0.245	0.016	0.089
EF	0.033	0.003	0.009	0.001	0.000	0.000	0.008
GC	0.046	0.043	0.040	0.098	0.244	0.016	0.081
<u>Exiter Relative Size (average)</u>							
Total (XRS)	7.997	3.666	3.006	3.817	24.863	1.089	7.406
EF	27.923	0.097	0.924	0.135	0.048	0.019	4.858
GC	2.044	5.587	4.128	4.085	25.858	1.283	7.164
<u>Exiter Relative Size (median)</u>							
Total (XRS)	0.065	0.013	0.013	0.250	1.867	0.005	0.369
EF	0.165	0.008	0.003	0.006	0.009	0.002	0.032
GC	0.052	0.021	0.027	0.307	2.292	0.005	0.451

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP market has the geographic extent of a single ZIP code area and groups all broadband types together. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.3 and II.B.4 for definitions of statistics.

Table 18: Exit Statistics for the ZIP Broadband Market by Method of Entry (Adjusted Data, Averages Over All ZIP Codes)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Exit Rate</u>							
Total (<i>XR</i>)	0.100	0.045	0.046	0.026	0.033	0.026	0.092
<i>EF</i>	0.012	0.017	0.025	0.003	0.003	0.004	0.021
<i>GC</i>	0.088	0.028	0.022	0.023	0.029	0.022	0.071
<u>Exiter Share</u>							
Total (<i>XSH</i>)	0.043	0.018	0.026	0.011	0.003	0.005	0.018
<i>EF</i>	0.003	0.002	0.009	0.000	0.000	0.000	0.002
<i>GC</i>	0.040	0.016	0.016	0.010	0.003	0.005	0.015
<u>Exiter Relative Size (average)</u>							
Total (<i>XRS</i>)	1.466	1.870	1.696	1.396	0.228	0.236	1.149
<i>EF</i>	0.099	0.114	1.129	0.204	0.019	0.025	0.265
<i>GC</i>	1.578	2.911	2.184	1.537	0.253	0.270	1.456
<u>Exiter Relative Size (median)</u>							
Total (<i>XRS</i>)	0.034	0.009	0.009	0.010	0.004	0.004	0.012
<i>EF</i>	0.016	0.008	0.002	0.009	0.011	0.003	0.008
<i>GC</i>	0.037	0.011	0.022	0.010	0.003	0.004	0.015

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP market has the geographic extent of a single ZIP code area and groups all broadband types together. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.3 and II.B.4 for definitions of statistics.

Table 19: Exit Statistics for the ZIP-BB Broadband Market by Method of Exit (Unadjusted Data, Averages Over All ZIP Codes and Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Exit Rate</u>							
Total (XR)	0.168	0.114	0.091	0.127	0.142	0.050	0.231
EF	0.028	0.039	0.033	0.009	0.008	0.007	0.041
GC	0.091	0.058	0.037	0.085	0.098	0.025	0.131
CF	0.049	0.016	0.022	0.033	0.037	0.018	0.058
<u>Exiter Share</u>							
Total (XSH)	0.158	0.101	0.068	0.121	0.157	0.038	0.107
EF	0.027	0.034	0.020	0.007	0.006	0.005	0.017
GC	0.085	0.053	0.029	0.085	0.107	0.016	0.063
CF	0.046	0.014	0.020	0.030	0.044	0.017	0.029
<u>Exiter Relative Size (average)</u>							
Total (XRS)	6.86	69.57	6.67	32.87	59.30	7.10	30.40
EF	12.004	2.573	3.754	0.978	5.154	0.666	4.188
GC	6.27	123.22	5.80	40.52	54.84	3.0	38.93
CF	5.116	40.59	8.84	17.72	77.88	17.12	27.88
<u>Exiter Relative Size (median)</u>							
Total (XRS)	0.502	0.226	0.051	0.406	2.488	0.090	0.627
EF	0.363	0.151	0.005	0.023	0.037	0.003	0.097
GC	0.190	0.251	0.063	0.476	1.525	0.040	0.424
CF	0.637	0.311	0.165	0.373	4.864	0.302	1.109

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP-BB market has the geographic extent of a single ZIP code area and differentiates among broadband types. Single-round entrants and exiter have not been removed from the data (refer to section II.B.5). See section II.B.3 and II.B.4 for definitions of statistics.

Table 20: Exit Statistics for the ZIP-BB Broadband Market by Method of Exit (Adjusted Data, Averages Over All ZIP Codes and Broadband Types)

	Dec. 2005	June 2006	Dec. 2006	June 2007	Dec. 2007	June 2008	Average (annualized)
<u>Exit Rate</u>							
Total (XR)	0.143	0.050	0.056	0.033	0.050	0.039	0.124
EF	0.012	0.015	0.029	0.004	0.005	0.005	0.023
GC	0.092	0.028	0.017	0.021	0.030	0.018	0.069
CF	0.039	0.007	0.011	0.009	0.016	0.016	0.033
<u>Exiter Share</u>							
Total (XSH)	0.134	0.039	0.039	0.028	0.045	0.029	0.052
EF	0.011	0.010	0.017	0.003	0.003	0.004	0.008
GC	0.086	0.023	0.013	0.017	0.024	0.011	0.029
CF	0.036	0.006	0.009	0.008	0.018	0.015	0.015
<u>Exiter Relative Size (average)</u>							
Total (XRS)	6.01	81.55	3.23	6.48	8.97	7.60	18.97
EF	3.057	1.218	3.112	0.758	5.491	1.155	2.465
GC	5.99	148.72	2.94	8.39	2.31	2.0	28.40
CF	5.722	31.66	2.23	3.28	29.74	17.84	15.08
<u>Exiter Relative Size (median)</u>							
Total (XRS)	0.526	0.156	0.054	0.133	0.182	0.121	0.195
EF	0.781	0.058	0.006	0.052	0.038	0.024	0.160
GC	0.322	0.194	0.084	0.112	0.134	0.040	0.148
CF	0.617	0.218	0.206	0.342	1.922	0.332	0.606

Table notes: Figures are averages unless otherwise noted. The entry and exit rates are annualized (only) in the final column. The ZIP-BB market has the geographic extent of a single ZIP code area and differentiates among broadband types. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.3 and II.B.4 for definitions of statistics.

Table 21: The Distribution of Entry Statistics for the US-BB Broadband Market by Broadband Types (Unadjusted Data, Distribution across Years)

	Entry Rate (ER) Mean, Median (1 st decile, 9 th decile)	Entrant Share (ESH) Mean, Median (1 st decile, 9 th decile)	Entrant Relative Size (ERS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.069, 0.059 (0.05,0.08)	0.002, 0.001 (0.00,0.00)	0.021, 0.020 (0.02,0.03)
BPL	0.219, 0.200 (0.00,0.25)	0.009, 0.000 (0.00,0.01)	0.029, 0.020 (0.00,0.06)
Cable modem	0.114, 0.106 (0.09,0.15)	0.012, 0.002 (0.00,0.01)	0.076, 0.022 (0.01,0.08)
Fiber	0.212, 0.204 (0.19,0.24)	0.016, 0.013 (0.01,0.02)	0.076, 0.070 (0.03,0.09)
Satellite	0.000, 0.000 (0.00,0.00)	0.000, 0.000 (0.00,0.00)	NA NA
SDSL	0.111, 0.108 (0.08,0.15)	0.016, 0.010 (0.00,0.02)	0.123, 0.069 (0.05,0.23)
Fixed wireless	0.194, 0.176 (0.13,0.28)	0.093, 0.089 (0.04,0.13)	0.421, 0.379 (0.30,0.62)
Mobile wireless	0.376, 0.323 (0.22,0.53)	0.029, 0.001 (0.00,0.01)	0.032, 0.005 (0.00,0.01)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds, and are not annualized. The second and fifth order statistics are given in parentheses; these compose the first-to-ninth decile range for the six observations per broadband type. *ERS* is undefined for satellite firms because there is no entry at the national level. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 for definitions of statistics.

Table 22: The Distribution of Entry Statistics for the US-BB Broadband Market by Broadband Types (Adjusted Data, Distribution across Years)

	Entry Rate (ER) Mean, Median (1 st decile, 9 th decile)	Entrant Share (ESH) Mean, Median (1 st decile, 9 th decile)	Entrant Relative Size (ERS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.052, 0.045 (0.03,0.11)	0.001, 0.001 (0.00,0.00)	0.022, 0.021 (0.02,0.03)
BPL	0.131, 0.100 (0.00,0.33)	0.003, 0.000 (0.00,0.01)	0.021, 0.022 (0.00,0.04)
Cable modem	0.089, 0.088 (0.06,0.12)	0.004, 0.001 (0.00,0.01)	0.035, 0.019 (0.01,0.12)
Fiber	0.179, 0.159 (0.15,0.25)	0.014, 0.011 (0.00,0.04)	0.085, 0.068 (0.01,0.23)
Satellite	0.000, 0.000 (0.00,0.00)	0.000, 0.000 (0.00,0.00)	NA NA
SDSL	0.078, 0.078 (0.04,0.11)	0.007, 0.004 (0.00,0.02)	0.083, 0.046 (0.02,0.30)
Fixed wireless	0.130, 0.117 (0.07,0.20)	0.061, 0.050 (0.02,0.14)	0.415, 0.407 (0.19,0.68)
Mobile wireless	0.287, 0.243 (0.05,0.75)	0.029, 0.001 (0.00,0.16)	0.045, 0.005 (0.00,0.24)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds, and are not annualized. The second and fifth order statistics are given in parentheses; these compose the first-to-ninth decile range for the six observations per broadband type. *ERS* is undefined for satellite firms because there is no entry at the national level. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 for definitions of statistics.

Table 23: The Distribution of Entry Statistics for the ZIP-BB Broadband Market by Broadband Types (Unadjusted Data, Distribution across ZIP Codes and Years)

	Entry Rate (ER) Mean, Median (1 st decile, 9 th decile)	Entrant Share (ESH) Mean, Median (1 st decile, 9 th decile)	Entrant Relative Size (ERS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.137, 0.000 (0.00,0.50)	0.049, 0.000 (0.00,0.00)	36.053, 0.003 (0.00,0.57)
BPL	0.000, 0.000 (0.00,0.00)	0.183, 0.000 (0.00,1.00)	., . (., .)
Cable modem	0.033, 0.000 (0.00,0.00)	0.057, 0.000 (0.00,0.00)	18.379, 0.131 (0.00,11.63)
Fiber	0.209, 0.000 (0.00,1.00)	0.268, 0.000 (0.00,1.00)	24.679, 0.548 (0.02,19.40)
Satellite	0.125, 0.000 (0.00,0.50)	0.052, 0.000 (0.00,0.13)	0.621, 0.266 (0.05,0.86)
SDSL	0.128, 0.000 (0.00,0.50)	0.150, 0.000 (0.00,1.00)	29.351, 0.361 (0.02,4.93)
Fixed wireless	0.105, 0.000 (0.00,0.50)	0.209, 0.000 (0.00,1.00)	10.670, 0.678 (0.03,18.79)
Mobile wireless	0.386, 0.000 (0.00,1.00)	0.365, 0.000 (0.00,1.00)	176.771, 4.030 (0.10,34.34)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds and across all the ZIP codes in the data, and are not annualized. The first-to-ninth decile range is given in parentheses. *ERS* is undefined for BPL firms because there is only ever a single firm providing BPL service at a time, and so there are never any incumbents upon entry. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 for definitions of statistics.

Table 24: The Distribution of Entry Statistics for the ZIP-BB Broadband Market by Broadband Types (Adjusted Data, Distribution across ZIP Codes and Years)

	Entry Rate (ER) Mean, Median (1 st decile, 9 th decile)	Entrant Share (ESH) Mean, Median (1 st decile, 9 th decile)	Entrant Relative Size (ERS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.106, 0.000 (0.00,0.50)	0.039, 0.000 (0.00,0.00)	42.199, 0.003 (0.00,0.62)
BPL	0.000, 0.000 (0.00,0.00)	0.135, 0.000 (0.00,1.00)	NA NA
Cable modem	0.021, 0.000 (0.00,0.00)	0.029, 0.000 (0.00,0.00)	18.477, 0.090 (0.00,10.92)
Fiber	0.150, 0.000 (0.00,0.67)	0.182, 0.000 (0.00,1.00)	23.414, 0.515 (0.02,33.78)
Satellite	0.117, 0.000 (0.00,0.50)	0.046, 0.000 (0.00,0.11)	0.583, 0.266 (0.05,0.84)
SDSL	0.080, 0.000 (0.00,0.25)	0.094, 0.000 (0.00,0.31)	41.359, 0.375 (0.01,5.76)
Fixed wireless	0.069, 0.000 (0.00,0.00)	0.144, 0.000 (0.00,1.00)	11.556, 0.744 (0.03,18.27)
Mobile wireless	0.271, 0.000 (0.00,1.00)	0.251, 0.000 (0.00,1.00)	43.351, 2.043 (0.07,23.17)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds and across all the ZIP codes in the data, and are not annualized. *ERS* is undefined for BPL firms because there is only ever a single firm providing BPL service at a time, and so there are never any incumbents upon entry. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 for definitions of statistics.

Table 25: The Distribution of Exit Statistics for the US-BB Broadband Market by Broadband Types (Unadjusted Data, Distribution across Years)

	Exit Rate (XR) Mean, Median (1 st decile, 9 th decile)	Exiter Share (XSH) Mean, Median (1 st decile, 9 th decile)	Exiter Relative Size (XRS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.049, 0.050 (0.05,0.05)	0.030, 0.003 (0.00,0.00)	0.709, 0.046 (0.04,0.08)
BPL	0.067, 0.000 (0.00,0.20)	0.007, 0.000 (0.00,0.00)	0.084, 0.084 (0.00,0.17)
Cable modem	0.075, 0.074 (0.06,0.10)	0.021, 0.009 (0.00,0.04)	0.267, 0.095 (0.06,0.33)
Fiber	0.083, 0.079 (0.06,0.11)	0.023, 0.008 (0.00,0.01)	0.203, 0.082 (0.03,0.11)
Satellite	0.056, 0.000 (0.00,0.00)	0.000, 0.000 (0.00,0.00)	0.001, 0.001 (0.00,0.00)
SDSL	0.135, 0.141 (0.10,0.16)	0.078, 0.084 (0.04,0.12)	0.557, 0.504 (0.21,0.74)
Fixed wireless	0.165, 0.167 (0.11,0.20)	0.080, 0.083 (0.05,0.11)	0.423, 0.457 (0.35,0.51)
Mobile wireless	0.300, 0.307 (0.16,0.50)	0.000, 0.000 (0.00,0.00)	0.000, 0.000 (0.00,0.00)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds, and are not annualized. The first-to-ninth decile range is given in parentheses. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.3 for definitions of statistics.

Table 26: The Distribution of Exit Statistics for the US-BB Broadband Market by Broadband Types (Adjusted Data, Distribution across Years)

	Exit Rate (XR) Mean, Median (1 st decile, 9 th decile)	Exiter Share (XSH) Mean, Median (1 st decile, 9 th decile)	Exiter Relative Size (XRS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.032, 0.029 (0.03,0.04)	0.030, 0.002 (0.00,0.17)	0.852, 0.062 (0.04,4.82)
BPL	0.000, 0.000 (0.00,0.00)	0.000, 0.000 (0.00,0.00)	., . (., .)
Cable modem	0.050, 0.050 (0.04,0.07)	0.013, 0.003 (0.00,0.07)	0.331, 0.070 (0.01,1.74)
Fiber	0.050, 0.042 (0.03,0.09)	0.020, 0.002 (0.00,0.10)	0.303, 0.057 (0.03,1.52)
Satellite	0.056, 0.000 (0.00,0.33)	0.000, 0.000 (0.00,0.00)	0.001, 0.001 (0.00,0.00)
SDSL	0.103, 0.103 (0.06,0.16)	0.067, 0.066 (0.02,0.12)	0.713, 0.558 (0.15,2.11)
Fixed wireless	0.103, 0.090 (0.07,0.17)	0.046, 0.040 (0.02,0.09)	0.408, 0.439 (0.21,0.50)
Mobile wireless	0.187, 0.138 (0.00,0.50)	0.000, 0.000 (0.00,0.00)	0.000, 0.000 (0.00,0.00)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds, and are not annualized. The first-to-ninth decile range is given in parentheses. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.3 for definitions of statistics.

Table 27: The Distribution of Exit Statistics for the ZIP-BB Broadband Market by Broadband Types (Unadjusted Data, Distribution across ZIP Codes and Years)

	Exit Rate (XR) Mean, Median (1 st decile, 9 th decile)	Exiter Share (XSH) Mean, Median (1 st decile, 9 th decile)	Exiter Relative Size (XRS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.066, 0.000 (0.00,0.29)	0.030, 0.000 (0.00,0.00)	52.268, 0.003 (0.00,0.45)
BPL	0.096, 0.000 (0.00,0.00)	0.096, 0.000 (0.00,0.00)	NA NA
Cable modem	0.059, 0.000 (0.00,0.00)	0.055, 0.000 (0.00,0.00)	14.417, 0.279 (0.00,8.36)
Fiber	0.260, 0.000 (0.00,1.00)	0.256, 0.000 (0.00,1.00)	12.978, 0.821 (0.03,12.06)
Satellite	0.034, 0.000 (0.00,0.00)	0.020, 0.000 (0.00,0.00)	0.800, 0.071 (0.03,0.76)
SDSL	0.235, 0.000 (0.00,1.00)	0.207, 0.000 (0.00,1.00)	4.755, 0.400 (0.03,3.54)
Fixed wireless	0.172, 0.000 (0.00,1.00)	0.167, 0.000 (0.00,1.00)	6.559, 0.499 (0.02,11.11)
Mobile wireless	0.152, 0.000 (0.00,0.67)	0.187, 0.000 (0.00,1.00)	92.382, 8.582 (0.32,78.14)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds and across all the ZIP codes in the data, and are not annualized. The first-to-ninth decile range is given in parentheses. *XRS* is undefined for BPL firms because there is only ever a single firm providing BPL service at a time, and so there are never any remaining incumbents upon exit. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.3 for definitions of statistics.

Table 28: The Distribution of Exit Statistics for the ZIP-BB Broadband Market by Broadband Types (Adjusted Data, Distribution across ZIP Codes and Years)

	Exit Rate (XR) Mean, Median (1 st decile, 9 th decile)	Exiter Share (XSH) Mean, Median (1 st decile, 9 th decile)	Exiter Relative Size (XRS) Mean, Median (1 st decile, 9 th decile)
ADSL	0.040, 0.000 (0.00,0.13)	0.018, 0.000 (0.00,0.00)	60.582, 0.004 (0.00,0.51)
BPL	0.030, 0.000 (0.00,0.00)	0.030, 0.000 (0.00,0.00)	NA NA
Cable modem	0.026, 0.000 (0.00,0.00)	0.024, 0.000 (0.00,0.00)	6.671, 0.295 (0.02,11.16)
Fiber	0.150, 0.000 (0.00,0.67)	0.148, 0.000 (0.00,0.97)	8.423, 0.716 (0.04,10.68)
Satellite	0.026, 0.000 (0.00,0.00)	0.014, 0.000 (0.00,0.00)	0.717, 0.067 (0.03,0.55)
SDSL	0.165, 0.000 (0.00,0.50)	0.141, 0.000 (0.00,0.83)	3.478, 0.377 (0.03,2.42)
Fixed wireless	0.090, 0.000 (0.00,0.50)	0.085, 0.000 (0.00,0.10)	5.234, 0.439 (0.02,7.53)
Mobile wireless	0.045, 0.000 (0.00,0.00)	0.047, 0.000 (0.00,0.00)	22.529, 6.865 (0.01,39.86)

Table notes: means and deciles are calculated for each broadband type, across the six semi-annual rounds and across all the ZIP codes in the data, and are not annualized. The first-to-ninth decile range is given in parentheses. *XRS* is undefined for BPL firms because there is only ever a single firm providing BPL service at a time, and so there are never any remaining incumbents upon exit. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.3 for definitions of statistics.

Table 29: The Distribution of Entry Statistics for the ZIP Broadband Market by Census Region (Unadjusted Data)

	Entry Rate (ER) Mean	Entrant Share (ESH) Mean	Entrant Relative Size (ERS) Mean
New England	0.227	0.084	3.207
Middle Atlantic	0.225	0.098	10.425
East North Central	0.214	0.171	17.282
West North Central	0.305	0.251	16.101
South Atlantic	0.218	0.154	5.596
East South Central	0.294	0.204	13.687
West South Central	0.251	0.143	4.35
Mountain	0.261	0.226	55.882
Pacific Contiguous	0.198	0.154	14.148

Table notes: means are calculated for each Census region, across the six semi-annual rounds and across all the ZIP codes in the region, and are not annualized. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See section II.B.2 for definitions of statistics. New England states are CT, MA, ME, NH, RI, VT; Middle Atlantic states are NJ, NY, PA; East North Central states are IL, IN, MI, OH, WI; West North Central states are IA, KS, MN, MO, ND, NE, ND, SD; South Atlantic states are DC, DE, FL, GA, MD, NC, SC, VA, WV; East South Central states are AL, KY, MS, TN; West South Central states are AR, LA, OK, TX; Mountain states are AZ, CO, ID, MT, NM,NV, UT, WY; Pacific Contiguous states are CA, OR, WA.

Table 30: The Distribution of Entry Statistics for the ZIP Broadband Market by Census Region (Adjusted Data)

	Entry Rate (ER) Mean	Entrant Share (ESH) Mean	Entrant Relative Size (ERS) Mean
New England	0.190	0.061	2.589
Middle Atlantic	0.181	0.063	7.906
East North Central	0.156	0.097	9.579
West North Central	0.236	0.163	12.533
South Atlantic	0.166	0.092	3.195
East South Central	0.212	0.108	5.338
West South Central	0.192	0.101	3.784
Mountain	0.208	0.146	10.715
Pacific Contiguous	0.146	0.089	9.019

Table notes: means are calculated for each Census region, across the six semi-annual rounds and across all the ZIP codes in the region, and are not annualized. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.2 for definitions of statistics. New England states are CT, MA, ME, NH, RI, VT; Middle Atlantic states are NJ, NY, PA; East North Central states are IL, IN, MI, OH, WI; West North Central states are IA, KS, MN, MO, ND, NE, ND, SD; South Atlantic states are DC, DE, FL, GA, MD, NC, SC, VA, WV; East South Central states are AL, KY, MS, TN; West South Central states are AR, LA, OK, TX; Mountain states are AZ, CO, ID, MT, NM,NV, UT, WY; Pacific Contiguous states are CA, OR, WA.

Table 31: The Distribution of Exit Statistics for the ZIP Broadband Market by Census Region (Unadjusted Data)

	Exit Rate (XR) Mean	Exiter Share (XSH) Mean	Exiter Relative Size (XRS) Mean
New England	0.091	0.037	2.749
Middle Atlantic	0.102	0.053	6.915
East North Central	0.091	0.101	12.407
West North Central	0.089	0.122	17.749
South Atlantic	0.085	0.084	4.978
East South Central	0.112	0.127	10.285
West South Central	0.093	0.07	2.646
Mountain	0.082	0.108	12.93
Pacific Contiguous	0.097	0.087	11.804

Table notes: means are calculated for each Census region, across the six semi-annual rounds and across all the ZIP codes in the region, and are not annualized. Single-round entrants and exitters have not been removed from the data (refer to section II.B.5). See section II.B.3 for definitions of statistics. New England states are CT, MA, ME, NH, RI, VT; Middle Atlantic states are NJ, NY, PA; East North Central states are IL, IN, MI, OH, WI; West North Central states are IA, KS, MN, MO, ND, NE, ND, SD; South Atlantic states are DC, DE, FL, GA, MD, NC, SC, VA, WV; East South Central states are AL, KY, MS, TN; West South Central states are AR, LA, OK, TX; Mountain states are AZ, CO, ID, MT, NM,NV, UT, WY; Pacific Contiguous states are CA, OR, WA.

Table 32: The Distribution of Exit Statistics for the ZIP Broadband Market by Census Region (Adjusted Data)

	Exit Rate (XR) Mean	Exiter Share (XSH) Mean	Exiter Relative Size (XRS) Mean
New England	0.060	0.014	1.253
Middle Atlantic	0.069	0.018	1.630
East North Central	0.044	0.016	0.757
West North Central	0.035	0.016	1.342
South Atlantic	0.042	0.022	1.415
East South Central	0.042	0.018	1.496
West South Central	0.041	0.021	1.253
Mountain	0.037	0.015	0.786
Pacific Contiguous	0.053	0.016	0.755

Table notes: means are calculated for each Census region, across the six semi-annual rounds and across all the ZIP codes in the region, and are not annualized. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See section II.B.3 for definitions of statistics. New England states are CT, MA, ME, NH, RI, VT; Middle Atlantic states are NJ, NY, PA; East North Central states are IL, IN, MI, OH, WI; West North Central states are IA, KS, MN, MO, ND, NE, ND, SD; South Atlantic states are DC, DE, FL, GA, MD, NC, SC, VA, WV; East South Central states are AL, KY, MS, TN; West South Central states are AR, LA, OK, TX; Mountain states are AZ, CO, ID, MT, NM,NV, UT, WY; Pacific Contiguous states are CA, OR, WA.

Table 33: Correlations between Market Entry and Exit Measures across Time (Unadjusted Data, US-BB Market)

Measure x_t	$\text{Cor}(x_t, x_{t-1})$	$\text{Cor}(x_t, x_{t-2})$	$\text{Cor}(x_t, x_{t-3})$	$\text{Cor}(x_t, x_{t-4})$	$\text{Cor}(x_t, x_{t-5})$
Entry Rate (<i>ER</i>)	0.713**	0.464**	0.788**	0.814**	0.427
Entrant Share (<i>ESH</i>)	0.480**	0.653**	0.639**	0.718**	0.934**
Entrant Relative Size (<i>ERS</i>)	0.730**	0.625**	0.692**	0.894**	0.993**
Exit Rate (<i>XR</i>)	0.589**	0.485**	0.716**	0.357	-0.229
Exiter Share (<i>XSH</i>)	0.373*	0.294	0.625**	0.623**	0.959**
Exiter Relative Size (<i>XRS</i>)	-0.104	-0.121	0.069	0.413	0.849*

*Significant at the 5% level. **Significant at the 1% level.

Table notes: a cell entry is the autocorrelation between the measure x given in the row heading and the same variable at various lags. Significance refers to treating data as a sample from an infinite superpopulation. The first column of figures is the first autocorrelation, the second column in the second autocorrelation, and so on up to the fifth autocorrelation. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 34: Correlations between Market Entry and Exit Measures across Time (Adjusted Data, US-BB Market)

Measure x_t	$\text{Cor}(x_t, x_{t-1})$	$\text{Cor}(x_t, x_{t-2})$	$\text{Cor}(x_t, x_{t-3})$	$\text{Cor}(x_t, x_{t-4})$	$\text{Cor}(x_t, x_{t-5})$
Entry Rate (<i>ER</i>)	0.290	0.272	0.543**	0.770**	0.321
Entrant Share (<i>ESH</i>)	0.246	0.605**	0.423*	0.553*	0.974**
Entrant Relative Size (<i>ERS</i>)	0.677**	0.678**	0.672**	0.863**	0.995**
Exit Rate (<i>XR</i>)	0.393*	0.254	0.675**	0.688**	-0.256
Exiter Share (<i>XSH</i>)	0.153	0.105	0.392	0.694**	0.965**
Exiter Relative Size (<i>XRS</i>)	-0.136	-0.147	-0.014	0.271	0.923*

*Significant at the 5% level. **Significant at the 1% level.

Table notes: a cell entry is the autocorrelation between the measure x given in the row heading and the same variable at various lags. Significance refers to treating data as a sample from an infinite superpopulation. The first column of figures is the first autocorrelation, the second column in the second autocorrelation, and so on up to the fifth autocorrelation. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 35: Correlations between Market Entry and Exit Measures across Time (Unadjusted Data, ZIP Market)

Measure x_t	$\text{Cor}(x_t, x_{t-1})$	$\text{Cor}(x_t, x_{t-2})$	$\text{Cor}(x_t, x_{t-3})$	$\text{Cor}(x_t, x_{t-4})$	$\text{Cor}(x_t, x_{t-5})$
Entry Rate (<i>ER</i>)	-0.034	0.095	0.035	0.009*	0.033
Entrant Share (<i>ESH</i>)	0.194	0.343	0.159	0.093	0.197
Entrant Relative Size (<i>ERS</i>)	0.019	0.104	0.005 [†]	0.065	0.014 [†]
Exit Rate (<i>XR</i>)	0.020	-0.025	0.039	0.078	0.017
Exiter Share (<i>XSH</i>)	0.086	0.030	0.076	0.139	0.045
Exiter Relative Size (<i>XRS</i>)	0.127	0.081	0.018*	0.007 [†]	0.049

*Significant at the 5% level.

[†]Not significant at the 10% level.

Table notes: a cell entry is the autocorrelation between the measure x given in the row heading and the same variable at various lags. Unless otherwise noted, all autocorrelations are statistically significant at the 1% level (where significance refers to treating data as a sample from an infinite superpopulation). The first column of figures is the first autocorrelation, the second column in the second autocorrelation, and so on up to the fifth autocorrelation. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 36: Correlations between Market Entry and Exit Measures across Time (Adjusted Data, ZIP Market)

Measure x_t	$\text{Cor}(x_t, x_{t-1})$	$\text{Cor}(x_t, x_{t-2})$	$\text{Cor}(x_t, x_{t-3})$	$\text{Cor}(x_t, x_{t-4})$	$\text{Cor}(x_t, x_{t-5})$
Entry Rate (<i>ER</i>)	-0.007	-0.019	0.002 [†]	-0.012	0.067
Entrant Share (<i>ESH</i>)	0.025	0.006*	0.027	-0.089	0.117
Entrant Relative Size (<i>ERS</i>)	-0.005 [†]	-0.009	0.128	0.003 [†]	-0.010 [†]
Exit Rate (<i>XR</i>)	0.007	0.013	0.012	0.052	0.006 [†]
Exiter Share (<i>XSH</i>)	0.007	0.003 [†]	0.015	-0.003 [†]	0.008 [†]
Exiter Relative Size (<i>XRS</i>)	0.003 [†]	0.003 [†]	0.014 [†]	0.036	0.019 [†]

*Significant at the 10% level.

†Not significant at the 10% level.

Table notes: a cell entry is the autocorrelation between the measure x given in the row heading and the same variable at various lags. Unless otherwise noted, all autocorrelations are statistically significant at the 1% level (where significance refers to treating data as a sample from an infinite superpopulation). The first column of figures is the first autocorrelation, the second column in the second autocorrelation, and so on up to the fifth autocorrelation. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 37: Correlations between Market Entry and Exit Measures across Time (Unadjusted Data, ZIP-BB Market)

Measure x_t	$\text{Cor}(x_t, x_{t-1})$	$\text{Cor}(x_t, x_{t-2})$	$\text{Cor}(x_t, x_{t-3})$	$\text{Cor}(x_t, x_{t-4})$	$\text{Cor}(x_t, x_{t-5})$
Entry Rate (<i>ER</i>)	0.003*	0.092	0.036	0.045	-0.021
Entrant Share (<i>ESH</i>)	0.199	0.291	0.160	0.198	0.177
Entrant Relative Size (<i>ERS</i>)	0.041	0.071	0.038	0.011 [†]	0.002 [†]
Exit Rate (<i>XR</i>)	0.133	0.079	0.125	0.204	0.002 [†]
Exiter Share (<i>XSH</i>)	0.141	0.068	0.127	0.244	0.011
Exiter Relative Size (<i>XRS</i>)	0.788	0.474	0.158	0.031*	0.005 [†]

[†]Not significant at the 10% level.

Table notes: a cell entry is the autocorrelation between the measure x given in the row heading and the same variable at various lags. Unless otherwise noted, all autocorrelations are statistically significant at the 1% level (where significance refers to treating data as a sample from an infinite superpopulation). The first column of figures is the first autocorrelation, the second column in the second autocorrelation, and so on up to the fifth autocorrelation. Single-round entrants and exiters have not been removed from the data (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 38: Correlations between Market Entry and Exit Measures across Time (Adjusted Data, ZIP-BB Market)

Measure x_t	$\text{Cor}(x_t, x_{t-1})$	$\text{Cor}(x_t, x_{t-2})$	$\text{Cor}(x_t, x_{t-3})$	$\text{Cor}(x_t, x_{t-4})$	$\text{Cor}(x_t, x_{t-5})$
Entry Rate (<i>ER</i>)	-0.041	-0.041	-0.002 [†]	-0.017	0.008
Entrant Share (<i>ESH</i>)	0.088	0.116	0.080	-0.002 [†]	0.118
Entrant Relative Size (<i>ERS</i>)	-0.005 [†]	-0.002 [†]	0.058	0.084	-0.015 [†]
Exit Rate (<i>XR</i>)	0.030	0.040	0.029	0.053	0.001 [†]
Exiter Share (<i>XSH</i>)	0.029	0.037	0.044	0.055	0.006
Exiter Relative Size (<i>XRS</i>)	-0.003 [†]	-0.002 [†]	-0.006 [†]	0.072	0.002 [†]

[†]Not significant at the 5% level.

Table notes: a cell entry is the autocorrelation between the measure x given in the row heading and the same variable at various lags. Unless otherwise noted, all autocorrelations are statistically significant at the 1% level (where significance refers to treating data as a sample from an infinite superpopulation). The first column of figures is the first autocorrelation, the second column in the second autocorrelation, and so on up to the fifth autocorrelation. Single-round entrants and exiters have been removed from the data (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 39: Correlations between Market Entry and Exit Measures (US-BB Market)

	Unadjusted Data		Adjusted Data	
	No Correction for Market Fixed Effects	With Correction for Market Fixed Effects	No Correction for Market Fixed Effects	With Correction for Market Fixed Effects
	Entry Rate (ER_t)	Entry Rate (ER_t)	Entry Rate (ER_t)	Entry Rate (ER_t)
Exit Rate				
XR_{t+4}	0.455	-0.463	0.256	-0.106
XR_{t+3}	0.290	-0.423	0.167	-0.243
XR_{t+2}	0.612	0.149	0.170	-0.221
XR_{t+1}	0.655	0.308	0.669	0.632
XR_t	0.470	0.191	0.170	-0.104
XR_{t+1}	0.720	0.598	0.153	-0.219
XR_{t+2}	0.690	0.502	0.591	0.486
XR_{t+3}	0.578	0.223	0.530	0.386
XR_{t+4}	0.293	-0.310	-0.114	-0.736
	Entrant Share (ESH_t)	Entrant Share (ESH_t)	Entrant Share (ESH_t)	Entrant Share (ESH_t)
Exiter Share				
XSH_{t+4}	0.557	-0.400	0.414	-0.179
XSH_{t+3}	0.572	-0.017	0.317	0.091
XSH_{t+2}	0.573	0.134	0.390	0.172
XSH_{t+1}	0.326	0.104	0.047	-0.022
XSH_t	0.387	0.207	0.197	0.151
XSH_{t+1}	0.390	0.241	0.090	0.052
XSH_{t+2}	0.321	0.140	0.041	-0.002
XSH_{t+3}	0.337	-0.098	0.169	0.073
XSH_{t+4}	0.160	-0.053	0.062	0.081

Table notes: each entry is the correlation between the exit variable in the row heading with the entry variable in the column subheading. For columns labeled Unadjusted Data, single-round entrants and exiters have not been removed from the data, while for columns labeled Adjusted Data, they have been (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 40: Correlations between Market Entry and Exit Measures (ZIP Market)

	Unadjusted Data		Adjusted Data	
	No Correction for Market Fixed Effects	With Correction for Market Fixed Effects	No Correction for Market Fixed Effects	With Correction for Market Fixed Effects
	Entry Rate (ER_t)	Entry Rate (ER_t)	Entry Rate (ER_t)	Entry Rate (ER_t)
Exit Rate				
XR_{t-4}	-0.023	-0.111	0.005	-0.015
XR_{t-3}	0.064	-0.024	0.115	0.099
XR_{t-2}	0.070	-0.031	0.081	0.067
XR_{t-1}	0.282	0.207	0.106	0.111
XR_t	0.006	-0.09	0.027	0.029
XR_{t+1}	0.189	0.13	-0.060	-0.066
XR_{t+2}	0.056	-0.039	0.026	0.028
XR_{t+3}	0.055	-0.021	-0.001	0.025
XR_{t+4}	0.007	-0.045	0.010	0.064
	Entrant Share (ESH_t)	Entrant Share (ESH_t)	Entrant Share (ESH_t)	Entrant Share (ESH_t)
Exiter Share				
XSH_{t-4}	0.087	-0.231	0.013	-0.100
XSH_{t-3}	0.138	-0.179	0.146	0.095
XSH_{t-2}	0.147	-0.139	0.087	0.025
XSH_{t-1}	0.506	0.337	0.125	0.076
XSH_t	0.224	-0.014	0.103	0.056
XSH_{t+1}	0.453	0.327	-0.055	-0.138
XSH_{t+2}	0.096	-0.132	0.012	-0.047
XSH_{t+3}	0.171	-0.01	0.007	-0.030
XSH_{t+4}	0.052	-0.216	0.008	-0.019

Table notes: each entry is the correlation between the exit variable in the row heading with the entry variable in the column subheading. For columns labeled Unadjusted Data, single-round entrants and exiters have not been removed from the data, while for columns labeled Adjusted Data, they have been (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.

Table 41: Correlations between Market Entry and Exit Measures (ZIP-BB Market)

	Unadjusted Data		Adjusted Data	
	No Correction for Market Fixed Effects	With Correction for Market Fixed Effects	No Correction for Market Fixed Effects	With Correction for Market Fixed Effects
	Entry Rate (ER_t)	Entry Rate (ER_t)	Entry Rate (ER_t)	Entry Rate (ER_t)
Exit Rate				
XR_{t-4}	0.074	-0.062	0.046	-0.057
XR_{t-3}	0.082	-0.038	0.159	0.098
XR_{t-2}	0.115	-0.020	0.116	0.071
XR_{t-1}	0.323	0.159	0.061	0.039
XR_t	0.051	-0.048	0.013	0.003
XR_{t+1}	0.137	0.031	-0.053	-0.080
XR_{t+2}	0.063	-0.025	0.060	0.042
XR_{t+3}	0.036	0.000	-0.007	-0.015
XR_{t+4}	0.021	-0.040	0.036	0.034
	Entrant Share (ESH_t)	Entrant Share (ESH_t)	Entrant Share (ESH_t)	Entrant Share (ESH_t)
Exiter Share				
XSH_{t-4}	0.100	-0.315	0.046	-0.269
XSH_{t-3}	0.215	-0.117	0.319	0.122
XSH_{t-2}	0.211	-0.130	0.224	0.072
XSH_{t-1}	0.630	0.409	0.361	0.278
XSH_t	0.411	0.240	0.267	0.272
XSH_{t+1}	0.244	-0.094	-0.084	-0.238
XSH_{t+2}	0.137	-0.180	0.076	-0.07
XSH_{t+3}	0.198	0.006	0.014	-0.07
XSH_{t+4}	0.130	-0.069	0.095	0.057

Table notes: each entry is the correlation between the exit variable in the row heading with the entry variable in the column subheading. For columns labeled Unadjusted Data, single-round entrants and exiters have not been removed from the data, while for columns labeled Adjusted Data, they have been (refer to section II.B.5). See sections II.B.2 and II.B.3 for definitions of statistics.