When Delivery Comes to Town: Digital Distribution Platform Penetration and Establishment Exit

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Abstract

Digital distribution platforms facilitate transactions between existing establishments and consumers by lowering matching costs. In doing so, such platforms alter the competitive landscape of an industry. We present and test a holistic perspective outlining the ways in which digital distribution platforms affect value creation and capture within an industry. We argue that digital distribution platforms affect establishments through three pathways: a) altering the nature of consumer search; b) re-valuing strategic assets and resources; and c) introducing a novel intermediary into the value chain. Using data on the restaurant industry, we find that platform penetration increases the likelihood of establishment exit on average, but that the effect is importantly moderated by segment and establishment characteristics. The hazardous effect of platform penetration is smaller for highly familiar establishments (the rich get richer) and for niche market segments (the classic long-tail effect). Further, the effect is larger for restaurants who had previously invested in assets tied to the old business model that are less useful, and for restaurants operating with lower levels of efficiency who struggle to share profits with the new intermediary. Through this work, we add to our understanding of how digital distribution platforms affect the industries they enter.

Keywords: platforms, digital markets, competition, industry evolution, ecosystem.

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While many digital platforms like Uber and Airbnb introduce new entrants to an industry that increase competition for incumbents (Chang and Sokol 2022, Farronato and Fradkin 2018, Zervas et al. 2017), digital *distribution* platforms connect consumers to existing incumbent establishments. For example, Grubhub connects consumers with restaurants around them, Instacart allows consumers to order grocery delivery from local stores, and Shipt offers consumers delivery from local convenience and retail establishments. As with other technological advances, the emergence of digital distribution platforms therefore poses challenges and opportunities to established firms and has implications for their success and survival (e.g., Amit and Zott 2001, Meyer and Cennamo 2019).

By facilitating transactions between professional establishments and consumers, digital distribution platforms increase the potential market for such establishments by lowering the costs of finding customers and increasing demand for their products (Lanzolla et al. 2020). Yet, by doing so, such platforms alter which strategic assets and resources are most valuable in the market, changing the competitive landscape and creating new "winners" or "losers" (e.g., Adner and Lieberman 2021, Jacobides et al. 2018). To extend our understanding of how digital platforms reshape industries, it is important to develop a holistic understanding of the ways in which such platforms change the value of establishment resources and capabilities, and test that theory to complement the limited existing empirical evidence on how digital distribution platforms affect establishment performance (Li and Wang 2020).

In this research, we study how the emergence of digital distribution platforms affect industry incumbents. We propose theory that outlines the ways in which digital distribution platforms may change what is valuable within an industry and identifies when the growth of such platforms is more versus less detrimental for establishments in the market. Integrating literature on consumer search, adaptation, and value-based strategy, we argue that digital distribution platforms affect establishments within an industry through three pathways: a) by changing the nature of consumer search (e.g., Brynjolfsson et al. 2011, Dinerstein et al. 2018, Lanzolla et al. 2020); b) by re-valuing strategic assets and resources (e.g., Cattani 2006, Tripsas 1997); and c) by introducing a novel intermediary into the value chain (e.g., Brandenburger and Stuart 1996, Farrell and Katz 2000). Thus, we argue that, as with other technological breakthroughs,

the emergence of digital distribution platforms can reshape the competitive position of existing firms and that some incumbents will be better able to weather this transition than others.

We develop hypotheses corresponding to each pathway in our theory. First, we suggest that the emergence of digital distribution platforms will benefit establishments operating in smaller market segments, as digital platforms will enable greater access to such "niche" establishments through the classic long-tail effect (Brynjolfsson et al. 2006, 2011). However, at the same time, changes in the nature of consumer search facilitated by the platform may benefit well-known establishments within a market segment, as consumers may opt towards simplicity and familiarity when faced with an abundance of choice (e.g., Armstrong et al. 2009, Degeratu et al. 2000, Iyengar and Kamenica 2010). Second, we argue that establishments whose have invested in assets that are de-valued in the novel platform ecosystem may struggle to adjust as they are less able to generate value from their existing resources and capabilities (Eggers and Kaplan 2009, Eklund and Kapoor 2019). Third, we argue that the introduction of an intermediary that extracts a share of value created will be particularly harmful for less-resourced or less-efficient establishments that do not have the ability to withstand pressure to their profit margins (Brandenburger and Stuart 1996).

We test these predictions in the U.S. restaurant industry during the onset of growth in restaurant delivery platforms from 2012 to 2018. This is a particularly attractive setting to study digital distribution platforms given that the emergence of delivery platforms has dramatically altered the industry (Wang 2019). We examine how consumer adoption of delivery platforms across different geographies (core-based statistical areas, or CBSAs) in the United States affects the likelihood of restaurant exit. To address endogeneity concerns related to platforms' choices of when to enter certain markets and the growth in platform penetration upon entry, we show that the results hold using an instrumental variables identification strategy that links delivery platform penetration to the historical density of roads within a locality.

Our empirical analysis finds evidence that the emergence of digital distribution platforms in the restaurant industry increased the likelihood of establishment exit on average – a one-percentage point

increase in platform penetration increases the likelihood of establishment exit by 1.6 percent. Further, we largely find support for the posited theoretical perspective outlining the heterogeneous effects of digital distribution platforms. Platform penetration has a smaller effect on the hazard of exit for older establishments that are more familiar to consumers and for establishments specializing in less prevalent or "niche" cuisines, and a larger effect for restaurants that have invested heavily in assets that are likely to be de-valued (i.e., location and physical retail space) and for restaurants operating with lower levels of efficiency.

Through this research, we generate insight regarding how digital distribution platforms affect the industries that they enter and contribute to a literature that examines the effect of platform entry on incumbents (e.g., Farronato and Fradkin 2018, Seamans and Zhu 2014, Zervas et al. 2017). One example of such insight is our attempt to reconcile literature suggesting that digital platforms can help lead to a "long tail" that benefits smaller, niche complementors (e.g., Brynjolfsson et al. 2011, Zhang 2016) with studies highlighting how digital platforms mostly benefit the most successful and familiar complementors (e.g., Hosanagar et al. 2014, Lee and Hosanagar 2019). Specifically, we outline and show how the long tail effect can exist at the segment level, while the familiarity effect can exist within any given segment. More generally, by focusing on the entry of digital distribution platforms, we extend a line of literature that considers platforms that cooperate, rather than compete, with existing offerings (e.g., Cennamo et al. 2021, Jacobides et al. 2018). As different kinds of platforms may have disparate effects on industries, this project takes an important step in unpacking the effects that digital distribution platforms have on the industries that they enter. Through the theoretical perspective we propose, we provide insight on the resources and strategies most valuable within a newly created platform ecosystem (e.g., Kapoor and Agarwal 2017, Meyer and Cennamo 2019, Tiwana 2015). In doing so, we add to a body of work that considers how digital platforms shape competitive dynamics for the providers competing upon them (Boudreau 2010, Kapoor and Agarwal 2017, Miric et al. 2019, Raj 2022).

Importantly, this research has practical implications for platform organizers, providers, and policymakers. We shed light on how digital distribution platforms have affected competition and market

structure within the restaurant industry, and support the popular press view that restaurant delivery platforms may have negative effects on the restaurants they cooperate with. To the extent that such platforms are especially deleterious for younger and independent establishments, it is possible that they may lead to industry consolidation and anti-competitive effects. Policymakers should consider policies that ensure that restaurants are able to extract value from their partnerships with delivery platforms or mobilize resources that allow vulnerable restaurants to manage the transition to the novel ecosystem. For establishments seeking to work with digital distribution platforms, it is important to understand how platforms change consumer search behavior and to understand that they must cultivate assets that fit with the emerging platform ecosystem. And for the platforms themselves, if it is important to have a diversity of providers, platform organizers should provide support to the most vulnerable establishments, younger or independent establishments and establishments that find that their previous competitive advantage has been eroded, perhaps by increasing their visibility on the platform or providing them with favorable bargaining terms. Such steps may mitigate the negative impact that digital distribution platforms have had on restaurants and enable the restaurants and platforms to cooperatively create value and co-exist.

Distributional Effects of Digital Distribution Platforms

Two-sided digital platforms affect how value is captured by introducing a new actor into the value chain – the platform organizer – who extracts a surplus for connecting consumers with the providers hosted on the platform (Gawer 2021). Such platforms increase the range of sellers offered to buyers and decrease costs of matching buyers and sellers (Amit and Zott 2001, Lanzolla et al. 2020). Further, by directing consumption through the platform, digital platforms can change which assets are most valuable within an industry and enable novel business models (Meyer and Cennamo 2019).

Extant literature has studied how the introduction of "peer-to-peer" or "sharing economy" platforms, where supply is provided mostly by individuals or novel entrants rather than by incumbents that have traditionally made up an industry, has affected the performance of industry incumbents. Such work has found that evidence that the entry of these platforms increases the number of industry

participants and competition within the industry. Peer-to-peer platforms have negatively affected incumbent performance in the hotel industry (Farronato and Fradkin 2018, Zervas et al. 2017), classified advertising industry (Seamans and Zhu 2014), and the ridesharing and taxi industries (Abhishek et al. 2019, Cramer and Krueger 2016).

While peer-to-peer platforms typically introduce new participants into an industry, digital distribution platforms largely work with existing industry actors. For example, Instacart connects consumers with existing brick-and-mortar grocery stores, and Hotels.com connects consumers with incumbent hotels. On such platforms, professional establishments are the providers, and by working with the platform, establishments can outsource the cost of building in-house distributional capabilities at the cost of paying a commission or a fee for the services used (Chen and Wu 2013). Rather than competing with the offerings on the platform, professional establishments can cooperate with the platform to create additional value (e.g., Adner and Lieberman 2021, Jacobides et al. 2018). Of course, many platforms display elements of hybridity, serving industry incumbents as well as new entrants as complementors. For example, Etsy sells crafted goods from a variety of sellers, including existing small businesses as well as individual new entrants, and Netflix hosts content created by existing film and television studios as well as self-created content. The extent to which a platform introduces new entrants vs. works with incumbent industry actors is an important factor that has implications for the effect of platform entry and penetration on incumbent establishments.

On digital distribution platforms, the platform organizer serves as an intermediary, facilitating the matching of buyers and sellers while extracting value from both sides of the market. However, where platforms differ from existing intermediaries is that they offer nearly unlimited "shelf space" and have sophisticated search and recommendation tools, enabled by the collection of high quality and granular consumer data (e.g., Brynjolfsson et al. 2011, Degeratu et al. 2000). Such features allow platforms to facilitate matching and reduce transactions costs more efficiently than traditional intermediaries, potentially resulting in increased value creation in the industry and allowing the platforms to extract a greater share of the value created (Lanzolla et al. 2020).

For the net effect of platform entry and penetration to be positive for industry incumbents, it must stimulate sufficient market expansion to overcome the loss in the share of value captured by the firms within an industry. Platforms create more value when the industry is characterized by heterogenous actors on both sides of the platform and high search and matching costs across buyers and sellers (Lanzolla et al. 2020, Schilling 2000), and in such markets, platforms may benefit industry actors as they stimulate significant market growth. Industry profitability may also play a role in shaping the net effect of platform penetration, as in some industries, firms may operate with little margin for error and be unable to withstand the entry of another actor into the value chain. Relatedly, the effect of platforms on an industry may depend on the price-sensitivity of consumers and suppliers. Platforms are known to pursue "seesaw" strategies that subsidize the more price-sensitive side of the market and pass along the costs of such subsidies to the other side (Dou and Wu 2021, Eisenmann et al. 2006). Given these contingencies, it is likely that the average effect of consumer-to-firm platform entry and growth on establishment survival will vary across industries.

Regardless of the average effect of platform penetration, the emergence of a digital distribution platform reshapes the strategic positioning of incumbents (Meyer and Cennamo 2019), and some establishments may find their competitive advantage destroyed and be forced to exit. However, certain establishments will be better able to weather the entry and growth of a digital distribution platform. In this paper, we propose a holistic theoretical perspective outlining how digital distribution platforms affect establishments within an industry. We do so by identifying what makes these platforms unique and distilling how these characteristics alter value creation and capture within an industry. Integrating literature on consumer search, adaptation, and the value-based strategy, we outline the pathways through which digital distribution platforms change what is valuable within an industry and identifies for which establishments the growth of such platforms may be more vs. less beneficial. First, we argue that the expanded "shelf space" on digital distribution channels combined with platform search and recommendation tools change how consumers search for and evaluate offerings within an industry (e.g., Brynjolfsson et al. 2011, Dinerstein et al. 2018, Lanzolla et al. 2020). Second, we suggest that the

emergence of digital distribution channels will differentially affect establishments based on whether their existing asset base is complementary to or redundant with the platform's service offerings (e.g., Cattani 2006, Tripsas 1997). Third, we argue that the introduction of the platform as an intermediary will place pressure on establishments' profit margins, ultimately harming establishments that are not well-resourced (e.g., Brandenburger and Stuart 1996, Farrell and Katz 2000).

In proposing these three channels to offer a holistic perspective, we develop a series of testable hypotheses. It is important to note that our proposed hypotheses do not represent all the ways that the processes outlined below may moderate the effect of digital distribution platforms on establishments. Instead, they represent a way for us to validate our overall theoretical framework within our empirical setting with the data available to us. Below, we discuss each pathway in more detail.

Changes to Consumer Search

Digital platforms facilitate matching across buyers and sellers, reducing consumer search costs (Lanzolla et al. 2020). On digital platforms, the very nature of search is altered. The expanded "shelf space" offered on platforms provides consumers with a variety of options to choose from (Brynjolfsson et al. 2011). By reducing geographic frictions and providing consumers with a wide variety of options, digital distribution platforms reduce search costs and establishment differentiation and intensify competition (Li and Wang 2020, Overby and Forman 2014). Further, digital platforms may affect the nature of search through the use of recommendations or other strategies that serve to direct consumption towards favored providers on the platform (e.g., Holtz et al. 2020, Lee and Hosanagar 2019, Raj 2022).

Digital platforms can reshape the distribution of consumption by fostering an environment that allows niche goods or services to find an audience, expanding the variety of goods and services that consumers are able to choose from (e.g., Brynjolfsson et al. 2011, Degeratu et al. 2000). The larger array of offerings combined with the dramatic reduction in consumer search costs brought about by the centralized nature of the platform search tools increase consumer exploration and discovery (Brynjolfsson et al. 2011, Oestreicher-Singer and Sundararajan 2012). Together, these characteristics can lead to an

environment that facilitates "long-tail" effects and allows establishments operating in niche market segments to thrive (e.g., Brynjolfsson et al. 2006, 2011, Oestreicher-Singer and Sundararajan 2012, Zhang 2018). Accordingly, establishments operating in less popular market segments may find that they are better able to take advantage of digital platforms relative to establishments occupying crowded market spaces.

> **H1a:** The relationship between digital distribution platform penetration and the likelihood of establishment exit decreases with market segment nicheness.

While digital platforms may help niche market segments be more visible and successful than they might otherwise be, within any given market segment such platforms may lead to industry consolidation around well-known and well-regarded incumbents (e.g., Hosanagar et al. 2014, Lee and Hosanagar 2019, Tan et al. 2017). When consumers are faced with a myriad of choices, they often default towards simplicity and familiarity (e.g., Armstrong et al. 2009, Degeratu et al. 2000, Iyengar and Kamenica 2010). Brand names are powerful signals of quality and familiarity that allow consumers to infer the benefits pertaining to a product (Nelson 1974) and brand recognition is a powerful predictor of consumer choice in online markets (Danaher et al. 2003, Degeratu et al. 2000, Ehrenberg et al. 1990). Recognizable establishments may be able to take advantage of their familiarity to consumers to attract more consumption and generate more value than their lesser-known peers on digital distribution platforms, while lesser-known establishments that are more likely to rely on the consumer experience, atmosphere, and service quality as competitive advantages (Sulek and Hensley 2004), may be disadvantaged as such differentiators are not visible to consumers on the platform.

> **H1b:** The relationship between digital distribution platform penetration and the likelihood of establishment exit decreases with establishment familiarity.

Re-Valuation of Strategic Assets

Based on their strategic positioning, establishments may have differentiated assets, routines, and capabilities and thus may experience industry change in different ways (Cattani 2006, Tripsas 1997). In some cases, industry change can destroy the value of existing assets and resources (e.g., Tushman and

Anderson 1986), while in other cases, such change can actually increase the value of a portfolio of assets and resources, either through foresight or because of luck (e.g., Cattani 2006, Tripsas 1997). As digital platforms emerge within an industry, they cause a revaluation of strategic assets that may result in new winners or losers.

Investment in assets tied to the legacy (rather than the emerging) market environment may make establishments less willing and able to adapt to a changing environment (Eggers and Park 2018). To adapt to industry change, establishments must re-configure their portfolio of resources, routines, and capabilities so that they fit with novel opportunities (Teece et al. 1997), as establishments that are heavily invested in assets suited towards the existing business model are likely to find that they are not appropriating as much value from these assets as expected (Caldecott and McDaniels 2014, Joskow 2006). Managers may be less capable of balancing their attention between the legacy and emerging environment if their portfolio of assets and capabilities is a poor fit for novel opportunity (Eklund and Kapoor 2019). Further, resource endowments are sticky in the short run (Teece et al. 1997), and even establishments that recognize the need to acquire or re-configure resources may be unable to do so in a timely manner (Eklund et al. 2022).

Based on the logic above, we hypothesize that prior investments and strategic positioning will moderate the effect of digital distribution platform penetration on establishment exit. Digital distribution platform penetration will be more detrimental for establishments who have invested heavily in assets that are less valuable within the novel platform ecosystem.

> **H2:** The relationship between digital distribution platform penetration and the likelihood of establishment exit increases with investment in assets suited towards the legacy business model.

Introduction of an Intermediary

As noted above, digital distribution platforms serve as intermediaries, facilitating the matching of buyers and sellers while extracting value from both sides of the market. By extracting value from the transactions that they facilitate, intermediaries can increase prices for consumers and/or place pressure on suppliers' profit margins (Chiang et al. 2003, Farrell and Katz 2000). Upon the entry of digital

distribution channels, establishments may be forced to operate with tighter margins and may have less margin for error in their operations.

Because of the pressure that they can place on establishments' operating margins, digital distribution platforms can reduce differentiation and create intense price competition (Li and Wang 2020, Overby and Forman 2014). This can create a challenging competitive environment for establishments that are not well-resourced. Establishments that have accumulated slack resources or operate with better efficiency may be better able to withstand pressure to their profit margins and thus weather the emergence of a digital distribution platform. This may be particularly important during the emergence of a digital distribution platforms, as platforms may pursue "seesaw" strategies that subsidize the more price-sensitive side of the market (often consumers) and pass along the costs of such subsidies to the other side as they attempt to grow rapidly (Dou and Wu 2021, Eisenmann et al. 2006).

> **H3:** The relationship between digital distribution platform penetration and the likelihood of establishment exit decreases with establishment financial resources.

Setting, Data, and Methodology

Empirical Setting

We study the effect of digital distribution platforms using the restaurant industry as a setting. Since the mid-2000s, the restaurant industry has been transformed by the entrance of food delivery platforms, such as Grubhub, DoorDash, Postmates, and UberEATS. Despite the relative novelty of this business model, online food delivery platforms have exceeded $120 billion in gross revenues and continue to grow at a rapid rate (Wang 2019). Food delivery platforms rely upon professional restaurants as the complementors within their platform ecosystem. Because of this, existing establishments within the industry are not necessarily competing against platform offerings, but rather work with the platform to create value, making this an attractive setting to study how the growth of a digital distribution platform affects establishments within an industry.

Restaurant delivery platforms enable restaurants to engage in delivery and takeout business without constructing their own ordering platform or delivery logistics. In exchange for facilitating these

transactions, most platforms charge a commission in the range of 15-30 percent for each order, leaving the restaurant with the remaining revenue on each item sold (Restaurant Engine 2020). While platforms are potentially able to increase opportunity for restaurants by facilitating growth through the delivery and takeout market, they are controversial with restaurant owners, as the platforms can place pressure on the already thin profit margins in the restaurant industry and strain in-person restaurant operations (Feldman et al. 2021).

Data

To identify the effect of food delivery platforms on restaurants in the United States, we require data on the entry and penetration of food delivery platforms across the country and establishment-level data on restaurants.

To identify entry and penetration of food delivery platforms across geographies, we rely upon data obtained from Second Measure (Bloomberg Second Measure 2022). Second Measure analyzes anonymized purchase data using a panel of over three million consumers to provide insight on consumer behavior and purchasing patterns across the United States. Using this data, Second Measure has provided us with a measure of penetration, calculated as the percent of consumers within a CBSA that have recorded transactions with each of the four largest food delivery platforms (Grubhub, Postmates, UberEats, and DoorDash) from 2012 through 2020 for all CBSAs in the United States. The Second Measure panel is a representative dataset of the U.S. consumer population and should be a reasonable proxy for consumer platform use across geographies. To measure of platform penetration, we consider the maximum penetration across the four considered services within a CBSA in a given year.[1] We focus on maximum penetration because each CBSA tends to have a single dominant platform, but which platform dominates varies by CBSA. Figure 1 presents a binned scatterplot showing the growth of delivery platform penetration across the time period studied in this project (2012-2018). Platform penetration

[1] The Second Measure data records market penetration for Grubhub and Postmates in every year of the sample, for DoorDash starting in 2013, and for UberEats starting in 2017. Results are robust to using the average penetration across these four major services within the CBSA in a given year. See *Appendix Tables A3* and *A4*.

grows gradually from 2012 through 2017 before experiencing a sharper increase from 2017 to 2018. Across the sample, the mean value of platform penetration is 1.7%, though in the last year of the sample (2018), it reaches 4.5% and is higher than 20% in some CBSAs by 2018.

To measure restaurant-level outcomes, we use establishment-level restaurant data from the National Establishment Time Series (NETS) database. The NETS data is collected and organized by Dun and Bradstreet. The data consist of establishment-level longitudinal microdata covering the vast majority of U.S. businesses and have been used as an alternative to the U.S. Census data in studies in management, economics, and finance that seek to study the performance of establishments across the United States. (e.g., Becerra et al. 2020, Hegde et al. 2021, Levine and Toffel 2010, Neumark et al. 2010). The NETS data is organized at the establishment-year level and includes all years from 1990 through 2019. We use observations from NETS corresponding with SIC codes 5812 (Eating Places) and 5813 (Drinking Places). We exclude caterers, commissaries, and contract food services.

Our sample consists of the overlapping establishment-years within the NETS and SecondMeasure data. The data are comprised of the population of U.S. restaurant establishments from 2012 through 2018, inclusive. Observations from 2019 are excluded as we are unable to determine which restaurants exited in that year. We also exclude restaurants that we are unable to link to a core Metropolitan or Micropolitan Statistical Area as well as establishments that have relocated during their lifespan. The composite dataset consists of approximately 3.6 million restaurant-year observations for over 770,000 establishments, spanning 924 CBSAs.

While the NETS data includes sales and employment figures for its sample of restaurants, such data is often imputed, especially for smaller establishments, and may not be reliable (Barnatchez et al. 2017). As such, we focus on restaurant survival as the dependent variable at the restaurant-level. Exit is defined as the last year of existence in the NETS database. Using the NETS data, we also construct measures of restaurant entry and exit at the CBSA-level. We construct the rate of new restaurant entry as the count of new establishments in a given year divided by total count of restaurants in the previous year,

the rate of restaurant exit as the count of exits in a given year divided by total count of restaurants in the previous year, and the entry-to-exit ratio as the count of entries divided by the count of exits.

We examine the baseline relationship between digital distribution platform penetration and restaurant exit and then consider moderation as outlined in the hypotheses above. To test H1a, which predicts that the effects of digital distribution platforms will be less detrimental to establishments in niche market segments, we construct a measure of "Cuisine prevalence" that measures the relative prevalence of the different cuisine-types in our data at the CBSA-year level (calculated as the percent of restaurants alive within the CBSA in the year that are categorized as belonging to cuisine *i*). We sort restaurants into cuisines using their name and the eight-digit SIC code assigned by NETS.[2] A lower cuisine prevalence suggests that the restaurant is operating in a less prevalent or niche market segment. We expect digital distribution platform penetration to be more likely to lead to exit for establishments operating in more prevalent cuisine market segments.

To test H1b, which predicts that the effects of digital distribution platforms will be less detrimental to recognizable establishments, we identify older and multilocation restaurants within the sample, as older restaurants that are entrenched in their community and chain or franchised restaurants are both likely to be more recognizable and familiar to consumers. We construct the variable "Age" as the difference between the year *t* and the founding year of the restaurant according to the NETS data. To identify multilocation restaurants ("Multilocation"), we rely first on the NETS chain vs. standalone designation, and then supplement this classification using name matching. In addition to the restaurants designated as chains by NETS, we classify any establishment that shares its name with 10 or more other establishments as a multilocation restaurant to account for franchises where there are multiple locations

[2] To classify restaurants into cuisines, we use restaurant names in the NETS data and tag restaurants based on a list of words common to different cuisine types. This allows us to generate cuisine classifications for roughly 40% of sample restaurants. For the remainder, we use the SIC8 codes to sort restaurants into cuisines. The SIC8 code does not provide sufficient information to identify a cuisine classification for roughly 20% of restaurants in the sample. These restaurants are coded as having an "Unclassified" cuisine and are included in the main analysis (results are robust to their exclusion). For the main analysis, we use the following cuisines: American; European; Bars, Taverns, and Clubs; East Asian; Fast Food; Ice Cream or Frozen Desserts; Mexican and Latin American; Seafood; South and Southeast Asian; Steak or BBQ; and Unclassified.

under different ownership. We expect digital distribution platform penetration to be less likely to lead to exit for older and multilocation establishments.

To test H2, which predicts that digital distribution platforms will be more detrimental to establishments who have invested in assets suited towards the existing business model, we examine the moderating role of investment in physical real estate and establishment location. As retail establishments transition from an only brick-and-mortar business model to more reliance on online sales: a) physical retail spaces lose value, and b) location considerations may change as stores depend less on in-person traffic. Further, rent and real estate costs are the highest non-variable expense for restaurants (Decker 2019), meaning that such investments are costly and sticky in the short-term. While we do not have data on real estate prices for individual restaurants in the data, we proxy for the investment in the retail space using the log average median home value at the ZIP-code level using data from the U.S. Census American Community Surveys (ACS). We standardize this variable such that it has a mean value of zero and a standard deviation of one ("Real estate prices"). We examine the role of restaurant location using data on accessibility from the National Walkability Index ("Walkability index") constructed by the U.S. Environmental Protection Agency (U.S. EPA 2021). We expect digital distribution platform penetration to be more likely to lead to exit for establishments who face higher real estate costs and for those in more walkable areas, as the value of prime real estate locations should decline as more transactions are carried out online.

Finally, to test H3, which predicts that digital distribution platforms will be less detrimental to establishments with greater financial resources, we construct a proxy for an establishment's financial health, calculated as estimated revenue-per-employee, using the NETS data ("Revenue-per-employee"). This measure captures operational efficiency, which serves as a proxy for the profitability and financial resources of an establishment. We expect digital distribution platform penetration to be more likely to lead to exit for establishments with a lower average revenue-per-employee.

In addition to these moderator variables, we construct multiple control variables to use in the analysis. We first include the main effects for each moderator variable, which allows us to control for the

fact that exit rates may vary based on market segment ("Cuisine prevalence"), the track record of success for the firm ("Age", "Multilocation", "Revenue-per-employee"), and key elements of cost and resource structure ("Real estate prices", "Walkability index"). In addition, we control for restaurant cuisine through cuisine fixed effects to control for variations in competition across cuisine segments. To control for the attractiveness of a given market and local economic and demographic conditions, we control for median income and population at the county-level using data from the U.S. Census. We also control for local restaurant density and for restaurant accessibility. Table 1 presents summary statistics for the variables used in the analyses and the *Appendix* contains the full set of variables used along with their definitions.

We start by exploring model-free evidence of the relationship between digital distribution platform penetration and establishment entry and exit using data at the CBSA-level. In Figure 2, we present a binned scatter plot showing the relationship between delivery platform penetration and restaurant entry rates, exit rates, and the ratio of entry-to-exit from 2012 to 2018 with the inclusion of CBSA and year fixed effects. Figure 2 presents preliminary evidence that delivery platform penetration has no relationship with restaurant entry rates (Panel A) but appears to have a positive relationship with exit rates (Panel B), and a negative relationship with entry-to-exit ratios (Panel C).[3] These results provide preliminary evidence that digital distribution platform penetration increases the likelihood of restaurant exit but has no compensatory positive effect on entry.

Estimation Strategy

In this study, we examine the relationship between the penetration of restaurant delivery platforms and restaurant exit. We estimate the likelihood of restaurant exit using a Cox proportional hazard model to account for right censoring in the data (Greene 2003).

$$Exit\ hazard_{ijt} = h\left(t \middle| Platform\ Penetration_{jt}, C_{ijt}, Year\ FE_t, Cuisine\ FE_k\right)$$

[3] All patterns persist with regression analysis including controls for economic and demographic conditions (see *Appendix Table A1*), with and without the instrumental variables estimation strategy discussed later in the draft.

$$= h_0^j(t)\exp(\beta_1 Platform\ Penetration_{jt} + \beta_2 C_{it} + Year\ FE_t + Cuisine\ FE_k) \quad (1)$$

In this equation, *i* indexes the establishment, *j* indexes the CBSA, *t* indexes the year, and *k* indexes cuisine. The exit hazard captures the instantaneous rate of exit, defined as the probability that an establishment exits in the next time interval, Δt, conditional on not yet having exited. $h_0^j(t)$ is the baseline hazard common to restaurants within CBSA *j*. By stratifying the baseline hazard by CBSA, we allow the baseline hazard to vary by location, allowing for different baseline survival probabilities across geographies. *Platform Penetration* measures the penetration of restaurant delivery platforms into the CBSA each year. *C* refers to the vector of establishment-year controls. *Year FE* refers to year fixed effects (which allow us to control for common time effects). To identify how platform penetration affects the hazard of restaurant survival, we will examine whether *Platform Penetration* predicts the hazard of exit. To test hypotheses 1-3, we interact *Platform Penetration* with the moderator variables *Cuisine prevalence* (H1a), *Age* (H1b), *Multilocation* (H1b), *Real estate prices* (H2), *Walkability index* (H2), and *Revenue-per-employee* (H3).

Because platform penetration may be affected by observable or unobservable factors which may also influence measures of restaurant performance, there may be concerns that the estimates obtained from the analysis above cannot be interpreted causally. As a first step to address these concerns, the models control for observable factors that plausibly could be related both to platform penetration at the CBSA-level as well as restaurant performance at the establishment-level. However, while this may address concerns about the most obvious confounding factors, these estimates still be biased, as unobservable CBSA-level characteristics may also affect both platform penetration as well as restaurant performance. To address such concerns, we utilize an instrumental variables estimation strategy that links digital distribution platform presentation with historical road density within a locality. We discuss this estimation strategy in more detail and present the results resulting from this analysis following the presentation of our main results.

Results

Main Results

In Table 2, we present the estimates of the effect of digital distribution platform on the hazard of exit using the Cox hazard estimation discussed above. Column 1 stratifies the baseline estimated hazard at the CBSA-level and conditions only on platform penetration and year, column 2 adds in fixed effects at the cuisine-level and controls for multilocation status and revenue-per-employee, column 3 adds in controls for local demographic and economic conditions, and column 4 adds in controls for local market conditions and establishment accessibility. Across all considered models, we find a positive and statistically significant relationship between platform penetration and the likelihood of restaurant exit. The fully-specified estimates suggest that a one-percentage point increase in platform penetration is associated with a 1.6 percent increase in the hazard of exit for sample restaurants ($HR = 4.722$, $p < 0.001$). This suggests – maybe unsurprisingly – than any benefits existing restaurants receive from increased access to consumers brought by the delivery platforms is outweighed by the substantial fees those platforms extract from their restaurant complementors.

We next turn to testing our hypotheses outlining the distributional effects of digital distribution platforms. To do so, we interact each of the moderator variables outlined above with the measure of platform penetration and test for significance in the interaction effect. The results of this analysis are presented in Table 3.

We first examine how cuisine prevalence moderates the effect of platform penetration on the likelihood of restaurant exit to test whether digital distribution platforms are less detrimental for establishments operating in niche market segments (H1a). In column 1, we show that cuisine prevalence positively moderates the relationship between platform penetration and the likelihood of establishment exit ($HR = 501.828$, $p = 0.014$), providing support for H1a. To contextualize the size of this effect, we calculate the marginal effect of a one percentage point increase in platform penetration at different values of cuisine prevalence. According to the hazard estimates, a one percentage point increase in platform

penetration is associated with a 1.2 percent increase in the likelihood of exit for a low cuisine prevalence establishment (25th percentile) relative to a 2.0 percent increase for a high cuisine prevalence establishment (75th percentile).

We next examine how establishment age and multilocation status moderates the effect of platform penetration on the likelihood of exit to test whether digital distribution platforms are less detrimental for establishments that are more familiar to consumers (H1b). We find partial support for H1b. In column 2, we show that the relationship between digital distribution platform penetration on the likelihood of exit is weaker for older establishments ($HR = 0.545$, $p < 0.001$). A one percentage point increase in platform penetration is associated with a 3.9 percent increase in the likelihood of exit for a two-year old establishment (25th percentile) but has no meaningful relationship with the likelihood of exit for an eight-year old establishment (75th percentile). However, in column 3, we fail to find evidence that multilocation status moderates the effect of digital platform penetration on the likelihood of establishment exit (H1b: $HR = 1.043$, $p = 0.914$). This null result persists with alternate definitions of the multilocation status variable (*Appendix Table A1*), but we do find the predicted interaction effect in the instrumental variables estimation as well as some of the robustness tests contained in the *Appendix.*

In columns 4 and 5, we consider how investment in assets suited towards the legacy business model moderates the relationship between digital distribution platform penetration and establishment exit (H2). We find evidence that that greater investment in expensive physical retail ($HR = 1.028$, $p < 0.001$) and restaurant accessibility ($HR = 1.029$, $p = 0.039$) both positively moderate the relationship between digital distribution platform penetration and establishment exit, providing support for H2. The hazard estimates suggest that a one percentage point increase in platform penetration is associated with an increase in the likelihood of exit of: a) 1.0 percent for restaurants located in areas with low real estate prices (25th percentile) vs. 1.5 percent for restaurants located in areas with high real estate prices (75th percentile); and b) 1.4 percent for restaurants with a low walkability index (25th percentile) vs. 1.6 percent for restaurants with a high walkability index.

Finally, we examine how financial resources may moderate the effect of a digital distribution platform by providing establishments with the means to weather the introduction of a novel intermediary (H3). The results of this analysis are displayed in column 6 of Table 3. We find evidence that revenue-per-employee negatively moderates the relationship between digital distribution platform penetration and the likelihood of establishment exit ($HR = 0.826$, $p < 0.001$). The hazard estimates suggest that a one percentage point increase in platform penetration is associated with a 1.8 percent increase in the likelihood of exit for restaurants at the 25th percentile of revenue-per-employee, and has no meaningful effect on restaurants at the 75th percentile of revenue-per-employee. We graphically display the marginal effects of platform penetration on the hazard of exit across all considered moderators in Figure 3.

Instrumental Variables Estimation

While the results presented thus far outline a relationship between digital distribution platform penetration and establishment exit controlling for a number of economic, demographic, and restaurant-level characteristics, there may be concerns that this relationship is correlational rather than causal, as there may be unobservable CBSA-level characteristics correlated with both the penetration of digital distribution platforms and the likelihood of establishment exit. To address such concerns, we show that our results persist with an instrumental variables (IV) estimation strategy that uses historical road density to predict the growth in platform penetration over time.

An IV estimation relies on the use of an instrument that is correlated with the independent variable but has no direct effect on the outcome of interest. If these conditions are met, the instrumental variables strategy can be used to estimate the causal effect of the independent variable on the outcome of interest (Greene 2003). We instrument for growth in platform penetration at the CBSA-level using historical road density. Areas with greater road density are likely to be more travelable and to have greater broadband internet availability (Kolko 2012), both of which are likely to increase delivery platform penetration. For data availability reasons, we rely upon road density estimates from 2003 and construct a CBSA-level measure of road density by averaging across ZIP codes within a CBSA (Kolko 2012). As the

road density value is time invariant, we interact the road density values with a year trend to generate an instrument that allow for heterogeneous impacts across time (Chan et al. 2016). This is valid in this setting as historical road density does not just affect platform penetration in a cross-section but influences the growth of platform penetration over time (see, for example, Chan et al. 2016, Forman and Zeebroeck 2012, Stevenson 2008).

For an instrument to be valid, it must satisfy two conditions. First, the instrument must meet the relevance condition, which states that the instrument must have a strong relationship with the independent variable. We find a strong first-stage relationship between the instrument and platform penetration, suggesting that the relevance condition is met. Areas with greater historical road density exhibit faster growth of delivery platform penetration over time and the fully-specified first-stage model for the main effect has an *F*-statistic well over the rule of thumb value of 10 ($F = 89.0$).[4] Second, the instrument must meet the exclusion restriction, which states that the instrument must only affect the outcome variable through the treatment variable. We argue that this is the case. By using historical road density data, we do not capture changes in road density over time that may be driven by local economic conditions during the sample period (e.g., faster growing areas may see sharper increases in road density). To the extent that historical road density is linked to unobservable CBSA-level characteristics, the considered models include CBSA fixed effects. While historical road density may be indirectly related to restaurant exit through its relationship with urban development or economic characteristics, we account for such effects by including the controls discussed above to capture demographic and economic characteristics. Further, to the extent that road density affects survival through restaurant accessibility and neighborhood characteristics, controlling for the walkability index should account for such effects.

To conduct the IV estimation, we use linear probability models. The dependent variable is a binary variable set equal to one in the year that the restaurant exits.[5] Since interaction terms in IV models

[4] See *Appendix Table A3* for first-stage estimates.
[5] The IV analysis excludes one CBSA (the Bainbridge, GA CBSA) for which we do not have data on road density. In draft tables for the IV analysis, we present the root mean squared error as a measure of fit rather than R-squared values, as R-squared values can be skewed and uninformative for IV estimation.

require separate IVs for each main effect and interaction effect (meaning the need for many instruments), we conduct subsample analyses, splitting the sample into top and bottom quartile establishments for all continuous variables considered as moderators and splitting the sample by establishment type for multilocation status.

In Table 4, Panel A, we present estimates from the IV linear probability model estimating the main effect of digital distribution platform penetration on the likelihood of establishment exit. The estimate in the fully-specified model in column 4 suggests that a one percent increase in platform penetration increases the likelihood of exit by 0.2 percentage points ($p < 0.001$). This represents a 3.2 percent increase when scaled by the unconditional sample mean likelihood of exit. In Table 4, Panel B, we present the IV subsample analyses to examine the heterogeneous effects of digital distribution platform penetration on establishment exit. The results are supportive of our hypotheses. We find that platform penetration has a larger effect on the likelihood of exit for: high vs. low cuisine prevalence restaurants (columns 1 and 2, H1a), independent vs. multilocation restaurants (columns 6 and 7, H1b; note that we did not find a meaningful interaction with multilocation status in the main analysis), restaurants located in areas with high vs. low real estate prices (columns 8 and 9, H2), high vs. low walkability restaurants (columns 10 and 11, H2), and low vs. high revenue-per-employee restaurants (columns 12 and 13, H3). While we see little difference in the size of the effect of platform penetration on bottom quartile and top quartile establishments based on age, we see that the effect of platform penetration on establishment exit is lower for top quartile establishments compared to bottom three quartile establishments (columns 3-5, H1b). This result may suggest that the moderating effects of age as it shapes consumer familiarity takes a while to emerge and may also reflect that fact that very young restaurants that open during the sample period may be better able to optimize their strategies for the platform ecosystem. Taken together, we believe these results provide additional support for our results and help address concerns regarding endogeneity.

Ex-Post Analysis: Threshold Effects

In additional analysis, we explore whether the effect of digital distribution platforms on the likelihood of establishment exit is present across different levels of platform penetration or only emerges at certain thresholds. We briefly describe these results below, before discussing the more detail in the *Appendix.* Across our sample localities, we document significant heterogeneity in the penetration of restaurant delivery platforms – at the end of our sample, platform penetration remains at 0 percent in a number of CBSAs, while is higher than 20 percent in others). We split CBSAs into quartiles depending on platform penetration in 2018. We examine the main effect of platform penetration on exit on the likelihood of exit across subsamples defined by these quartiles. The results of this analysis (*Appendix Table A4*) suggest that the effect of platform penetration on establishment exit emerges only at higher levels of platform penetration. This result adds important nuance to our findings, as it suggests that the effects of digital distribution platforms on industry establishments only manifest in a strong and consistent manner once penetration passes a certain threshold and the platform enters the mainstream.

Robustness

We conduct a number of tests to evaluate the robustness of the relationship between platform penetration and establishment exit. For concision, we describe these tests briefly below. While these robustness tests largely provide confidence in our main results, we document some discrepancies across various specifications. We discuss such discrepancies in more detail in the *Appendix*.

We show that our results are largely consistent using a linear probability model rather than a Cox hazard model (*Appendix Table A5*) and also show that results largely persist using either the average penetration across the four platforms for which we have consumer use data and the lagged maximum penetration across the four platforms for which we have consumer use data as our main independent variable (*Appendix Table A6*). Results persist when excluding restaurants for which we are unable to identify a cuisine classification (*Appendix Table A7*). To address concerns that our results may instead capture the rise of other Internet-based services that may affect the restaurant industry (e.g., Yelp! or

Google Reviews), we consider analyses that include a control for the percent of households with access to Internet service within a CBSA in a given year. While this data is unavailable for all sample CBSAs and is only available from 2013 onwards, we find consistent results with the inclusion of this control (*Appendix Table A8*). Finally, we investigate whether these effects differ by platform considered in our sample and show that consistently, across the four considered services, platform penetration is associated with an increased likelihood of establishment exit (*Appendix Table A9*).

Discussion

In this study, we propose and test holistic theory that outlines how the emergence of a digital distribution platform affects establishments within an industry. We argue that digital distribution platforms affect establishments through three different pathways: a) by changing the nature of consumer search; b) by revaluating strategic assets; and c) by introducing an intermediary into the value chain. In a study of the U.S. restaurant industry, we present evidence that the emergence of digital distribution platforms has increased the likelihood of restaurant exit. Further, we provide empirical support for the heterogeneous effects of digital distribution platforms on establishments within an industry.

This research adds to a body of work that seeks to understand how digital platforms affect industry incumbents (e.g., Cramer and Krueger 2016, Farronato and Fradkin 2018, Seamans and Zhu 2014, Zervas et al. 2017). Distinct from existing literature which studies how peer-to-peer or sharing economy platforms can affect industry dynamics, we focus on the entry and growth of digital distribution platforms. Our findings reveal similarities and differences across these kinds of platforms. For both kinds of platforms, strategic positioning of incumbents plays an important role in determining the effect of platform penetration on establishment performance. On the other hand, while the emergence of peer-to-peer platforms allows small, new entrants to grab a foothold within the market (Barzilay et al. 2018), the emergence of digital distribution platforms appear more likely to lead to industry consolidation by well-known or well-resourced establishments. By identifying which factors moderate the relationship between such platforms and establishment survival, we shed light on the characteristics and resources that may be

more or less valuable within a newly created platform ecosystem (Kapoor and Agarwal 2017, Meyer and Cennamo 2019) and contribute to a growing body of work that considers how digital platforms affect competitive dynamics in the industries in which they enter (e.g., Boudreau 2010, Miric et al. 2019, Rietveld and Eggers 2018). This project highlights the tension between the value creation opportunities and value capture challenges that digital platforms pose to industry actors (Wang and Miller 2020).

This work has limitations that offer opportunities for future research. As this study focuses on one empirical context, there may be limits to how generalizable these results are to other settings. Perhaps for other goods where platforms lower the cost of consumption more dramatically, the growth in value creation may outweigh the loss in the share of value captured and thus the emergence of digital distribution platforms may have a positive relationship with establishment survival. In other settings where the platform makes a concerted effort to facilitate consumer discovery, the changes in search facilitated by the platform may benefit younger or independent establishments. Further, in industries where participation in the platform ecosystem requires a more drastic shift in strategies or business models, the platforms may create different winners or losers (e.g., perhaps young establishments that have less inertial tendencies would benefit in such settings).

As this research largely assumes that the effects of platform penetration are homogenous across platforms, future work could also examine heterogeneity across different platform firms to examine how specific platform strategies can mitigate or exacerbate the effects documented here. Further, research could extend this study to examine the effects of digital distribution platform penetration beyond the period of platform entry and initial growth. In addition, this work does not address which establishments choose to co-operate with the digital distribution platform or what the implications of such cooperation are. While promising strides are being made in this area (Li and Wang 2020), further work is needed to identify the costs and benefits of platform participation for establishments , especially as platforms offer an increasingly differentiated set of services, which may result in very different effects upon adoption.

Nevertheless, this work has important practical implications for market participants as well as policymakers. The spread of platforms across industries and markets has been unyielding, and actors

across a variety of industries will have to navigate the transition to a platform ecosystem. This work suggests that platform organizers and policymakers must be cognizant that such platforms may have negative consequences for some industry incumbents. Understanding the consequences of platforms for industry actors is crucial to implementing policies that allow such platforms to increase value creation and benefit consumers, while mitigating the deleterious effects on existing industry actors and preventing anti-competitive outcomes.

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Figure 1. Delivery Platform Penetration Over Time.

The figure shows a binned scatter plot of delivery platform penetration from 2012 through 2018. Data points are grouped into twenty equally-sized bins and an aggregate statistic is used to summarize each bin.

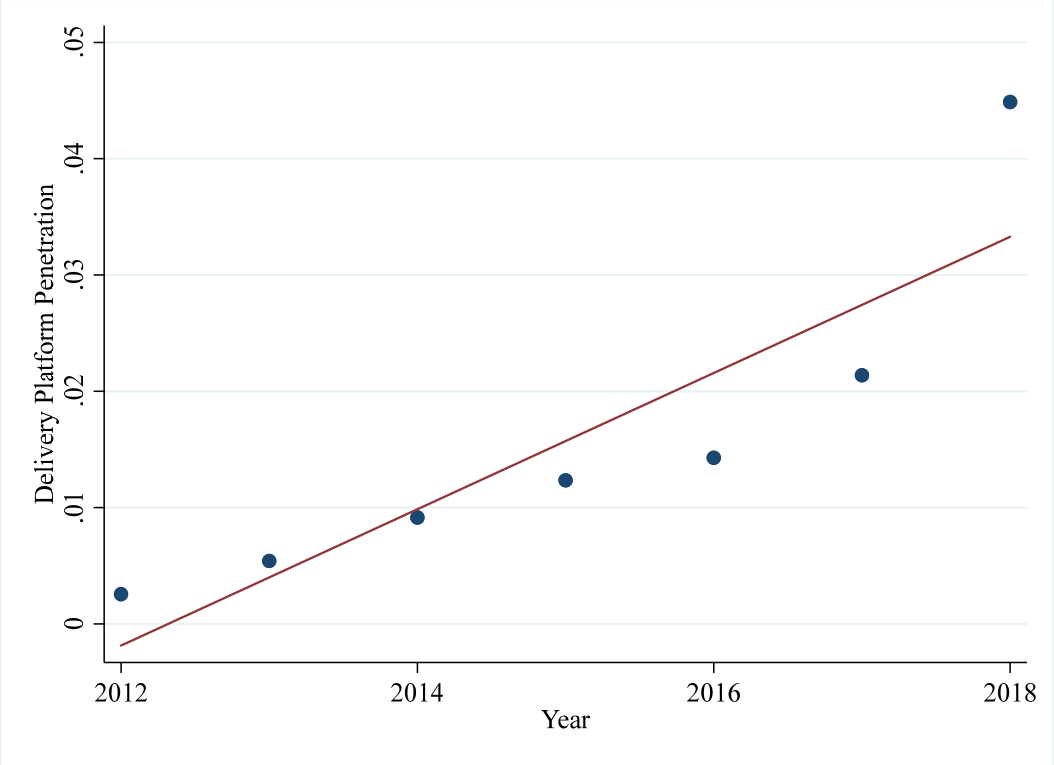
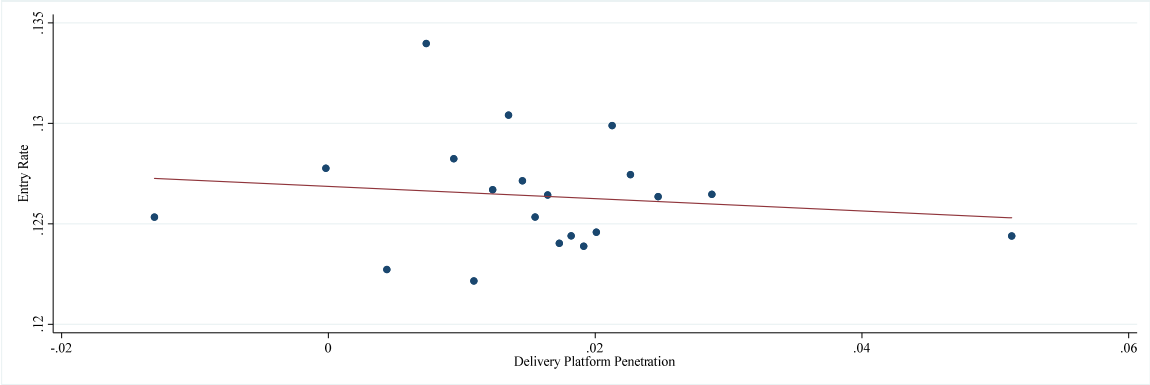


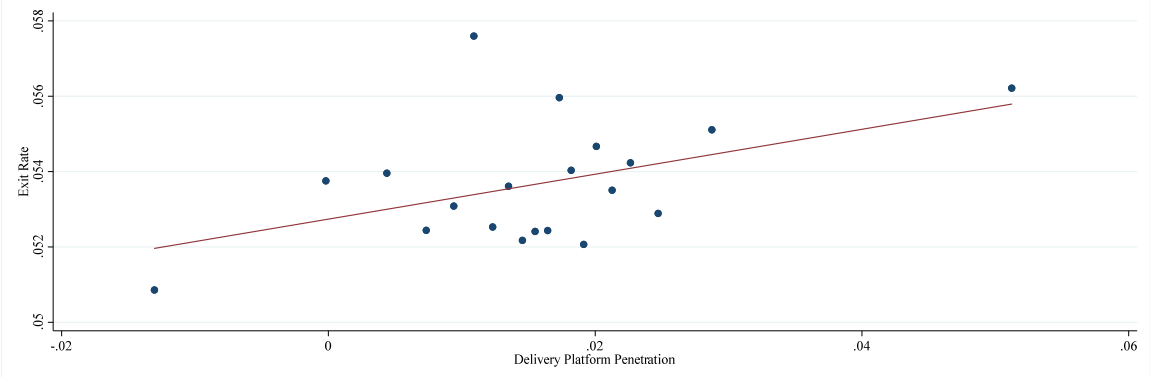
Figure 2. Delivery Platform Penetration and CBSA-Level Entry Rates, Exit Rates, and Entry-to-Exit Ratios.

The figure shows a binned scatter plot of delivery platform penetration and CBSA-level entry rate (Panel A), exit rate (Panel B), and CBSA-level entry-to-exit ratio (Panel C) with CBSA and year fixed effects. Data points are grouped into twenty equally-sized bins and an aggregate statistic is used to summarize each bin.

Panel A. Entry rates



Panel B. Exit rates



Panel C. Entry-to-exit ratio

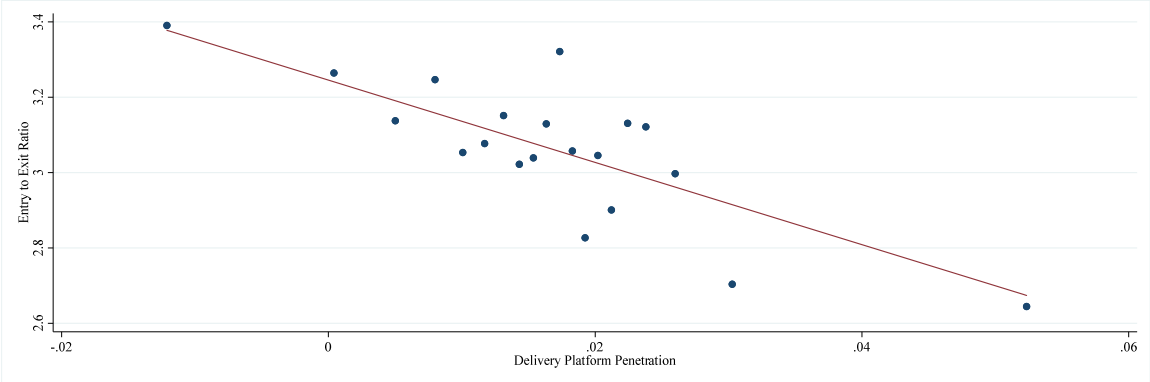
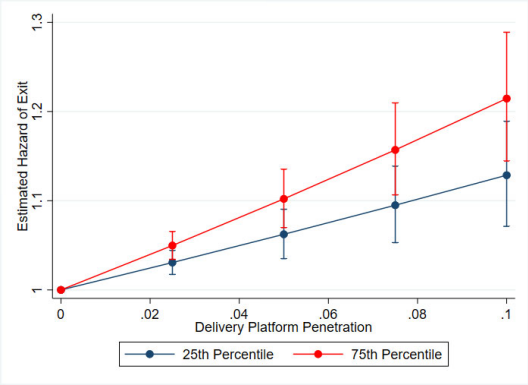


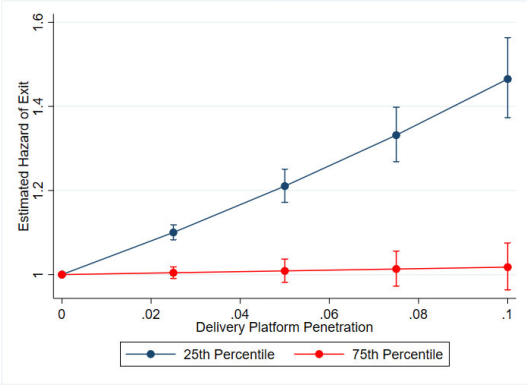
Figure 3. How Do Age, Multilocation Status, and Investment in Legacy Assets Moderate the Effect of Delivery Platform Penetration and Hazard of Restaurant Exit?

This figure plots the marginal effect of an increase in delivery platform penetration on restaurant exit for: restaurants at the 25th age percentile and 75th age percentile (Panel A); standalone vs. multilocation establishments (Panel B); pizza restaurants vs. all other restaurants (Panel C); fast food restaurants vs. all other restaurants (Panel D); restaurants in locations with high (75th percentile) and low (25th percentile) real estate prices; and restaurants with high (75th percentile) and low (25th percentile) revenue-per-employee. The dots display point estimates, and the brackets display 95% confidence intervals. The results underlying these figures are displayed in Table 5.

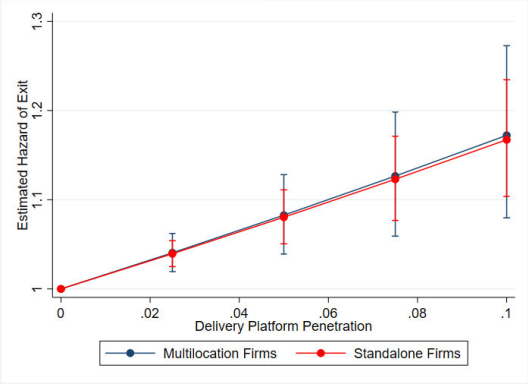
Panel A. Moderating effect of cuisine prevalence.



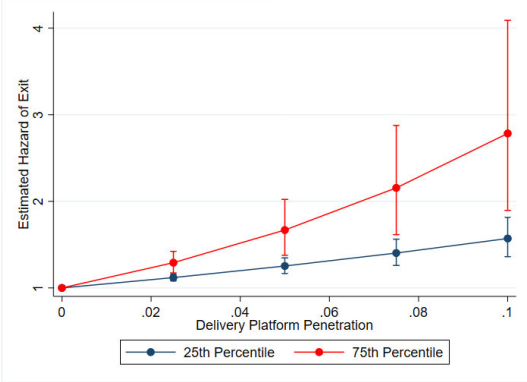
Panel B. Moderating effect of age.



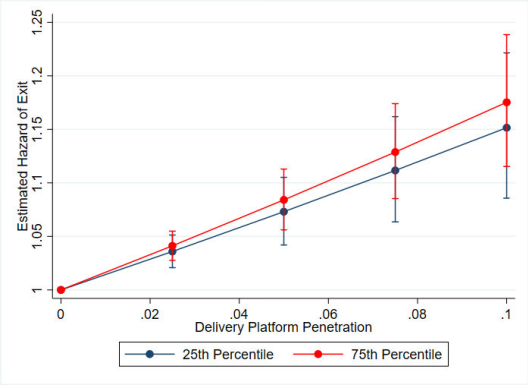
Panel C. Moderating effect of multilocation status.



Panel D. Moderating effect of local real estate prices.



Panel E. Moderating effect of restaurant walkability.



Panel F. Moderating effect of revenue-per-employee.

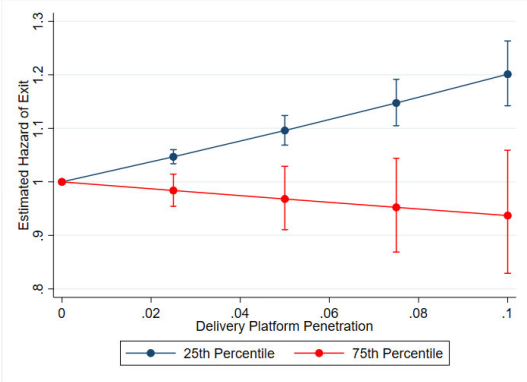


Table 1. Summary Statistics.

The table reports summary statistics for sample CBSAs and restaurants from 2012 through 2019 for the main independent and dependent measures and control variables.

Panel A. CBSA-level statistics		
Number of CBSAs		924
Platform penetration	mean	1.7%
	st.dev.	2.5%
Road density	mean	0.003
	st.dev.	0.002
Entry rate	mean	12.5%
	st.dev.	5.2%
Exit rate	mean	5.8%
	st.dev.	3.2%
Entry-to-exit ratio	mean	3.1
	st.dev.	2.7
Population	mean	352,808
	st.dev.	1,131,032
Median per-capita income	mean	$41,194
	st.dev.	$10,206

Panel B. Restaurant statistics		
Number of unique restaurants		776,841
Multilocation indicator		
Standalone establishment		598,298
Multilocation establishment		178,543
Panel C. Restaurant-year statistics		
Exit	mean	5.1%
	st.dev.	22.0%
Platform penetration	mean	5.6%
	st.dev.	5.7%
Road density	mean	0.007
	st.dev.	0.003
Age	mean	6.3
	st.dev.	7.1
Revenue-per-employee (*thousands*)	mean	$31.3
	st.dev.	$11.7
Median housing prices (*thousands)*	mean	$282.9
	st.dev.	$210.7
Restaurant density	mean	1.9
	st.dev.	0.7
Cuisine prevalence	mean	14.0%
	st.dev.	7.3%
Walkability index	mean	11.9
	st.dev.	4.3

Table 2. Delivery Platform Penetration and Hazard of Restaurant Exit.

The table reports the results of estimating equation (1) to examine how delivery platform penetration affects the hazard of restaurant exit. All specifications are estimated using Cox proportional-hazard models stratified at the CBSA-level to allow for differing baseline hazard models across CBSAs. The table reports hazard ratios rather than coefficients; a hazard ratio above (below) 1 indicates that the covariate has a positive (negative) relationship with the probability of exit. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
Dependent variable:	Exit	Exit	Exit	Exit
Platform penetration	4.879***	4.799***	5.489***	4.722***
	(1.302)	*(1.256)*	*(1.472)*	*(1.302)*
Multilocation establishment		0.723***	0.719***	0.723***
		(0.009)	*(0.009)*	*(0.009)*
Revenue-per-employee		0.988***	0.988***	0.988***
		(0.001)	*(0.001)*	*(0.001)*
Log population			0.991	1.001
			(0.006)	*(0.009)*
Log median income			0.885***	0.860***
			(0.014)	*(0.015)*
Standardized real estate prices			0.997***	0.997***
			(0.001)	*(0.001)*
Restaurant density				1.028
				(0.020)
Cuisine prevalence				2.907***
				(0.379)
Walkability index				0.990***
				(0.001)
CBSA stratification?	Yes	Yes	Yes	Yes
Cuisine fixed effects?	No	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes
Number of restaurants	776,841	698,022	693,943	693,943
Restaurant-year observations	3,585,331	3,103,033	3,074,142	3,074,142

Table 3. Heterogeneous Effects of Delivery Platform Penetration and Hazard of Restaurant Exit

The table reports the results of estimating a modified version of equation (2) to examine how delivery platform penetration affects the hazard of restaurant exit and to identify explore the factors that moderate this effect. All specifications are estimated using Cox proportional-hazard models stratified at the CBSA-level to allow for differing baseline hazard models across CBSAs. All specifications also include the full suite of controls included in Table 2, column 4. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	2.014**	153.424***	4.694***	1.745	3.234***	610.966***
	(0.575)	*(55.170)*	*(1.341)*	*(0.615)*	*(1.196)*	*(656.805)*
Platform penetration x…						
Cuisine prevalence	501.828***					
	(622.539)					
Age		0.545***				
		(0.013)				
Multilocation establishment			1.043			
			(0.410)			
Standardized real estate prices				1.028***		
				(0.006)		
Walkability index					1.029**	
					(0.014)	
Revenue-per-employee						0.826***
						(0.036)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
CBSA stratification?	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Number of restaurants	693,943	693,943	693,943	693,943	693,943	693,943
Restaurant-year observations	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142

Table 4. IV Estimates of the Effect of Delivery Platform Penetration on Restaurant Exit.

The table reports the results of estimating a modified version of equation (1) to examine how delivery platform penetration affects the hazard of restaurant exit and to explore the factors that moderate this effect using the IV estimation strategy outlined in the draft. Panel A estimates the main effect of delivery platform penetration. Panel B explores heterogeneity in the effect using subsample analyses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Main effect.

	(1)	(2)	(3)	(4)
Dependent variable:	Exit	Exit	Exit	Exit
Platform penetration	0.147***	0.154***	0.175***	0.162***
	(0.037)	*(0.044)*	*(0.043)*	*(0.041)*
Multilocation establishment		-0.015***	-0.015***	-0.015***
		(0.001)	*(0.001)*	*(0.001)*
Age		0.000***	0.000***	0.000***
		(0.000)	*(0.000)*	*(0.000)*
Revenue-per-employee		-0.001***	-0.001***	-0.001***
		(0.000)	*(0.000)*	*(0.000)*
Log population			-0.001	0.000
			(0.000)	*(0.000)*
Log median income			-0.007***	-0.009***
			(0.001)	*(0.001)*
Standardized real estate prices			-0.000***	-0.000***
			(0.000)	*(0.000)*
Restaurant density				0.001
				(0.001)
Cuisine prevalence				0.049***
				(0.008)
Walkability index				-0.001***
				(0.000)
CBSA fixed effects?	Yes	Yes	Yes	Yes
Cuisine fixed effects?	No	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes
First-stage *F*-statistic	86.1	86.5	89.9	89.0
Number of restaurants	776,786	697,975	693,896	693,896
Restaurant-year observations	3,585,077	3,102,805	3,073,914	3,073,914
Root mean squared error	21.8%	23.2%	23.2%	23.2%

Panel B. Heterogeneous effects.

Moderator:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Cuisine prevalence		Age			Multilocation status	
Sample:	Bottom quartile	Top quartile	Bottom quartile	Top quartile	Bottom three quartiles	Independent	Multilocation
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	0.051	0.329***	0.053	0.072**	0.163***	0.151***	0.045
	(0.039)	*(0.069)*	*(0.054)*	*(0.033)*	*(0.045)*	*(0.037)*	*(0.046)*
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage *F*-statistic	82.5	114.0	61.1	97.2	90.5	88.0	89.5
Number of restaurants	184,482	209,333	502,302	238,185	582,243	534,482	159,414
Restaurant-year observations	780,870	761,706	839,909	911,370	2,289,051	2,274,172	799,742
Root mean squared error	21.6%	23.5%	20.8%	23.6%	23.2%	24.3%	19.5%

Moderator:	(8)	(9)	(10)	(11)	(12)	(13)
	Standardized real estate prices		Walkability index		Revenue-per-employee	
Sample:	Bottom quartile	Top quartile	Bottom quartile	Top quartile	Bottom quartile	Top quartile
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	0.128***	0.176***	0.147***	0.268***	0.233**	0.132**
	(0.044)	*(0.063)*	*(0.045)*	*(0.055)*	*(0.091)*	*(0.057)*
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
CBSA fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
First-stage *F*-statistic	118.41	18.8	233.6	35.064	72.522	65.507
Number of restaurants	186,851	203,224	177,260	177,913	311,630	207,940
Restaurant-year observations	3,585,077	3,102,805	3,102,774	3,102,774	3,102,774	3,102,774
Root mean squared error	23.9%	23.1%	24.1%	22.5%	27.6%	23.3%

Appendix

When Delivery Comes to Town: Digital Distribution Platform Penetration and Establishment Exit

Appendix Table of Contents.

Variable Definitions.

Platform penetration is the maximum of the four platform-specific measures of penetration provided by SecondMeasure. The platform-specific measures of presentation are the percent of consumers within a CBSA in SecondMeasure's sample that have recorded at least one transaction with one of the four considered delivery services (DoorDash, Grubhub, Postmates, and UberEats) in each year.

Exit is an indicator variable that is equal to 1 if this is the establishments last year of existence according to the NETS database.

Age is the age of the establishment calculated as the difference between year *t* and the first year the establishment is in existence.

Multilocation is an indicator variable that is equal to 1 if the restaurant is classified as a multilocation establishment. Establishments are classified as a multilocation establishment if: a) the NETS database indicates that it is not a standalone establishment; or b) there are ten or more other establishments with the same name in the NETS database.

Revenue-per-employee is calculated as revenue in thousands of dollars divided by count of employees using the NETS estimates of revenues and employment. This variable is winsorized at the 1^{st} and 99^{th} percentile to account for outliers.

Log population is the logged population in a given year calculated at the county-level. This value is obtained from Census ACS estimates.

Log median income is the logged median per-capita income in a given year calculated at the county-level. This value is obtained from Census ACS estimates.

Standardized real estate prices is the log-transformed median average home price within the ZIP code that the restaurant is located in. This variable is standardized such that the mean is equal to zero and the standard deviation is equal to one.

Restaurant density is the number of establishments per 1,000 individuals living within the county that an establishment is located.

Cuisine prevalence is the relative prevalence of the cuisine type of a restaurant within a CBSA in a given year, calculated as the count of same-cuisine restaurants in a CBSA divided by the total count of restaurants in a CBSA.

Walkability index is the National Walkability Index value for the census block that the restaurant is located in. The National Walkability Index is calculated by the United States Environmental Protection Agency.

Road density is constructed at the CBSA-level as the average road density (kilometers of road per 100 square kilometers of land) across all ZIP-codes within the CBSA. The ZIP-code level road density data is taken from Kolko (2012).

Summary of Robustness Checks.

We conduct a number of tests to evaluate the robustness of our main results. Across all tests, the main effect of platform penetration on establishment exit remains positive. However, considering the tests examining heterogeneity in the effect to test our theory, there are some discrepancies relative to the estimates obtained from our main analysis. We discuss these discrepancies below.

In *Appendix Table A5*, we examine whether the results are consistent using linear probability models to obtain estimates rather than the Cox hazard models used in the main analysis. While in the main analysis, we do not find a significant interaction between platform penetration and multilocation status, using the linear probability model, we do, and as predicted in H1a, we find that multilocation status negatively moderates the relationship between platform penetration and exit. However, using the linear probability model, we no longer find a significant interaction between platform penetration and restaurant walkability. Likewise, in *Appendix Table A6, Panel A*, using average platform penetration across the four considered delivery platforms as our main independent variable rather than maximum platform penetration across the four considered delivery platforms, we find a significant negative interaction between platform penetration and multilocation status, and no longer find a significant interaction between platform penetration and walkability index. We note that in *Appendix Table A6, Panel B* (using a lagged version of platform penetration as our independent variable), *Appendix Table A7* (excluding all restaurants coded as having an unclassified cuisine), and *Appendix Table A8* (controlling for local internet availability), our results remain consistent with our main results for all interactions.

The robustness tests raise questions regarding the multilocation and walkability interactions. While our main results do not find any evidence that multilocation status moderates the effect of platform penetration on establishment exit, some of our robustness tests suggest that it might (and it is worth noting that the IV estimation in the draft also finds evidence of disparate effects depending on multilocation status). Further, while our main results (and the IV estimation) suggest that restaurant walkability moderates the effect of platform penetration on establishment exit, some of the robustness tests do not find a statistically significant effect. We include these results for the sake of transparency. We believe that the evidence we produce is consistent with the theory we propose and provides support for our assertions that the effect of digital distribution platform penetration is shaped by its effect on consumer search costs, the revaluation of strategic assets, and the introduction of a new intermediary. The mixed evidence on these two specific hypotheses provides avenues for further researchers to clarify when and under what conditions such factors may be important in determining the effect of digital distribution platforms.

Description of Threshold Effects Analysis.

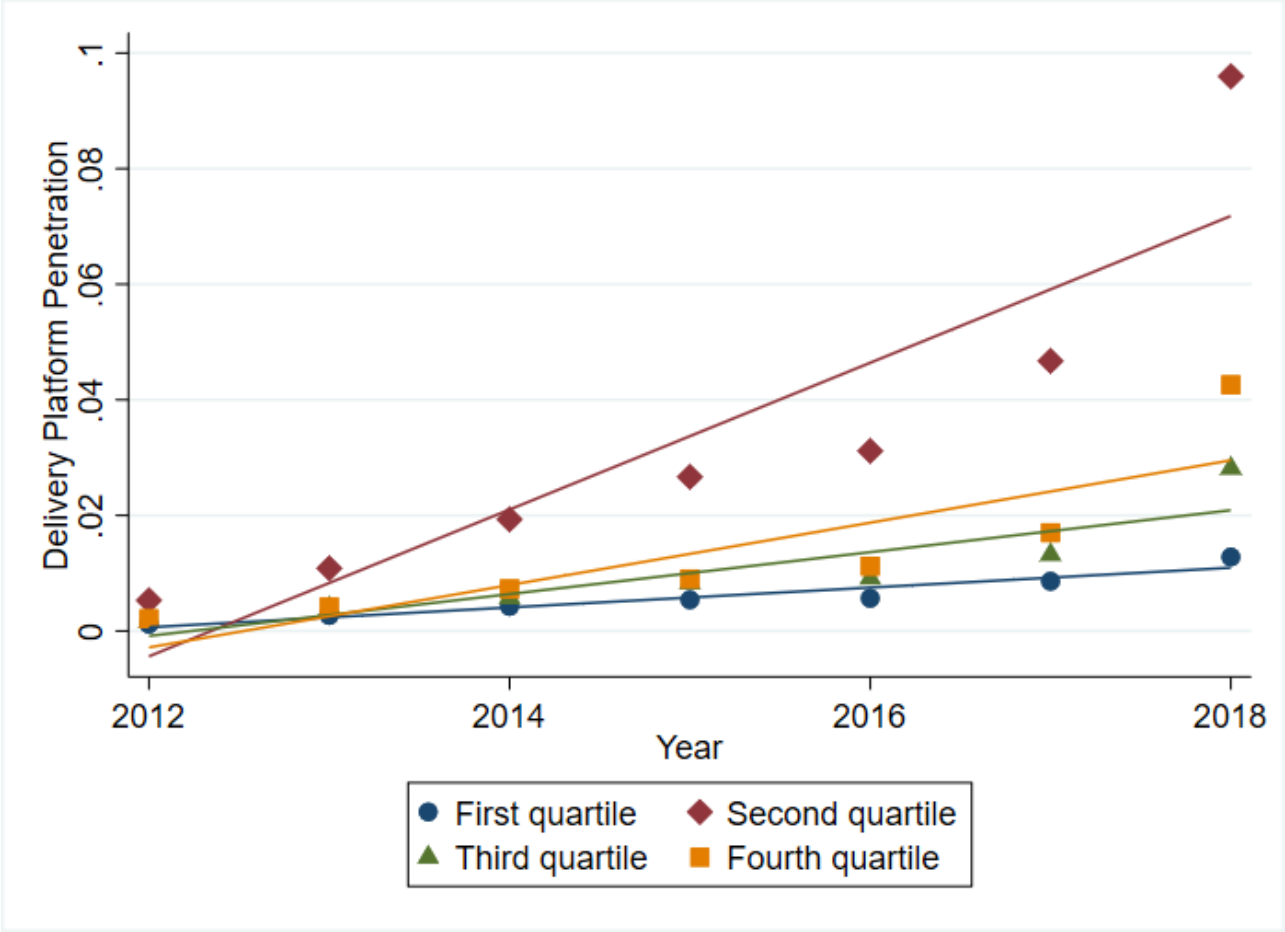
In additional analysis, we explore whether the effect of digital distribution platforms on the likelihood of establishment exit is present across different levels of platform penetration or only emerges at certain thresholds. Across our sample localities, we document significant heterogeneity in the penetration of restaurant delivery platforms during the analysis time period. At the end of our period of study, platform penetration remains at 0 percent in a number of CBSAs, while it is higher than 20 percent in others. It is possible that the effects of digital distribution platform penetration on establishment exit may differ meaningfully in CBSAs that experience higher penetration compared to CBSAs that do not see meaningful adoption of the platform during the sample.

To shed further insight into whether the effect of platform penetration differs depending on the level of adoption, we conduct a split sample analysis across CBSAs depending on the level of platform penetration achieved in the final year of our sample. We first split CBSAs into quartiles depending on the level of platform penetration in 2018. In *Appendix Figure A1*, we present binned scatter plots showing the growth in platform penetration across these subsamples of CBSAs. Across all subsamples, we see platform penetration increase across time, but the slope of such growth varies meaningfully. For first quartile CBSAs, average platform penetration is 0.6 percent across the sample and 1.3 percent in 2018; for second quartile CBSAs, average platform penetration is 1.0 percent across the sample and 2.8 percent in 2018; for third quartile CBSAs, average platform penetration is 1.3 percent across the sample and 4.3 percent in 2018; for fourth quartile CBSAs, average platform penetration is 3.4 percent across the sample and 9.6 percent in 2018.

We next examine the main effect of platform penetration on exit on the likelihood of exit across subsamples defined by these quartiles. The results of this analysis are presented in *Appendix Table A4* and suggest that the effect of platform penetration on establishment exit emerges only at higher levels of platform penetration. We find that the relationship between platform penetration and exit is negative and not significant for restaurants located in first and second quartile CBSAs as defined by platform penetration in 2018 (columns 1 and 2), indicating that platform penetration does not have a meaningful relationship with establishment exit and low levels of penetration. The relationship between platform penetration is positive and not significant for restaurants located in third quartile CBSAs as defined by platform penetration in 2018 (column 3) and for restaurants located in all but the top quartile CBSAs as defined by platform penetration in 2018 (column 4). It is only among top quartile CBSAs as defined by platform penetration in 2018 (column 5) that we find a positive and significant relationship between platform penetration and the likelihood of exit. This result adds important nuance to our findings, as it suggests that the effects of digital distribution platforms on industry establishments only emerge in a strong and consistent manner once penetration passes a certain threshold and the platform enters the mainstream.

Appendix Figure A1. Binned Scatter Plot of Platform Penetration Across Subsamples of CBSAs Based on 2018 Platform Penetration.

The figure shows a binned scatter plot of delivery platform penetration from 2012 through 2018 for subsamples of CBSAs based on 2018 platform penetration. CBSAs are categorized into quartiles based on platform penetration within the CBSA in 2018 (the last year of the sample). First quartile CBSAs represent CBSAs with the lowest platform penetration in 2018; fourth quartile CBSAs represent CBSAs with the highest platform penetration in 2018. Data points are grouped into twenty equally-sized bins and an aggregate statistic is used to summarize each bin.



Appendix Table A1. Delivery Platform Penetration and Restaurant CBSA-Level Entry Rates, Exit Rates, and Entry-to-Exit Ratios.

The table reports the results of regression analyses examining how delivery platform penetration affects restaurant entry rates, exit rates, and the entry-to-exit ratio at the CBSA-level. Columns 1-3 are estimated using OLS regressions, and columns 4-6 are estimated using the IV estimation strategy outlined in the draft. All specifications include CBSA and year fixed effects as well as controls for the population within the CBSA and the median per-capita income. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS estimation			IV estimation		
Dependent variable:	Entry rate	Exit rate	Entry-to-exit ratio	Entry rate	Exit rate	Entry-to-exit ratio
Platform penetration	-0.022	0.058**	-6.597***	0.076	0.255***	-20.326***
	(0.045)	*(0.025)*	*(1.740)*	*(0.086)*	*(0.054)*	*(4.658)*
Log population	-0.027	0.006	-13.929***	-0.040	-0.024	-11.677***
	(0.038)	*(0.023)*	*(2.318)*	*(0.040)*	*(0.024)*	*(2.495)*
Log per-capita income	-0.005	0.002	-1.678	-0.009	-0.001	-1.392
	(0.035)	*(0.012)*	*(1.129)*	*(0.035)*	*(0.012)*	*(1.172)*
CBSA fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	N/A	N/A	N/A	190.8	190.8	183.5
Number of CBSAs	924	924	924	923	923	923
Observations	6,468	6,468	5,942	6,461	6,461	5,936
R-squared	0.321	0.425	0.393	0.321	0.420	0.389

Appendix Table A2. Robustness of the Multilocation Measure.

The table reports the results of estimating a modified version of equation (1) to examine how delivery platform penetration affects the hazard of restaurant exit and how multilocation status moderates this effect. This analysis is analogous to that contained in Table 3, column 3, except it uses alternative measures of multilocation status. In column 1, multilocation status is defined as it is in the draft; in column 2, multilocation status is defined based on the NETS definition as well as a name matching algorithm that identifies restaurants with 50 or more establishments of the same name; in column 3, multilocation status is defined only based on the NETS definition. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Multilocation definition:	Baseline	Restricted name matching	No name matching
Dependent variable:	Exit	Exit	Exit
Platform penetration	4.694***	4.794***	4.794***
	(1.341)	*(1.380)*	*(1.380)*
Multilocation establishment	0.721***	0.556***	0.556***
	(0.015)	*(0.016)*	*(0.016)*
Platform penetration x…			
Multilocation establishment	1.043	0.839	0.839
	(0.410)	*(0.518)*	*(0.518)*
Controls?	Yes	Yes	Yes
CBSA stratification?	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes
Number of restaurants	693,943	693,943	693,943
Restaurant-year observations	3,074,142	3,074,142	3,074,142

Appendix Table A3. First-Stage Equation at the Restaurant-Level Predicting Delivery Platform Penetration with Historical Road Density.

The table reports the results of the first-stage equation used to generate the IV estimates at the restaurant-level in Tables 4 and 5. The dependent variable is the measure of delivery platform penetration at the CBSA-level, and the main independent variable is historical road density at the CBSA-level interacted with indicator variables for each year. All specifications include CBSA, year, and cuisine fixed effects as well as the full suite of controls included in Table 3, column 4. The *F*-Statistic reported is a test for the significance of the interaction of historical road density at the CBSA-level interacted a year trend. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(1)	(1)	(1)
Dependent variable:	Platform penetration	Platform penetration	Platform penetration	Platform penetration
Road density x year	1.953***	1.960***	1.954***	1.948***
	(0.211)	*(0.211)*	*(0.206)*	*(0.206)*
Multilocation establishment		-0.000	-0.000	-0.000
		(0.000)	*(0.000)*	*(0.000)*
Age		*-0.000*	*-0.000*	*-0.000*
		(0.000)	*(0.000)*	*(0.000)*
Revenue-per-employee		*0.000*	*0.000*	*0.000*
		(0.000)	*(0.000)*	*(0.000)*
Log population			0.000***	0.000
			(0.000)	*(0.000)*
Log median income			0.002**	0.002**
			(0.001)	*(0.001)*
Standardized real estate prices			0.000	0.000
			(0.000)	*(0.000)*
Restaurant density				0.001
				(0.001)
Cuisine prevalence				0.003**
				(0.001)
Walkability index				-0.000
				(0.000)
CBSA fixed effects?	Yes	Yes	Yes	Yes
Cuisine fixed effects?	No	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes
First-stage *F*-statistic	86.1	86.5	89.9	89.0
Number of restaurants	776,786	697,975	693,896	693,896
Restaurant-year observations	3,585,077	3,102,805	3,073,914	3,073,914
R-squared	92.8%	92.8%	92.8%	92.8%

Appendix Table A4. Delivery Platform Penetration and Hazard of Restaurant Exit Across CBSAs.

The table reports the results of estimating equation (1) to examine how delivery platform penetration affects the hazard of restaurant exit across CBSAs with different levels of platform penetration across the sample period. All specifications are estimated using Cox proportional-hazard models stratified at the CBSA-level to allow for differing baseline hazard models across CBSAs. The table reports hazard ratios rather than coefficients; a hazard ratio above (below) 1 indicates that the covariate has a positive (negative) relationship with the probability of exit. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	CBSA Quartiles by Maximum Platform Penetration Across Sample:				
Sample CBSAs:	Bottom quartile	Second quartile	Third quartile	Bottom three quartiles	Top quartile
Dependent variable:	Exit	Exit	Exit	Exit	Exit
Platform penetration	0.150	0.763	3.264	2.039	3.158***
	(0.399)	*(1.918)*	*(4.949)*	*(1.874)*	*(1.134)*
Multilocation establishment	0.702***	0.721***	0.693***	0.703***	0.731***
	(0.025)	*(0.021)*	*(0.020)*	*(0.013)*	*(0.011)*
Revenue-per-employee	*0.991***	0.990***	0.990***	0.990***	0.987***
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*
Log population	1.022	0.893***	1.003	0.979	1.004
	(0.052)	*(0.026)*	*(0.020)*	*(0.017)*	*(0.010)*
Log median income	0.746	0.679*	0.748***	0.734***	0.873***
	(0.205)	*(0.137)*	*(0.069)*	*(0.062)*	*(0.015)*
Standardized real estate prices	0.992**	0.990***	0.991***	0.991***	0.997***
	(0.003)	*(0.003)*	*(0.001)*	*(0.001)*	*(0.001)*
Restaurant density	1.206**	1.250***	1.016	1.066*	1.022
	(0.092)	*(0.057)*	*(0.033)*	*(0.036)*	*(0.022)*
Cuisine prevalence	1.154	1.641*	2.241***	1.702***	4.471***
	(0.274)	*(0.423)*	*(0.408)*	*(0.211)*	*(0.921)*
Walkability index	0.978***	0.982***	0.987***	0.984***	0.991***
	(0.005)	*(0.003)*	*(0.003)*	*(0.002)*	*(0.001)*
CBSA stratification?	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes
Number of restaurants	27,617	44,169	71,044	142,830	551,113
Restaurant-year observations	127,510	202,059	318,946	648,515	2,425,627

Appendix Table A5. Estimates of the Effect of Delivery Platform Penetration and Hazard of Restaurant Exit Using a Linear Probability Model.

The table reports the results of estimating a modified version of equation (2) to examine how delivery platform penetration affects the hazard of restaurant exit and to identify explore the factors that moderate this effect. This analysis is analogous to that contained in Tables 2 and 3, except it uses a linear probability model for estimation. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	0.065***	0.128***	0.080***	-0.008	0.034	0.082***	0.387***
	(0.013)	*(0.016)*	*(0.016)*	*(0.016)*	*(0.022)*	*(0.024)*	*(0.058)*
Platform penetration x…							
Age		-0.009***					
		(0.001)					
Multilocation establishment			-0.073***				
			(0.027)				
Cuisine prevalence				0.541***			
				(0.091)			
Standardized real estate prices					0.001***		
					(0.000)		
Walkability index						-0.001	
						(0.001)	
Revenue-per-employee							-0.011***
							(0.002)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of restaurants	693,943	693,943	693,943	693,943	693,943	693,943	693,943
Restaurant-year observations	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142
R-squared	0.019	0.019	0.019	0.019	0.019	0.019	0.020

Appendix Table A6. Estimates of the Effect of Delivery Platform Penetration and Hazard of Restaurant Exit Using Alternative Measures of Platform Penetration.

The table reports the results of estimating a modified version of equation (2) to examine how delivery platform penetration affects the hazard of restaurant exit and to identify explore the factors that moderate this effect. This analysis is analogous to that contained in Tables 2 and 3, except it uses alternative measures of platform penetration. In Panel A, platform penetration is measured as the average penetration across the four considered delivery platforms in each CBSA-year. In Panel B, platform penetration is measured as the lagged penetration value used in the main analysis. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Average platform penetration as IV.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	19.019***	3,051.050***	24.541***	1.978	3.130*	14.309***	1,656,451.471***
	(8.568)	*(1,849.705)*	*(10.654)*	*(0.991)*	*(1.978)*	*(9.865)*	*(1630716.303)*
Platform penetration x…							
Age		0.406***					
		(0.021)					
Multilocation establishment			0.167***				
			(0.064)				
Cuisine prevalence				16,739,904.212***			
				(40657447.304)			
Standardized real estate prices					1.040***		
					(0.010)		
Walkability index						1.021	
						(0.029)	
Revenue-per-employee							0.635***
							(0.025)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA stratification?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of restaurants	693,943	693,943	693,943	693,943	693,943	693,943	693,943
Restaurant-year observations	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142	3,074,142

Panel A. Lag platform penetration as IV.

Dependent variable:	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Exit	(6) Exit	(7) Exit
Platform penetration	22.661***	12,352.907***	21.566***	9.736***	8.420***	12.969***	798.213***
	(8.711)	*(5,774.194)*	*(7.762)*	*(3.957)*	*(5.673)*	*(6.367)*	*(811.389)*
Platform penetration x…							
Age		0.362***					
		(0.022)					
Multilocation establishment			1.488				
			(0.601)				
Cuisine prevalence				315.545***			
				(342.797)			
Standardized real estate prices					1.020**		
					(0.009)		
Walkability index						1.041**	
						(0.016)	
Revenue-per-employee							0.873***
							(0.042)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA stratification?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of restaurants	674,615	674,615	674,615	674,615	674,615	674,615	674,615
Restaurant-year observations	2,666,061	2,666,061	2,666,061	2,666,061	2,666,061	2,666,061	2,666,061

Appendix Table A7. Estimates of the Effect of Delivery Platform Penetration and Hazard of Restaurant Exit Excluding Unclassified Cuisines.

The table reports the results of estimating a modified version of equation (2) to examine how delivery platform penetration affects the hazard of restaurant exit and to identify explore the factors that moderate this effect. This analysis is analogous to that contained in Tables 2 and 3, except it excludes restaurants with an unclassified cuisine. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	4.241***	74.625***	4.010***	3.160***	1.745	2.400**	695.422***
	(1.124)	*(27.206)*	*(1.029)*	*(0.850)*	*(0.646)*	*(0.903)*	*(726.610)*
Platform penetration x…							
Age		0.607***					
		(0.016)					
Multilocation establishment			1.381				
			(0.453)				
Cuisine prevalence				12.960**			
				(14.961)			
Standardized real estate prices					1.025***		
					(0.006)		
Walkability index						1.043***	
						(0.017)	
Revenue-per-employee							0.828***
							(0.036)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA stratification?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of restaurants	568,023	568,023	568,023	568,023	568,023	568,023	568,023
Restaurant-year observations	2,588,590	2,588,590	2,588,590	2,588,590	2,588,590	2,588,590	2,588,590

Appendix Table A8. Estimates of the Effect of Delivery Platform Penetration and Hazard of Restaurant Exit Controlling for Internet Availability.

The table reports the results of estimating a modified version of equation (2) to examine how delivery platform penetration affects the hazard of restaurant exit and to identify explore the factors that moderate this effect. This analysis is analogous to that contained in Tables 2 and 3, except it controls for the percent of the population with access to internet coverage within a CBSA. Data on internet coverage is taken from the ACS yearly estimates for core statistical areas (CSAs) and is available from 2013 through the end of the sample. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Exit	Exit	Exit	Exit	Exit	Exit	Exit
Platform penetration	3.517***	185.278***	3.703***	1.386	1.370	1.965	182.086***
	(1.427)	*(103.675)*	*(1.547)*	*(0.536)*	*(0.628)*	*(0.912)*	*(209.804)*
Platform penetration x…							
Age		0.493***					
		(0.024)					
Multilocation establishment			0.734				
			(0.322)				
Cuisine prevalence				1,031.117***			
				(1,407.558)			
Standardized real estate prices					1.031***		
					(0.007)		
Walkability index						1.046***	
						(0.015)	
Revenue-per-employee							0.853***
							(0.036)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for internet coverage?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CBSA stratification?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuisine fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of restaurants	546,480	546,480	546,480	546,480	546,480	546,480	546,480
Restaurant-year observations	2,196,226	2,196,226	2,196,226	2,196,226	2,196,226	2,196,226	2,196,226

Appendix Table A9. Delivery Platform Penetration and Hazard of Restaurant Exit by Delivery Platform.

The table reports the results of estimating equation (2) to examine how delivery platform penetration affects the hazard of restaurant exit. This analysis is analogous to that contained in Table 2, column 4, except it uses a platform-specific measure of delivery platform penetration for each of the four considered platforms in this research. Heteroskedasticity-consistent standard errors clustered at the CBSA-level are shown in parentheses underneath the coefficient estimates. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)
Platform:	DoorDash	GrubHub	UberEats	PostMates
Dependent variable:	Exit	Exit	Exit	Exit
Platform-specific penetration	2.259**	9.594***	4.257***	8.345***
	(0.928)	*(2.509)*	*(1.548)*	*(4.497)*
Multilocation establishment	0.723***	0.723***	0.723***	0.723***
	(0.009)	*(0.009)*	*(0.009)*	*(0.009)*
Revenue-per-employee	*0.988***	0.988***	0.988***	0.988***
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Log population	1.000	1.001	1.001	1.001
	(0.009)	*(0.009)*	*(0.009)*	*(0.009)*
Log median income	0.860***	0.860***	0.860***	0.861***
	(0.015)	*(0.015)*	*(0.015)*	*(0.015)*
Standardized real estate prices	0.997***	0.997***	0.997***	0.997***
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
Restaurant density	1.032	1.027	1.029	1.031
	(0.021)	*(0.020)*	*(0.021)*	*(0.021)*
Cuisine prevalence	2.965***	2.884***	2.936***	2.930***
	(0.386)	*(0.367)*	*(0.383)*	*(0.375)*
Walkability index	0.990***	0.990***	0.990***	0.990***
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*
CBSA stratification?	Yes	Yes	Yes	Yes
Cuisine fixed effects?	No	Yes	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes
Number of restaurants	776,841	698,022	693,943	693,943
Restaurant-year observations	3,585,331	3,103,033	3,074,142	3,074,142