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Information technology and product variety in the city: The case of food trucks ☆

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ABSTRACT

Using the food truck industry as the setting, we provide direct evidence for how information technology can complement consumption variety in cities by reducing spatial information frictions associated with locally produced goods. We document the following facts: (1) food trucks use technology to overcome a spatial information friction; (2) proliferation of technology is related to growth in food trucks; (3) food trucks use their mobility to respond to consumer taste-for-variety; and (4) growth in food trucks is positively correlated with growth in food expenditures away from home. Taken together, our results illustrate how information technology can provide a meaningful increase in variety for urban consumers.

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1. Introduction

Traditionally, cities have been viewed as centers of productive activity, but recent work in urban economics has called attention to their role as centers of consumption as well. As documented in Glaeser et al. (2001), the growing populations of high amenity cities, the rise in urban rents relative to wages, and the rise in reverse commuting all point to the increasing importance of urban consumption agglomeration. Cities can provide consumption benefits in a number of ways, but among the most important is that cities are able to supply larger varieties of products and services than less densely populated areas.[1] This may be especially true for goods that have strong economies of scale (like theatre companies or professional sports teams), or for goods that serve niche interests—and therefore require a large enough contingent of interested consumers in order to be supplied.[2]

With the rise of the internet (and more specifically, of pervasive access to the internet via wireless networks), the future of cities as consumption centers depends critically on how urban consumption amenities interact with new, disruptive communication technologies.[3] Sinai and Waldfogel (2004) identify two potential channels. In the first, the internet acts as a *substitute* to the city by providing access to a great variety of goods and services supplied from the global marketplace. For example, news websites such as CNN.com and internet music services such as Pandora likely have a larger effect on the variety of news and music available in rural areas compared to cities. In the second channel, the internet acts as a *complement* to the city by providing information about goods and services which can only be produced and consumed locally. For example, the internet could provide better information about restaurant quality through online reviews, which are more beneficial to consumers living in urban areas that have high restaurant density (see Anderson and Magruder, 2012). Thus, on one hand,

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[1] Couture (2014) estimates large consumption benefits to urban density coming from gains from variety. Other benefits to urban density may include a preference to be in proximity to like-minded individuals, such as for the purposes of finding a mate (see Costa and Kahn, 2000).

[2] For example, larger cities have more varieties of restaurants (Schiff, 2015), and more and better newspapers (George and Waldfogel, 2003) and radio stations (Waldfogel, 2003). Importantly, these papers also show that the provision of products preferred by specific groups (i.e. blacks vs. whites) is increasing in the group size.

[3] On the production side, Gaspar and Glaeser (1998) study how productivity spillovers interact with communication technology. They find that telephone conversations increase face-to-face interactions, suggesting a complementarity between communication technology and urban density.

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the internet can decrease the variety advantage of cities by aggregating previously unconnected people and products into a single market. On the other hand, the internet can increase the variety advantage of cities if the increased level of information on local goods increases demand for them, and spurs the entry of new varieties.

In this paper, we highlight a specific channel through which the internet can complement cities by increasing the amount of local product variety. We focus on the ability of the internet to reduce spatial information frictions that are particularly associated with locally produced and consumed products in cities. We document this channel using the gourmet food truck industry, showing how information technology has reduced spatial information frictions, leading to increased access to food variety in urban areas.[4] Although we focus on one particular industry, the economic mechanisms at play are more general and suggest that the ability of the internet to reduce spatial information frictions is an important way in which information technology can complement the city.[5]

The fundamental idea is as follows: food trucks suffer from a spatial information friction because their mobility makes their location uncertain to consumers. Congestion, parking troubles or mechanical failure can cause a food truck to fail to show up at a previously announced location on schedule. Wireless internet technology reduces this friction because it allows the food truck to broadcast its location from the road in real-time. This reduces the consumer's uncertainty about a food truck's location, thereby increasing the demand for food trucks.[6]

As the number of food trucks grows, so too does access to local food variety, via two channels. The first channel is the direct effect of increasing the number of restaurants. But even if each food truck replaces one brick-and-mortar establishment so that there is no net increase in restaurants, growth in food trucks can still increase variety. This happens because food trucks use their mobility to capitalize on consumers' taste-for-variety. Imagine a city with three neighborhoods and three restaurants. If all restaurants are fixed-location, and if consumers are tied to their location (as they would be, for example, in the daytime lunch market where consumers are tied to their workplace), then each neighborhood has access to only one restaurant. If, on the other hand, the restaurants can move each day, then each neighborhood has access to all three restaurants. In this simple example, mobility increases access to variety threefold.

We provide empirical support for this theory in a number of ways. First, we provide direct evidence from food truck Twitter feeds that trucks do indeed use wireless technology to broadcast location information in real-time—including sudden, unforeseen circumstances that necessitate a change in location. The information released in these Twitter feeds could not have been communicated easily before the proliferation of wireless internet technology. To further reinforce our interpretation that wireless technology helps overcome spatial information frictions, we use Google search data to show that growing search interest in smartphones and social media in the late 2000's coincided with a large increase in food truck search interest, which we interpret as a proxy for the size of the market for food trucks.[7] We find that the relationship holds at the MSA-level as well. If search interest is a good proxy for technology adoption and the size of the market for food trucks, then the correlations provide more evidence that the growth in the food truck industry is indeed linked to the growth in wireless technology.[8]

Second, we provide evidence that food trucks use their mobility to capitalize on consumer taste-for-variety. Using a panel dataset of daily Washington DC food truck location decisions, we show that food trucks specifically avoid locations that they have visited recently. In other words, they are less likely to visit locations that they have been to recently than any other location, and they are more likely to return to a location if they have not been there in a while. The strength of this effect decreases as the length of time since the last visit increases. Considering that the primary market for our food trucks are office workers who are fixed to their locations by exogenous reasons, this food truck location choice pattern is consistent with consumers having a taste-for-variety that dies out over time. For example, a consumer who ate at a Korean BBQ truck yesterday gets a utility penalty from eating there today, and a smaller penalty from eating there tomorrow. Our interpretation is robust to a variety of alternative explanations, such as learning or time-varying demand.

Finally, we provide evidence that the growth in food trucks actually provides a meaningful increase in variety to urban consumers. If food trucks are only active in areas that are already variety-rich or if new food trucks simply displace brick-and-mortar restaurants, then the net, equilibrium effect of food trucks on variety may not be meaningful from a consumer welfare perspective. However, using our Washington DC food truck data combined with LEHD data from the Census Bureau, we show that in practice, food trucks do provide a large increase in variety, in part because they tend to choose locations that appear to be under served by brick-and-mortar restaurants (perhaps due to zoning restrictions, high rents, or lack of available land). In this way, food trucks can also create a more even distribution of variety across space in urban areas.

In addition, using household-level data from the Consumer Expenditure Survey (CEX), we provide evidence that the growth in food trucks has increased the aggregate consumption of food-away-from-home for urban consumers. This implies that food trucks did not simply cannibalize the market for brick-and-mortar restaurants, but actually expanded the market for food-away-from-home by increasing the net variety of available food options.

The rest of the paper is organized as follows. In Section 2, we provide some institutional background on the food truck industry, highlighting the facts that food trucks are indeed an urban phenomenon and that the industry has grown rapidly since the advent of smartphone technology. In Section 3, we present a simple theoretical framework that illustrates the role of spatial information frictions in the restaurant industry, and how technology can overcome it. In Section 4, we demonstrate that food trucks indeed

[4] Gourmet food trucks tend to operate in urban areas, perhaps because of demand agglomeration or because transportation costs in non-urban areas are too high.

[5] See Jensen (2007), Brynjolfsson et al. (2003), Anderson and Magruder (2012), Kroft and Pope (2013), Aker (2010), and Brown and Goolsbee (2002) for additional studies on the impact of information technology on particular markets.

[6] Some of the key factors that generate spatial information frictions, such as congestion, are likely more important in urban areas than in non-urban areas. Therefore, the internet can increase the variety advantage of cities even if local goods are equally available in urban and non-urban areas.

[7] We focus on smartphones because they are the most prevalent device for accessing wireless internet on the go. Food trucks can use them to make last minute location updates on Twitter and other outlets. Calling or texting someone with internet access to make updates is cumbersome in comparison. Similarly, consumers without immediate access to computers (i.e. those who do not work desk jobs) rely on smartphones to receive these updates. We focus on social media applications like Twitter because they allow food trucks to broadcast information to a large number of potential customers efficiently. Consumers can use social media to quickly collect the relevant information on food trucks they are interested in. An economy of scale is achieved when many trucks and consumers all use the same platform.

[8] Other papers have demonstrated that internet search data can be good proxies for real activity, and have shown the utility in using search data for economic research. See Choi and Varian (2009b,a), Choi and Liu (2011), Chauvet et al. (2013), Da et al. (2011), Markellos and Vlastakis (2012), Stephens-Davidowitz (2013), Kearney and Levine (2014), Liu et al. (2013), and Blakespoor et al. (2012).

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