Diffusion of E-commerce and Change in Productivity Distribution in the Korean Retail Sector

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Abstract

In this paper, I investigate the effect of the diffusion of e-commerce on the labor productivity distribution in the Korean retail sector. E-commerce enables consumers to be better informed of prices and product offerings and shop without visiting a brick and mortar store, which suggests that consumers' search and travel cost reduce dramatically (Brynjolfsson and Smith, 2000). Reduced search and travel cost could make offline stores face intensified competition because consumers become more sensitive to market prices and can switch between retailers more easily (Brown and Goolsbee, 2002; Goldmanis *et al*., 2009). In more competitive markets, inefficient offline retailers are less likely to survive, which truncate the productivity distribution from below. As a result, the productivity distribution may exhibit higher cut-off productivity, less dispersion and higher central tendency (Syverson, 2004).

However, e-commerce expands by taking away market share from offline retailers because consumers prefer to shop online to enjoy a wider variety of products and convenience of not having to travel (Gebhart, 2018). Reduced sales could shift the labor productivity distribution of offline retailers downwards if labor adjustment is not made immediately as sales decrease. I denote productivity distribution changes caused by enhanced competition due to e-commerce by (i) *a competition effect*, and those by reduced market share (ii) *a business stealing effect*. In this paper,

I estimate how these two effects combine and change the productivity distribution in local offline retail markets.

I use geographic variation in e-commerce penetration to find the causal effect of e-commerce on the productivity distribution of offline retailers. To do so, I construct a unique measure of online spending share based on 30 billion transactions of credit and debit cards. To correct for endogeneity caused by the correlation between local consumers' online purchase and offline retail productivity, I construct a Bartik-style instrument variable (Bartik, 1991) to exploit geographic variation in e-commerce penetration coming from initial differences in product consumption share. I predict the initial consumption share using the age distribution of a county 10 years prior based on the approach suggested by Maestas *et al*. (2016). I further instrument for e-commerce penetration by product category using US data because Korean data might be correlated with local productivity shocks.

I construct the county-level panel data on productivity distribution measures including (i) a cut-off productivity level (the tenth-percentile productivity), (ii) dispersion (the interquartile range among offline retailers), (iii) a central tendency (the median and the unweighted-average productivity) of productivity distributions in local offline markets. I compute the establishment-level labor productivity using the *Census on Establishments* and the *Business Register* from 2011 to 2015.

My findings are summarized in Table 1. The rise in online spending share increases the tenth-percentile productivity level and decreases the interquartile range in a county, which suggests that increased competition from e-commerce may truncate the productivity distribution from below and result in less dispersion (as seen in columns (1) and (2)). However, judging from the results in columns (3) and (4), the left-truncation in productivity distribution does not lead to improve the overall efficiency of local offline markets. The median and the unweighted-average productivity level fall with online share, which implies that the size of the offline retail markets significantly reduced due to the expansion of e-commerce.

To conclude, the diffusion of e-commerce in Korea spurs competition in offline retail markets. Nonetheless, the business stealing effect due to the e-commerce dominates the efficiency gain from a stronger selection which in turn shift the overall productivity distribution downward.

Table 1. Effects of E-Commerce on Productivity Distribution

	Tenth Percentile	Interquartile Range	Median.	Unweighted Mean
	(1)	(2)	(3)	(4)
Online share (%)	0.015***	-0.025***	-0.013***	-0.009***
	(0.006)	(0.006)	(0.004)	(0.003)
Control variables	Yes	Yes	Yes	Yes
County and year fixed effects	Yes	Yes	Yes	Yes
F-statistics in the first stage	128.4	128.4	128.4	128.4
Observations	985	985	985	985

Note: The sample consists of 197 counties from 2011 to 2015. For the dependent variables, the county-level productivity distribution measures in the offline retail markets are used. All dependent variables are logged values of labor productivities of offline retailers. The control variables consist of the log of per capita property tax, population growth rate, car ownership per capita, share of female population, and average household size. All explanatory variables are lagged by one year. County-level clustered standard errors are presented in parentheses. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Key Words: E-Commerce, Productivity Distribution, Retail, Credit Card, Online Spending

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