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Trade, Jobs, and E-commerce: Evidence from Korea

LEE Kyu Yub Research Fellow, Trade and Investment Policy Team, Department of International Trade (kylee@kiep.go.kr)
BAE Chankwon Research Fellow, Trade and Investment Policy Team, Department of International Trade (ckbae@kiep.go.kr)
LEE Sooyoung Research Fellow, Regional Trade Agreement Team, Department of International Trade (sooyoung.lee@kiep.go.kr)
PARK Ji Hyun Senior Researcher, Multilateral Trade Team, Department of International Trade (jhpark@kiep.go.kr)
YOO Saebyul Senior Researcher, Regional Trade Agreement Team, Department of International Trade (sbyoo@kiep.go.kr)

I. Introduction

E-commerce is rapidly growing. In the early 2000s, the size of Korea's B2C e-commerce market was less than 10 trillion KRW. By 2016, it had exceeded 60 trillion KRW. In 2016 Korea, the total B2C exports increased by more than 80%, reaching 2.3 trillion KRW. As consumers are shifting toward e-commerce, they enjoy a wider variety of goods and services at better prices from domestic as well as foreign markets. Gains from e-commerce are clear as documented by several scholars including Brynjolffson et al. (2003, 2012), Goolsbee and Klenow (2006), and recently, Einav et al. (2017).

What is unclear about e-commerce, and has been rarely asked from the perspective of international trade and employment, is whether e-commerce activity substitutes or complements trade in goods, and whether it creates or destroys jobs. This report provides evidence on the relationship between e-commerce and trade in goods and on the relationship between e-commerce and jobs given data in Korea.

II. E-commerce and Trade

In the existing literature on the internet and international trade, many economists have reported that internet access enhances openness (Riker 2014), trade in goods (Freund and Weinhold 2004, Osnago and Tan 2016), and trade in services (Choi 2010, Freund and Weinhold 2002, Kneller and Timmis 2016).

However, we point out that internet access is not sufficient, but necessary for e-commerce activity. Unlike the previous papers aforementioned, we avoid to use a variable for internet access but construct a variable measuring e-commerce activity in order to examine the impact of e-commerce on international trade. Due to the limitation for trade data, we only focus on trade in goods.

1). Model and Data

The main specification is as follows.

$$\ln Y_{kij} = \beta_0 + \beta_1 DI_{ki} + \beta_2 controls + \epsilon_{kij} \quad (1)$$

where Y_{kij} is country i's export to country j

at industry k. Controls include GDPs, partner country's ICT development index, and country fixed effect. Lastly, ϵ_{kij} is an error term.

We decompose the total value of exports Y_{kij} by mean value of export x_{kij} multiplying number of products n_{kij}, resulting in $Y_{kij} = x_{kij} \times n_{kij}$. DI_{ki} is a key independent variable denoting digital intensity which measures the degree to which industries engage in e-commerce activity. For digital intensity, we develop two different measures: $DI_1 = nD/nF$ and $DI_2 = DS/FS$ where nD denotes number of e-commerce firms, nF number of firms, DS total sales by e-commerce, and FS total sales revenue at the two-digit Korea Standard Industrial Classification (KSIC).

We collect export data from the Trade Statistics Service, construct digital intensity measures from the Korea Census, and use the ICT Development Index provided by International Telecommunication Union.

Table 1. Digital Intensity and Trade in Goods

	DI_1	DI_2	Obs.	R^2
Dep. V_{kij}	3.288* (0.580)	-	15,493	0.267
x_{kij}	1.660* (0.196)	-	15,493	0.137
n_{kij}	1.627* (0.434)	-	15,493	0.270
V_{kij}	-	2.614* (0.683)	15,493	0.266
x_{kij}	-	1.183* (0.210)	15,493	0.133
n_{kij}	-	1.431* (0.566)	15,493	0.270

Note: 1) * stands for significance at the 0.01 percent level.
2) Parenthesis denotes standard errors.
3) Values in the first columns are in logarithm.
Source: Author's Calculation

2). Results

Table 1 summarizes the relationship between digital intensity and international trade from equation (1). We report that the higher the digital intensity, the greater the total export. Further, the higher the digital intensity, the larger average value of export as well as number of products. Our results remain robust regardless of digital intensity measures. In short, e-commerce has a positive impact on exports in goods.

III. E-commerce and Jobs

The neoclassical theory of labor demand teaches us that the effects of e-commerce on employment are ambiguous because it generates not only scale effects but also substitution effects. Given output level, e-commerce exerts a positive employment effect arising from market expansion. At the same time, e-commerce generates a negative employment effect due to labor-capital substitution. In theory, e-commerce activity has two competing forces in employment effects. Empirical evidence on e-commerce and employment growth is also mixed. While USITC (2013) shows that e-commerce increases employment growth by 1-2%, Biagi and Falk (2017) report that e-commerce is neutral to employment growth.

This report studies the relationship between e-commerce and employment at industry-level and firm-level. Unlike previous papers, we conduct empirical analysis on digital intensity and job creation as well as destruction in addition to job growth rates at industry-level. Further, we attempt to identify systematic differences between e-commerce and non-e-commerce firms in terms of employment.

1). Industry-level

The main specification for regression at industry-level is simple. As a dependent variable we consider job growth, job creation, and job destruction rates. To build variables for job creation and destruction rates, we refer to Davis and Haltiwanger (1992). As an independent variable we use digital intensity measures as described in Section II. At this turn, variables for digital intensity are constructed at the three-digit KSIC. Using data from the Korea Census 2010 and National Business Survey, we do the OLS and quantile regression analysis in both manufacturing and services industries.

In manufacturing industries, we report that digital intensity has no particular relationship with job growth, creation, and destruction rates in both the OLS and quantile regression. We interpret this result as an indication that e-commerce is neutral to employment growth and job creation/destruction rates in Korean manufacturing industries.

Table 2. Digital Intensity and Job Growth, Creation in Services

Job Growth Rates (Dep. Var.)						
	OLS	q(.1)	q(.25)	q(.5)	q(0.75)	q(.9)
DI_1	**.82*** (.17)	.11 (.24)	.05 (.08)	**.49*** (.15)	**1.26*** (.31)	**1.91*** (.40)
R^2	0.21	0.09	0.10	0.09	0.12	0.30
DI_2	**.46*** (.17)	.07 (.22)	.03 (.07)	**.32*** (.12)	**1.38*** (.32)	**2.99*** (.48)
R^2	.11	.09	.10	.07	.09	.24
Obs	119	119	119	119	119	119
Job Creation Rates (Dep. Var.)						
	OLS	q(.1)	q(.25)	q(.5)	q(0.75)	q(.9)
DI_1	**.59+** (.13)	.05 (.07)	.06 (.06)	**.43*** (.11)	**1.18*** (.30)	**1.33*** (.31)
R^2	.17	0.04	.06	.10	.12	.29
DI_2	**.33*** (.13)	.03 (.06)	.01 (.05)	**.36*** (.11)	**.93*** (.26)	**2.13*** (.34)
R^2	.08	.04	.06	.07	.08	.25
Obs	110	110	110	110	110	110

Note: 1) *, + stand for significance at the 0.01 and 0.05 percent level.
2) Parenthesis denotes standard errors.
Source: Author's Calculation

In services, we find a positive relationship between digital intensity and employment growth/job creation rates. In Table 2, the second column shows that digital intensity relates positively on average to both job growth and job creation rates regardless of digital intensity measures. The third to seventh columns in Table 2 provide further with estimates at quantiles (q=.1, .25, .5, .75, .9) of the job growth/job creation distribution in services. The estimates show that digital intensity relates positively to job growth/job creation rates at the median and upper distribution.

Lastly, no relationship is found between digital intensity and job destruction in services industries as in manufacture.

2) Firm-level

At firm-level, we attempt to identify systematic differences between e-commerce and non-e-commerce firms in terms of employment. In a usual regression setting, we encounter endogeneity issues arising from the e-commerce variable, as the dummy for e-commerce status is not independent of error term.

In order to relieve endogeneity from e-commerce, we adopt the propensity score matching (PSM) technique. First, we calculate propensity scores by logit model. Next, we use a matching algorithm based on the estimated propensity scores from logit. After the matching process, we obtain a best match for each e-commerce firms from non-e-commerce firms.

Table 3 summarizes the difference of employment between e-commerce and non-e-commerce firms before and after the matching technique. Differences are positive, suggesting that e-commerce firms have on average higher

employment (in terms of total as well as permanent workers) than non-e-commerce ones in manufacturing and services industries but not in agriculture.

Table 3. Employment Difference between E-commerce and Non-E-commerce Firms

		Total Employment		Permanent Employment	
		Diff.	S.D.	Diff.	S.D.
Agri-cul-ture	NM	-.812	1.982	-.617	1.416
	M(1)	.555	1.798	-.333	1.429
	M(5)	1.861	1.276	7.555	.972
Manu-fac-ture	NM	6.548	**2.173***	6.193	**2.133***
	M(1)	8.148	**3.599+**	8.018	**3.548+**
	M(5)	7.508	**3.456+**	7.260	**3.452+**
Ser-vices.	NM	8.825	**.343***	6.672	**.260***
	M(1)	2.748	**.793***	2.091	**.686***
	M(5)	2.564	**.610***	1.892	**.547***

Note: 1) NM provides values without matching while M(1) and M(5) give values after applying matching algorithm. Number in parenthesis after M indicates the number of observations in applying nearest neighbor matching.
2) Diff means the difference between the numbers of employment in e-commerce and those in non-e-commerce firms. S.D. means standard deviation.
3) *, + stand for significance at the 0.01 and 0.05 percent level.

Source: Author's Calculation

Further, we find that e-commerce firms also have on average higher total compensation than non-e-commerce ones. It is interesting, however, that compensation per capita at e-commerce firms is largely equal to or lower than that in non-e-commerce ones. This result implies that the increase in total labor compensation at e-commerce firms is mainly driven by increases in employment.

V. Concluding Remarks

This report mainly explores the substitutability/complementarity between e-commerce activity and trade-in-goods/jobs. Although there is a possibility that e-commerce activity could substitute trade in goods and jobs, we found no such evidence in Korea. In other words, the data in Korea shows that e-commerce activity relates positively to trade in goods. At industry-level, e-commerce activity is positively related (at least, neutral depending on industries) to job growth and creation. At firm-level, e-commerce firms hire more workers than non-e-commerce ones.

A caveat in interpreting the evidence we found is that the complementarity between e-commerce and trade/jobs can become stronger or weaker as e-commerce activity continues to grow in the future.

Nonetheless, a lesson from the evidence we found is that new policies relating to e-commerce should be formulated in connection with trade and jobs. For e-commerce and trade, we suggest that the government encourage firms (small-and-medium-sized firms in particular) to engage actively in cross-border e-commerce export, while it make efforts to streamline customs clearance processes for e-commerce to lower trade barriers. For e-commerce and jobs, we emphasize the role of labor market polices with vocational training and retraining programs due to labor market reallocation arising from e-commerce. KIEP