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Regional Amenities, Services Offshoring, and Skilled Employment in the Republic of Korea

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Abstract: *This study empirically examines the effect of services offshoring and regional amenities on the composition of skilled employment for services firms. Analysing Korean firm-level data spanning from 2006 to 2019, we find that services offshoring, characterised by the import of services intermediate inputs, correlates with an increase in the proportion of skilled workers within firms.*

Additionally, the effects of this shift are nuanced based on different skill levels: services offshoring leads to an increase in the share of permanent headquarters workers to total workers. However, it does not affect the share of high-end skilled workers, such as headquarters' share of management and research and development (R&D) workers. Moreover, regional amenities promote the positive effect of services offshoring on permanent headquarters workers' shares. Lastly, the positive effect of offshoring on demand for high-end skilled workers in headquarters is significantly greater for firms with higher R&D intensity.

Keywords: Services firms; Entry; Productivity; Korean firm-level data; Regional amenities; Industry heterogeneity

JEL Classification: F10, F14, L80

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1. Introduction

Trade liberalisation and its impact on jobs is a long-debated issue. Nowadays, trade liberalisation is not limited to trade in goods but also leads to a burgeoning services trade along with technological progress and a globalisation trend. Ariu et al. (2019) maintain that there is increasing interest in the impact of service liberalisation on job displacement, particularly amongst high-skilled workers. Indeed, the labour force in most developed economies is primarily in the services sector, and (tradable) service industries are more skill-intensive than manufacturing industries (Gervais and Jensen, 2019). Regional amenities are also significant sources for promoting the expansion of services. Amenities attract skilled human capital and support agglomeration, driving knowledge creation/accumulation and productivity improvement. Thus, it is critical to understand what causes a rise (or decline) in high-skilled workers in the services industries and what their linkages are with regional amenities. Whilst the role of regional amenities and services liberalisation on the employment of skilled workers draws attention separately, we examine changes in the composition of skilled employment for services firms considering both services offshoring and regional amenities.

Does services offshoring (import of services intermediate inputs) substitute or complement domestic jobs? What kind of jobs between low-skilled and high-skilled jobs are influenced by services offshoring? Is the effect of services offshoring on demand for skilled workers the same as that of manufacturing offshoring?[1] How do regional amenities affect skilled workers' shares in services sectors? What is the interplay of services offshoring (firm internal) and regional amenities (firm external) on the composition of skilled workers for services firms?

Using detailed Korean services firm-level data for 2006–2019, we find that services offshoring leads to an increase in the share of permanent headquarters workers to total workers (= permanent workers + temporary workers). However, offshoring does not affect the share of management and research and development (R&D) workers in the headquarters. Our detailed analysis reveals that services offshoring increases the share of skilled workers, such as permanent workers mainly located in headquarters. However, the proportion of high-end skilled workers, like management and R&D workers amongst the permanent headquarters workers, does not change in response to the offshoring. Regional amenities play a role in promoting the positive effect of services offshoring on skilled workers' shares, particularly for

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[1] When developed countries' manufacturing firms offshore low-skilled tasks to developing countries, the demand for highly skilled workers increases in both countries.

the results of headquarters workers' shares to total workers, not management and R&D workers' shares. Interestingly, a firm's R&D intensity magnifies the positive effect of offshoring on the share of management and R&D workers in headquarters.

The contributions of this paper are as follows: First, whilst previous studies debated the effect of services offshoring on employment and the composition of skilled workers (changes in demand for high-skilled workers), we consider not only the demand factor but also the supply factor that attracts high-skilled workers, such as regional amenities. Also, we analyse the role of regional amenities in shaping the effect of services offshoring on skilled workers' shares. Second, thanks to our detailed data, we implement a comprehensive analysis by matching industry, firm, and regional information. In particular, we can trace a firm's services offshoring activity and its time-series variations with regional amenities. Lastly, our measures for the skilled workers share consist of various levels of skills measured by workers' characteristics, from temporary workers to management and R&D workers. Thus, we are able to capture the heterogeneous effects of services offshoring on the composition of skilled workers' shares.

Theoretical background and literature: Previous studies usually focused on the effect of offshoring on high-skilled workers' shares in *manufacturing* industries (e.g. Feenstra and Hanson (1996)). Since developed countries tend to offshore their relatively unskilled tasks (but skilled tasks on the value chain from developing countries' perspective) to developing countries, offshoring in the manufacturing sector leads to an increase in the relative demand for high-skilled workers for both countries, thereby leading to an increase in wage inequality in both countries.

Recent studies have begun to analyse the effect of services offshoring on the domestic labour market. Amiti and Wei (2005) found that services offshoring did not lead to job loss using country-industry data for several countries. Eppinger (2019), using German firm-level data, showed that service offshoring firms increase their employment. Some recent works have begun addressing services firms' offshoring and distribution of skill-employed. Geishecker and Gorg (2013) showed that services offshoring is associated with a decrease in the real wage of low and medium-skilled workers but an increase for high-skilled workers. Crino (2010) and Crino (2012) showed that services offshoring increases the demand for high-skilled workers more than for low-skilled workers. Liu and Trefler (2019) found that services offshoring increases job turnover in occupation categories, with small adverse effects of services offshoring on employment, wages, or earnings. Ariu et al. (2019) found that services offshoring reduces the employment of low-skilled services workers but increases the employment of high-

skilled managers. They also found that services offshoring enhances firms' performance in terms of sales (turnover).

Another strand of literature compares and contrasts the role of regional amenities and labour market (economic) conditions on high-skilled workers' mobility. Some studies highlight the role of amenities in the decision-making of high-skilled workers' mobility and their employment (Glaeser et al., 2001; Florida, 2002; Buch et al., 2014).[2] In particular, Buch et al. (2017) found that local labour market conditions influence mobility decisions, but amenities also matter for highly skilled workers' mobility. However, other studies emphasise that labour market conditions, such as firms' demand for high-skilled workers, are more important in determining high-skilled workers' employment than amenities (e.g. Moretti (2013)). This study reconciles the above two strands of literature by examining the interplay of services offshoring and regional amenities in determining a services firm's composition of skilled workers.

2. Data and Methodology

2.1. Data

We use Korean firm-level data from the Survey of Business Activities collected from Statistics Korea from 2006 to 2019. These micro-data are collected annually from all enterprises operating in the Republic of Korea (henceforth, Korea) with at least 50 regular workers and capital of W300 million. Industries are classified based on the Korea Standard Industrial Classification (KSIC) system, and data also include regional information on firm location (8 metropolitan cities and 9 states). This dataset provides rich information on firm sales, export activity, employees, wages, material costs, foreign capital share, and assets, etc. We focus on services industries. Services sectors include Wholesale and Retail (KSIC: 45-47), Transportation (49-52), Press, Broadcast, and Information (58-63), Finance and Insurance, Real Estate and Rental and Leasing (64-69), Professional, Scientific, and Technical Services, Management of Companies and Enterprises (70-75). We exclude Accommodation and Food Services (55-56), and Arts, Entertainment, and Recreation (90-91) industries because these sectors have had almost no services offshoring activities.[3]

Services sectors are also engaged in trade in intermediate inputs. We measure the ratio of services firms' intermediate input imports (from their affiliates) to total cost as a proxy of

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[2] Also, previous studies have examined factors that affect high- and low-skilled workers' movements separately (Brown and Scott, 2012; Buch et al., 2017).
[3] Pyun (2020, 2021) also uses the same Korean services firm-level data to examine services firms' behaviour.

services offshoring. During the sample period, we have about 2,800 services firms; about 20% of firms are engaged in services offshoring. Our variable of interest is the services firms' composition of skilled workers. We have data for permanent and temporary workers. For permanent workers, we can divide them into headquarters workers and branch workers. Also, for headquarter workers, there are more detailed workers' categories: management workers, R&D workers, manufacturing workers, and other parts workers. Thus, we construct two kinds of skilled-worker shares: (1) the share of mid-skilled workers: the share of permanent headquarters workers to total workers (= permanent + temporary workers), (2) the share of high-end skilled workers: the share of management and R&D workers in headquarters to the total headquarters workers. These two measures capture various aspects of a firm's use of skilled workers. Headquarters workers are considered relatively high-skilled amongst total workers. However, our second measure is more related to firm utilisation of high-end skilled workers as we select only management and R&D workers from the permanent headquarters workers, which is a numerator in the first measure.
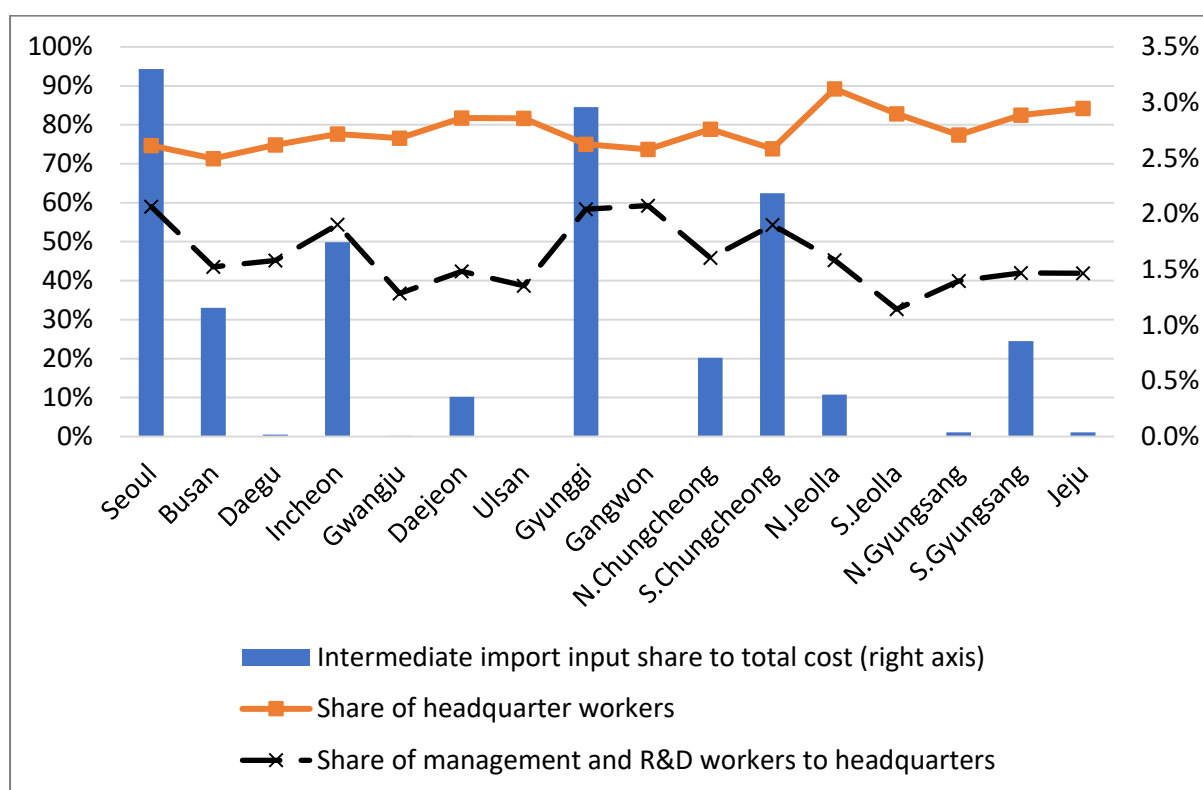
Figure 1: Share of Skilled Workers and Services Offshoring Across Services Industries
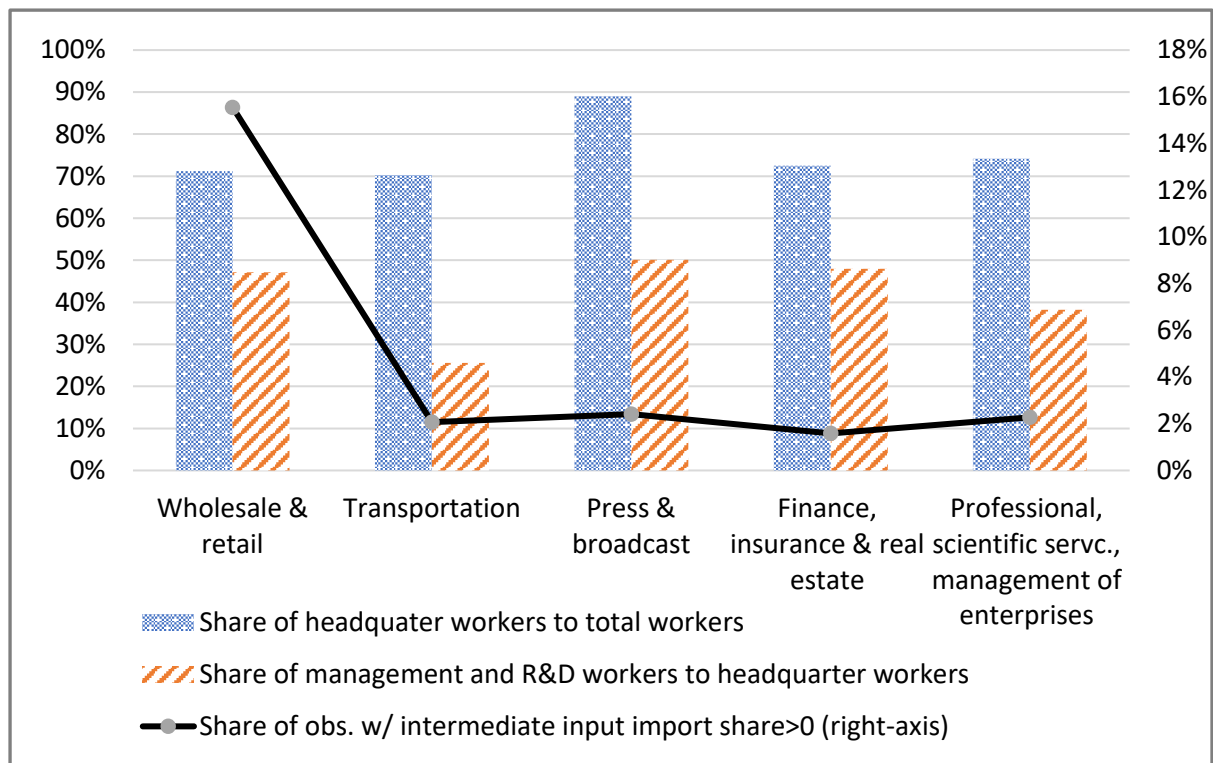
Source: Author's calculations based on the Survey of Business Activities.

Figure 1 plots the measure of services offshoring and the two measures of the skilled workers' shares across industries. The mean of the share of permanent headquarters workers to total workers is about 75% across all services industries, and that of management and R&D workers in headquarters to the total headquarters workers is about 30%. The Press, Broadcast, and Information (58-63) industry has the highest shares of the two skilled-worker measures, whilst the Transportation (49-52) industry shows the lowest shares of the two measures. However, services offshoring occurs most frequently in the Wholesale and Retail (45-47) industry, in which about 16% of firm-year observations is coded as services offshoring (the ratio of intermediate input imports to total cost is greater than zero). Other services industries show that about 2% of total observations have a positive value for services offshoring.

Figure 2: Share of Skilled Workers and Services Offshoring Across Regions

Source: Author's calculations based on the Survey of Business Activities.

Figure 2 illustrates services offshoring measures and the two measures of the skilled workers' shares across regions. Whilst the ratio of permanent headquarters workers to total workers is quite constant over regions, the ratio of management and R&D workers in headquarters to total headquarters workers shows variations across regions. Seoul and its suburb, the Gyunggi region, display the highest share, with about 60% of management and R&D workers in headquarters to total headquarters workers. However, South Jeolla, a

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relatively undeveloped region, shows the lowest skilled share regarding headquarters management and R&D workers. Services offshoring also shows enormous variations across regions: Seoul and Gyunggi have the highest value of services offshoring, and firms' shares of intermediate input imports to total cost in the regions are, on average, 0.033 and 0.030, respectively.

We also collect information on regional amenities (education, accommodation, and living infrastructure) and economic variables. We broadly categorise our regional amenities variables as follows: (1) education: the number of private education institutes for 1,000 population in the region (a proxy for private education size); (2) health: the number of beds in medical institutions for 1,000 population in the region; (3) leisure: urban park area per 1,000 population; (4) technology-friendly environment: internet access rate – the percentage of people aged 3 or older who have used the internet within the past month; and (5) economy: log of regional GDP. Then, we normalise these five indices (from 0 to 1) and construct a weighted average of the amenity index for 17 regions. Also, we include agglomeration measures such as population density and population growth. Note that the number of regional services firms is included as a proxy of agglomeration in the services sector. More regional factors, such as the regional ageing ratio (ageing population ratio), and land price growth rate, are also added.

Figure 3: Regional Amenities for the Republic of Korea
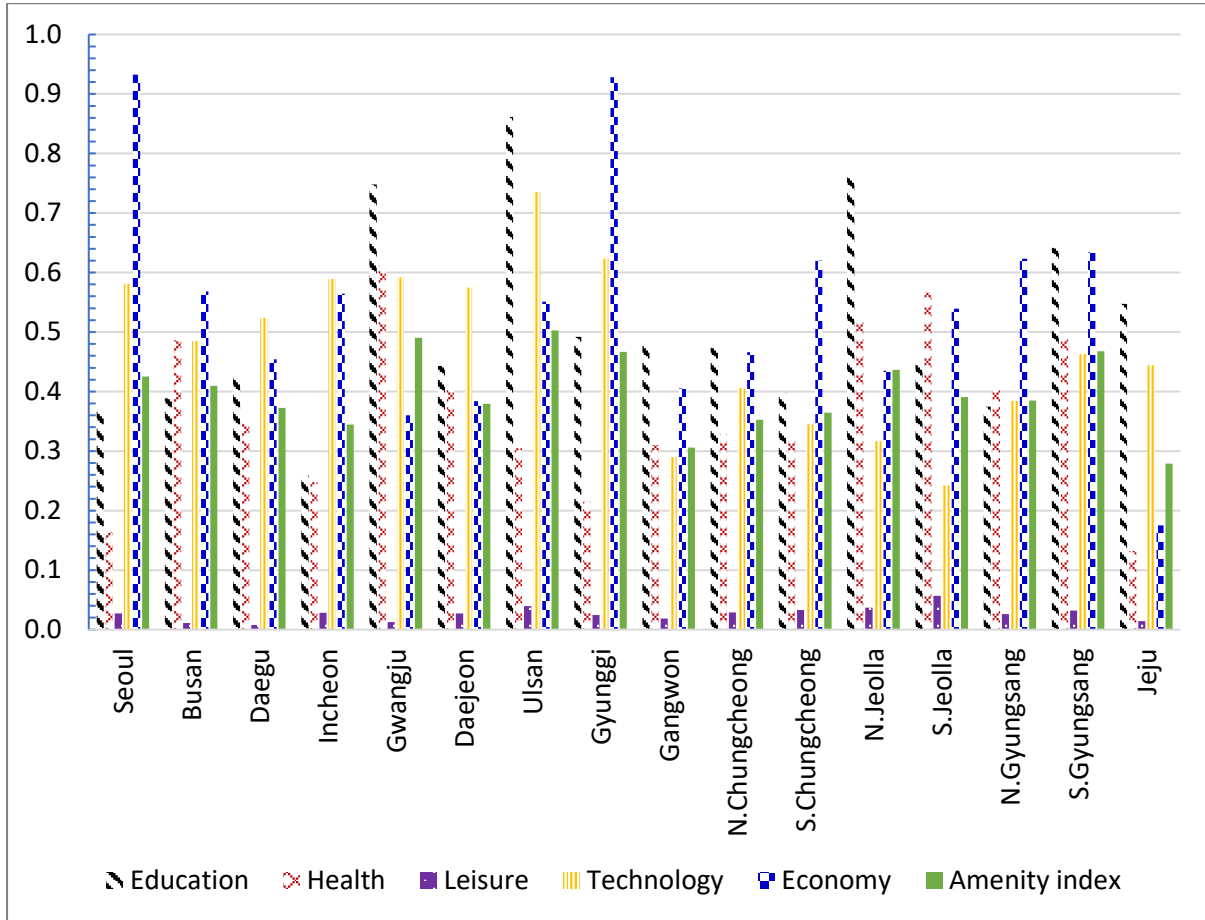
Source: Author's calculations based on the Survey of Business Activities.

Figure 3 plots the regional amenities indices across regions. As expected, Seoul and Gyunggi, the most concentrated areas, have the highest value of regional economy indices amongst all regions. But regarding education and technology amenities, Ulsan, one of the metropolitan cities, displays the highest regional amenity indices, and Gwangju follows next (whilst North Jeolla province is the second-highest in the education amenity index). The aggregate regional amenity index shows that Ulsan and Gwangju, two metropolitan cities, are ranked first and second, respectively. Gyunggi and Seoul are ranked fourth and sixth.

Lastly, we collect firm- and industry-level variables that influence a firm's composition of skilled workers. Labour productivity, which is real revenue divided by total permanent employees, is included. Patent is the number of patents that firms are granted. Size is the log of a firm's total permanent employment. These variables can be related to a firm's composition of skilled workers.[4] We also include the firm's foreign capital share, export-to-sales ratio, log

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[4] Pyun (2022) found that a services firm's labour productivity, patent, and size are positively associated with its inauguration of offshoring activities.

of the average wage, R&D intensity (= R&D investment/sales), and debt-to-asset ratio. A firm's foreign dependence may promote an increase in its share of skilled workers. A higher wage level and R&D intensity are expected to be positively associated with a higher share of skilled workers. We add the industry-level Herfindahl index (HHI), which is calculated as $\sum_{i \in j} s_{it}^2$, where s_{it} is the market share of firm i in industry j at time t. This is a proxy for the degree of industry concentration capturing the level of domestic competition.

2.2. Empirical Specification

We systematically investigate the effect of regional amenities and services offshoring on the labour market outcomes of services firms using panel data regression techniques, particularly tracing the composition of high- and low-skilled workers in the services industry. The empirical specification for services firms is as follows:

Services firm's skilled workers share$_{(ijkt)}$ = β_1· Services offshoring$_{ijkt-1}$ + β_2 · Regional amenities$_{kt-1}$ + X_{ijkt-1} γ +α_i +α_j+ α_k+ α_t + e_{ijkt} (1)

where i denotes the firm level, j denotes the industry, k denotes the region, and t indicates the time dimension. The services firm's skilled workers share is the dependent variable, for which we include two kinds of skilled worker share measures: (1) mid-skilled workers' shares: the ratio of headquarters permanent workers to total workers; and (2) high-end skilled workers' shares: the ratio of management and R&D workers in headquarters to total workers. Services firms' offshoring indicates the share of intermediate input imports to total cost. Whilst regional amenities do not exhibit much time variation, but cross-sectional variation, a novel feature of this study is to control for time-varying regional amenity indices. By controlling for firm, industry, and region fixed effects and year fixed effects, α_i, α_j, α_k, and α_t, respectively, we focus on variations within firm, industry, and region. X_{ijkt-1} are the firm, industry, and regional-level controls: regional ageing, population growth, the land price growth rate, and the number of services firms in the region are included. A firm's labour productivity, (log of) wage, size (= log of permanent employment), foreign capital shares, exports to sales, the number of patents, R&D intensity (= R&D/sales), debt-to-asset ratio, and industry HHI are also added. e_{ijkt} is an error term. Standard errors are clustered at the industry level. We include year-lagged variables for all controls on the right-hand side to avoid possible endogeneity. To examine the interplay of services offshoring and regional amenities in shaping services firms' composition of skilled workers, we also include the interaction term of two main variables.

3.   Empirical Results

Table 1 reports the results with the share of permanent headquarters workers to total workers as a proxy for mid-skilled workers' shares. This measure captures the share of skilled workers to unskilled workers, whereas our second measure in Table 2 indicates the share of high-end skilled workers amongst generally skilled workers. Column (1) begins to examine cross-firm variations within industry, so we include industry, region, and year fixed effects but not firm fixed effects. Columns (2)–(6) contain firm fixed effects to capture firms within time-series variations with industry, region, and year fixed effects. Column (3) uses a subsample from 2006 to 2016 because we observe a decrease in the number of services firms in 2016 due to the renewal of some survey questions. Columns (4)–(5) focus on only offshoring firms that engaged in services intermediate imports at least once during the sample period. Lastly, column (6) considers firm-year observations with positive intermediate input imports in year t.

Table 1: Main Results: Share of Headquarter Workers to Total Workers

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Share of Headquarter Workers to Total Workers					
				For Service Offshoring		
	Full	Full	2006-2016	Firms		Offshore>0
Services offshoring (int import share to total cost) (t-1)	0.0780**	0.0105**	0.0124**	0.0148***	0.0144***	-0.0045
	(0.0280)	(0.0039)	(0.0048)	(0.0038)	(0.0040)	(0.0062)
Education (t-1)	-0.0180	-0.0121	0.0411	-0.1417		
	(0.0544)	(0.0398)	(0.0337)	(0.1186)		
Health (t-1)	-0.0315	-0.0075	-0.0742	0.2170		
	(0.0836)	(0.1004)	(0.1698)	(0.2209)		
Leisure (t-1)	-1.0800***	-0.8937**	-0.8128**	-0.0945		
	(0.3448)	(0.3996)	(0.3855)	(0.5451)		
Technology (t-1)	-0.0867	0.0842*	0.1071**	-0.0542		
	(0.0513)	(0.0415)	(0.0467)	(0.3178)		
Economy (t-1)	0.1640	0.0558	-0.1846	0.8417***		
	(0.4215)	(0.3151)	(0.2998)	(0.2154)		
Amenity index (t-1)					-0.1679	0.5488
					(0.6262)	(1.1034)
Ageing (t-1)	-0.0043	0.0076	0.0141	0.0073	0.0131	-0.0315**
	(0.0067)	(0.0072)	(0.0087)	(0.0254)	(0.0116)	(0.0112)
Pop. Growth (t-1)	-0.0184	0.0006	-0.0025	-0.0021	0.0094	-0.0161
	(0.0130)	(0.0095)	(0.0076)	(0.0111)	(0.0097)	(0.0152)
Land price growth (t-1)	-0.0008	-0.0022	0.0022	0.0052	-0.0023	0.0355***
	(0.0082)	(0.0064)	(0.0047)	(0.0192)	(0.0110)	(0.0115)
log # of services firms in the region (t-1)	-0.0580	-0.0178	0.0591	-0.1928***	0.0011	-0.0432
	(0.1153)	(0.0679)	(0.0706)	(0.0547)	(0.0211)	(0.0473)
Labour productivity (t-1)	-0.0001	-0.0093**	-0.0057*	-0.0201*	-0.0198	-0.0189**

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Share of Headquarter Workers to Total Workers					
				For Service Offshoring		
	Full	Full	2006-2016	Firms		Offshore>0
	(0.0141)	(0.0042)	(0.0033)	(0.0113)	(0.0119)	(0.0082)
Foreign capital share (t-1)	0.0443**	0.0312	0.0236	0.0271	0.0240	0.0444
	(0.0163)	(0.0184)	(0.0178)	(0.0338)	(0.0344)	(0.1489)
Export share to revenue (t-1)	0.0317**	0.0041	-0.0020	-0.0122	-0.0126	-0.0029
	(0.0126)	(0.0097)	(0.0074)	(0.0242)	(0.0233)	(0.0054)
log wage (t-1)	0.0116	-0.0306***	-0.0238***	-0.0187	-0.0201*	-0.0163
	(0.0113)	(0.0069)	(0.0068)	(0.0113)	(0.0113)	(0.0156)
log employment (t-1)	-0.0901***	-0.0621***	-0.0403***	-0.0820***	-0.0838***	-0.0996***
	(0.0051)	(0.0094)	(0.0090)	(0.0119)	(0.0118)	(0.0180)
R&D intensity (t-1)	-0.0011	0.0031***	0.0043***	0.1758	0.1746	0.1820
	(0.0012)	(0.0010)	(0.0013)	(0.2499)	(0.2535)	(0.1443)
# of patents (t-1)	0.0000	0.0000	-0.0000	0.0000	0.0000	0.0001
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Debt to assets (t-1)	-0.0016	-0.0019	-0.0057	-0.0013	-0.0011	0.0064
	(0.0127)	(0.0084)	(0.0085)	(0.0050)	(0.0049)	(0.0038)
HHI (t-1)	0.0329	0.0230	0.0774	0.0486	0.0545	-0.1640
	(0.0531)	(0.0507)	(0.0570)	(0.0742)	(0.0744)	(0.2034)
Firm FE	No	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Region, Year FE	Y	Y	Y	Y	Y	Y
# of firms	2823	2823	2484	609	609	339
Observations	15,185	14,173	10,962	3,450	3,450	1,277
R-squared	0.225	0.764	0.791	0.760	0.759	0.793

Note: Clustered robust standard errors at the industry level are reported in parentheses. *, ** and *** are the significance levels at 10%, 5% and 1%.
Source: Author's calculations.

The estimated coefficients of services offshoring are significantly positive in columns (1)–(5), suggesting that services offshoring can increase the share of headquarter workers to total workers. This is consistent with the theoretical rationale that an increase in demand for relatively skilled tasks is because home firms are slicing low-skilled tasks and offshoring them to foreign firms. We also control for regional amenity factors influencing skilled workers' shares. Since we control for a heavy array of fixed effects in various dimensions, firm-level control variables lose significance. Columns (2) and (3) show that the internet access rate (as a proxy for technology amenity) is positively associated with skilled workers' shares for the full sample. However, column (4) of the offshoring firms' sample shows that only regional economic factors, such as (log of) regional GDP, have a positive effect on skilled worker's shares, whereas other regional factors do not show any significant effects on skilled worker's

shares. Column (5) also shows that the regional amenity index does not have significant effects. Column (6) uses only a firm's positive offshoring observations, for which we exclude zero-offshoring observations. So, this sample focuses on intensive margins of offshoring (continuously positive offshoring) but not extensive margins (we look into new offshoring firms from zero to positive-value offshoring). Interestingly, the coefficient on services offshoring turns out to be negative and insignificant in column (6).

Other variables also affect services firms' skilled workers' shares. Firm size is consistently negatively related to firm headquarters permanent workers' shares. R&D intensity also shows a significant and positive sign in columns (2) and (3) of the full sample.

Table 2 shows the results with the share of management and R&D workers to headquarters workers as a proxy for the share of high-end skilled workers. This table shows how much services offshoring affects the skilled workers proportion amongst permanent headquarters workers. The estimated coefficients of services offshoring are insignificant, implying that Korean firms' offshoring would not change the demand for high-end skilled workers, such as management and R&D workers. Based on the results in Tables 1 and 2, Korean firms' services offshoring would focus on low-end skilled activities, so the demand for middle-skilled workers increases but that for high-end skilled workers does not. Another interesting point is that services offshoring shows a significant and positive effect on the share of management and R&D workers in column (6) for firms with positive offshoring observations. This implies that the effect of services offshoring on demand for high-end skilled workers is amplified for firms continuing offshoring, but not for those newly launching offshoring.

Also, our full sample results in columns (1) to (3) show that technology amenities in the region (its time-series variation) are positively associated with the share of management and R&D workers. When we limit our sample to only positive offshoring observations in column (6), the coefficient of the regional amenity index is significant and positive, suggesting that regional amenities attract high-end skilled workers into the region.

Table 2: Main Results (2): Management and R&D Workers to Headquarter Workers

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Share of Management and R&D Workers to Headquarter Workers**					
				For Service Offshoring Firms		
	Full	**Full**	**2006-2016**			**Offshore>0**
Services offshoring (int import share to total cost) (t-1)	0.0143	-0.0015	-0.0324*	0.0032	0.0018	**0.0623***
	(0.0189)	(0.0158)	(0.0185)	(0.0149)	(0.0151)	**(0.0205)**
Education (t-1)	0.1238**	0.1152*	0.0925	0.1886		
	(0.0552)	(0.0660)	(0.0544)	(0.1947)		
Health (t-1)	-0.3260***	-0.2486***	-0.2597**	0.2915		
	(0.0545)	(0.0816)	(0.0946)	(0.1892)		
Leisure (t-1)	0.8740*	0.4145	0.4261	-3.0321***		
	(0.4648)	(0.4864)	(0.4299)	(1.0052)		
Technology (t-1)	0.2124***	0.2468**	0.2817**	0.1662		
	(0.0527)	(0.0943)	(0.1345)	(0.1230)		
Economy (t-1)	-0.1691	-0.0558	0.1215	0.8047		
	(0.2696)	(0.3742)	(0.6174)	(0.5281)		
Amenity index (t-1)					0.7122	**1.0304***
					(0.4157)	**(0.5427)**
Ageing (t-1)	0.0141***	-0.0038	0.0033	-0.0048	-0.0016	0.0111
	(0.0039)	(0.0069)	(0.0120)	(0.0155)	(0.0110)	(0.0136)
Pop. Growth (t-1)	0.0065	-0.0140	-0.0042	-0.0404**	-0.0334	-0.0275
	(0.0120)	(0.0144)	(0.0131)	(0.0154)	(0.0196)	(0.0261)
Land price growth(t-1)	-0.0146*	-0.0166***	-0.0191**	-0.0211	-0.0136	0.0011
	(0.0079)	(0.0044)	(0.0070)	(0.0146)	(0.0093)	(0.0107)
log # of services firms in the region (t-1)	0.0375	-0.0746	-0.1204	-0.2212*	-0.0698**	-0.0635
	(0.0670)	(0.1112)	(0.1715)	(0.1164)	(0.0307)	(0.0423)
Labour productivity (t-1)	0.0396***	0.0102	-0.0041	0.0151	0.0146	0.0134
	(0.0068)	(0.0082)	(0.0122)	(0.0115)	(0.0124)	(0.0146)
Foreign capital share (t-1)	-0.0004	0.0097	-0.0465	-0.0286	-0.0284	0.1474***
	(0.0096)	(0.0328)	(0.0491)	(0.0188)	(0.0170)	(0.0483)
Export share to revenue (t-1)	-0.0255	-0.0130	-0.0143	-0.0332	-0.0315	-0.0294*
	(0.0160)	(0.0245)	(0.0152)	(0.0203)	(0.0202)	(0.0167)
log wage (t-1)	-0.0030	-0.0095	-0.0221	-0.0359**	-0.0337**	-0.0816***
	(0.0110)	(0.0121)	(0.0182)	(0.0162)	(0.0159)	(0.0264)
log employment (t-1)	-0.0142*	-0.0231**	-0.0364***	0.0097	0.0125	-0.0104
	(0.0079)	(0.0104)	(0.0087)	(0.0189)	(0.0183)	(0.0235)
R&D intensity (t-1)	0.0057***	0.0004	-0.0017	-0.3682	-0.3589	-0.2169
	(0.0017)	(0.0009)	(0.0015)	(0.2810)	(0.2859)	(0.3886)

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	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	**Share of Management and R&D Workers to Headquarter Workers**					
				For Service Offshoring		
	Full	**Full**	**2006-2016**	**Firms**		**Offshore>0**
# of patents (t-1)	0.0001**	-0.0002	0.0000	-0.0002	-0.0002	-0.0014***
	(0.0000)	(0.0003)	(0.0001)	(0.0003)	(0.0003)	(0.0001)
Debt to assets (t-1)	0.0158**	0.0118	-0.0220	-0.0014	-0.0022	0.0072
	(0.0066)	(0.0138)	(0.0234)	(0.0210)	(0.0206)	(0.0132)
HHI (t-1)	0.0789	0.0335	-0.0057	0.2786	0.2822	0.5613
	(0.0705)	(0.0955)	(0.0868)	(0.2145)	(0.2137)	(0.3235)
Firm FE	No	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Region, Year FE	Y	Y	Y	Y	Y	Y
# of firms	2823	2823	2484	609	609	339
Observations	15,185	14,173	10,962	3,450	3,450	1,277
R-squared	0.115	0.492	0.529	0.441	0.440	0.560

Note: Clustered robust standard errors at the industry level are reported in parentheses. *, ** and ***
are the significance levels at 10%, 5% and 1%.
Source: Author's calculations.

Columns (1)–(6) of Table 3 include the interaction term of services offshoring and regional amenities in Table 1 to investigate possible amplifying or moderating effects of services offshoring on headquarters worker shares depending on regional amenity conditions. We also include population density in the region as a proxy for regional agglomeration and its interaction term with services offshoring in column (7). Lastly, column (8) interacts firm's R&D intensity with services offshoring to examine whether the services offshoring effect on the share of high-skilled workers varies amongst individual firms' R&D inputs.

The results support the role of regional amenities in offshoring's effect on skilled workers' shares. Columns (1), (2), and (4) show that the positive effect of services offshoring on the headquarter workers share is amplified with higher education, health, and technology regional amenities. When considering the means of these regional amenity indices (0.51, 0.37, and 0.48, respectively), the average effect of services offshoring on skilled workers' share is positive. Column (6) also indicates that the regional amenity index magnifies the positive effect of offshoring on the shares of permanent headquarters workers.

Table 3: Interplay of Services Offshoring and Regional Amenities for Offshoring Firms

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Shares of Headquarter Workers to Total Workers (Only Offshoring Firms)							
Services offshoring (SO) (t-1)	-0.2192*** (0.0354)	-0.0433** (0.0172)	0.0524*** (0.0152)	-0.1287** (0.0485)	0.0257 (0.0760)	-0.3106*** (0.0724)	0.1713*** (0.0215)	0.0127** (0.0050)
SO (t-1) x Education (t-1)	0.6131*** (0.0862)							
SO (t-1) x Health (t-1)		0.3305*** (0.0934)						
SO (t-1) x Leisure (t-1)			-1.3994** (0.6072)					
SO (t-1) x Technology (t-1)				0.2635*** (0.0902)				
SO (t-1) x Economy (t-1)					-0.0119 (0.0841)			
SO (t-1) x Amenity index (t-1)						0.7941*** (0.1767)		
SO (t-1) x Pop density (t-1)							-0.1675*** (0.0254)	
SO (t-1) x R&D intensity (t-1)								0.5374 (0.9548)
Amenity index (t-1)						-0.2174 (0.6203)	0.1900 (0.6145)	-0.1704 (0.6284)
Pop. Density (t-1)							0.1373* (0.0716)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education (t-1)	-0.2015*	-0.1474	-0.1431	-0.1464	-0.1420			
	(0.1117)	(0.1145)	(0.1164)	(0.1170)	(0.1183)			
Health (t-1)	0.2331	0.2250	0.2219	0.2197	0.2186			
	(0.2179)	(0.2136)	(0.2214)	(0.2194)	(0.2139)			
Leisure (t-1)	-0.0088	-0.0927	0.1152	-0.1206	-0.0956			
	(0.5585)	(0.5399)	(0.5962)	(0.5434)	(0.5424)			
Technology (t-1)	-0.0692	-0.0597	-0.0582	-0.0735	-0.0546			
	(0.3128)	(0.3120)	(0.3165)	(0.3159)	(0.3154)			
Economy (t-1)	0.8258***	0.8455***	0.8342***	0.8141***	0.8447***			
	(0.2243)	(0.2166)	(0.2197)	(0.2247)	(0.2043)			
Ageing (t-1)	0.0071	0.0069	0.0072	0.0071	0.0073	0.0132	0.0192*	0.0131
	(0.0258)	(0.0254)	(0.0255)	(0.0256)	(0.0252)	(0.0120)	(0.0108)	(0.0116)
Pop. Growth (t-1)	-0.0019	-0.0030	-0.0018	-0.0026	-0.0022	0.0088	0.0357***	0.0095
	(0.0113)	(0.0112)	(0.0114)	(0.0112)	(0.0109)	(0.0096)	(0.0100)	(0.0099)
Land price growth (t-1)	0.0063	0.0065	0.0057	0.0049	0.0053	-0.0025	-0.0051	-0.0022
	(0.0191)	(0.0185)	(0.0193)	(0.0189)	(0.0190)	(0.0108)	(0.0121)	(0.0111)
log # of services firms in the region (t-1)	-0.1867***	-0.1932***	-0.1906***	-0.1861***	-0.1934***	0.0012	-0.0416	0.0013
	(0.0565)	(0.0552)	(0.0557)	(0.0564)	(0.0533)	(0.0208)	(0.0410)	(0.0214)
Labour productivity (t-1)	-0.0202*	-0.0201*	-0.0199*	-0.0213*	-0.0201*	-0.0208*	-0.0196	-0.0199
	(0.0112)	(0.0113)	(0.0113)	(0.0114)	(0.0114)	(0.0119)	(0.0122)	(0.0120)
Foreign capital share (t-1)	0.0279	0.0276	0.0270	0.0277	0.0271	0.0245	0.0317	0.0236
	(0.0333)	(0.0335)	(0.0337)	(0.0339)	(0.0337)	(0.0344)	(0.0395)	(0.0335)
Export share to revenue (t-1)	-0.0139	-0.0136	-0.0127	-0.0134	-0.0123	-0.0139	-0.0166	-0.0129
	(0.0239)	(0.0235)	(0.0240)	(0.0242)	(0.0241)	(0.0232)	(0.0255)	(0.0237)
log wage (t-1)	-0.0198	-0.0192	-0.0190	-0.0190	-0.0187	-0.0207*	-0.0215**	-0.0203*
	(0.0118)	(0.0115)	(0.0114)	(0.0115)	(0.0114)	(0.0116)	(0.0100)	(0.0111)

log employment (t-1)	-0.0835***	-0.0823***	-0.0820***	-0.0834***	-0.0819***	-0.0855***	-0.0741***	-0.0838***
	(0.0113)	(0.0118)	(0.0116)	(0.0119)	(0.0120)	(0.0115)	(0.0084)	(0.0119)
R&D intensity (t-1)	0.1687	0.1740	0.1748	0.1748	0.1758	0.1710	0.0957	0.1628
	(0.2461)	(0.2496)	(0.2485)	(0.2498)	(0.2502)	(0.2524)	(0.2234)	(0.2634)
# of patents (t-1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0000	0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
Debt to assets (t-1)	-0.0014	-0.0013	-0.0014	-0.0013	-0.0013	-0.0013	0.0007	-0.0009
	(0.0050)	(0.0050)	(0.0050)	(0.0050)	(0.0050)	(0.0050)	(0.0111)	(0.0050)
HHI (t-1)	0.0566	0.0503	0.0544	0.0543	0.0485	0.0619	0.0673	0.0546
	(0.0749)	(0.0746)	(0.0734)	(0.0748)	(0.0745)	(0.0750)	(0.0822)	(0.0745)
Firm, Industry, Region, Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	3,450	3,450	3,450	3,450	3,450	3,450	3,095	3,450
R-squared	0.760	0.760	0.760	0.760	0.760	0.760	0.774	0.759

Note: Clustered robust standard errors at the industry level are reported in parentheses. *, ** and *** are the significance levels at 10%, 5% and 1%.
Source: Author's calculations.

Table 4 adds the interaction term of services offshoring and regional amenities in Table 2. Here, we check the role of regional amenities in determining the effect of services offshoring on the share of relatively higher-skilled workers (management and R&D workers). First of all, unlike the results in Table 3, regional amenities do not significantly influence the effect of services offshoring on demand for high-end skilled workers. Column (2) shows that only the coefficient on the interaction term of services offshoring and regional health amenity index is positive and marginally significant at the 10% level. The positive effect of services offshoring on management and R&D workers' shares amongst permanent headquarters workers is observed with a higher regional health amenity index. Column (8) provides interesting evidence that the effect of services offshoring on the share of high-end skilled workers becomes significantly positive for firms with higher R&D intensity. This implies that the R&D intensity of firms can be a proxy for firm innovation effort, so innovative firms increase their demand for high-skilled workers significantly in response to their offshoring activities.

Table 4: Interplay of Services Offshoring and Regional Amenities for Offshoring Firms

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Shares of Management and R&D Workers to Headquarter (Only Offshoring Firms)							
Services offshoring (SO) (t-1)	-0.0281 (0.1276)	-0.0973 (0.0610)	0.0345 (0.0339)	-0.0617 (0.1014)	0.3867*** (0.0758)	-0.0777 (0.2045)	-0.0214 (0.0432)	-0.0073 (0.0130)
SO (t-1) x Education (t-1)	0.0820 (0.2972)							
SO (t-1) x Health (t-1)		0.5722* (0.2758)						
SO (t-1) x Leisure (t-1)			-1.1646 (1.5227)					
SO (t-1) x Technology (t-1)				0.1193 (0.1659)				
SO (t-1) x Economy (t-1)					-0.4176*** (0.0850)			
SO (t-1) x Amenity index (t-1)						0.1941 (0.4676)		
SO (t-1) x Pop density (t-1)							0.0274 (0.0555)	
SO (t-1) x R&D intensity (t-1)								**2.8937** (1.1969)
Amenity index (t-1)						0.7001* (0.3995)	0.8577 (0.6560)	0.6988 (0.4120)
Pop. Density (t-1)							0.0363 (0.1124)	
Education (t-1)	0.1806 (0.1738)	0.1788 (0.1828)	0.1874 (0.1907)	0.1865 (0.1913)	0.1783 (0.1910)			
Health (t-1)	0.2937	0.3054	0.2956	0.2927	0.3467*			

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(0.1922)	(0.1996)	(0.1916)	(0.1906)	(0.1965)			
Leisure (t-1)	-3.0206***	-3.0290***	-2.8576**	-3.0439***	-3.0722***			
	(1.0221)	(1.0039)	(1.2282)	(1.0012)	(0.9742)			
Technology (t-1)	0.1642	0.1566	0.1629	0.1575	0.1507			
	(0.1258)	(0.1311)	(0.1269)	(0.1305)	(0.1292)			
Economy (t-1)	0.8025	0.8113	0.7985	0.7922	0.9098*			
	(0.5312)	(0.5294)	(0.5306)	(0.5401)	(0.5275)			
Ageing (t-1)	-0.0048	-0.0056	-0.0049	-0.0049	-0.0066	-0.0016	0.0055	-0.0016
	(0.0155)	(0.0157)	(0.0156)	(0.0156)	(0.0159)	(0.0109)	(0.0186)	(0.0112)
Pop. Growth (t-1)	-0.0404**	-0.0419**	-0.0402**	-0.0407**	-0.0428**	-0.0335	-0.0229	-0.0327
	(0.0153)	(0.0157)	(0.0150)	(0.0156)	(0.0157)	(0.0197)	(0.0177)	(0.0197)
Land price growth (t-1)	-0.0210	-0.0188	-0.0207	-0.0213	-0.0185	-0.0137	-0.0262*	-0.0132
	(0.0147)	(0.0160)	(0.0150)	(0.0146)	(0.0149)	(0.0093)	(0.0143)	(0.0092)
log # of services firms in the region (t-1)	-0.2204*	-0.2218*	-0.2193*	-0.2182*	-0.2397*	-0.0698**	-0.0803	-0.0684**
	(0.1177)	(0.1174)	(0.1174)	(0.1199)	(0.1164)	(0.0306)	(0.0681)	(0.0308)
Labour productivity (t-1)	0.0151	0.0150	0.0152	0.0145	0.0155	0.0144	0.0157	0.0142
	(0.0115)	(0.0115)	(0.0114)	(0.0121)	(0.0113)	(0.0128)	(0.0120)	(0.0124)
Foreign capital share (t-1)	-0.0285	-0.0278	-0.0287	-0.0284	-0.0279	-0.0283	-0.0255	-0.0306*
	(0.0187)	(0.0185)	(0.0188)	(0.0186)	(0.0186)	(0.0169)	(0.0270)	(0.0156)
	-0.0334	-0.0356	-0.0336	-0.0338	-0.0344	-0.0319	-0.0311	-0.0332
Export share to revenue (t-1)	(0.0208)	(0.0215)	(0.0206)	(0.0207)	(0.0205)	(0.0207)	(0.0316)	(0.0201)
log wage (t-1)	-0.0361**	-0.0368**	-0.0362**	-0.0361**	-0.0362**	-0.0338**	-0.0357*	-0.0342*
	(0.0162)	(0.0163)	(0.0161)	(0.0162)	(0.0160)	(0.0158)	(0.0173)	(0.0165)
log employment (t-1)	0.0095	0.0091	0.0097	0.0091	0.0103	0.0121	-0.0016	0.0126
	(0.0192)	(0.0191)	(0.0192)	(0.0196)	(0.0187)	(0.0188)	(0.0155)	(0.0180)
R&D intensity (t-1)	-0.3691	-0.3713	-0.3690	-0.3686	-0.3670	-0.3598	-0.3557	-0.4225
	(0.2795)	(0.2803)	(0.2799)	(0.2807)	(0.2818)	(0.2848)	(0.3456)	(0.2659)
# of patents (t-1)	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002

	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0003)
Debt to assets (t-1)	-0.0014	-0.0014	-0.0014	-0.0014	-0.0008	-0.0023	-0.0125	-0.0016
	(0.0210)	(0.0214)	(0.0210)	(0.0211)	(0.0212)	(0.0205)	(0.0271)	(0.0206)
HHI (t-1)	0.2796	0.2816	0.2834	0.2811	0.2744	0.2840	0.3915*	0.2827
	(0.2138)	(0.2155)	(0.2133)	(0.2142)	(0.2151)	(0.2130)	(0.2190)	(0.2130)
Firm, Industry, Region, Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	3,450	3,450	3,450	3,450	3,450	3,450	3,095	3,450
R-squared	0.441	0.441	0.441	0.441	0.441	0.440	0.463	0.441

Note: Clustered robust standard errors at the industry level are reported in parentheses. *, ** and *** are the significance levels at 10%, 5% and 1%.
Source: Author's calculations.

4. Conclusion and Policy Implications

This study empirically investigates the effect of services offshoring and regional amenities on changes in the composition of skilled employment for services firms using Korean firm-level data for 2006–2019. Services offshoring shows nuanced effects on skilled workers' shares of services firms. Services offshoring increases the share of skilled workers measured as permanent headquarters workers to total workers (= permanent workers + temporary workers). However, the offshoring does not significantly affect the share of high-end skilled workers, such as management and R&D workers' share in the headquarters. This suggests that offshoring services leads to an increase in demand for skilled workers more than unskilled workers in general. However, the proportional change driven by offshoring differs amongst skilled workers. Furthermore, we find that regional amenities promote the positive effect of services offshoring on the share of mid-skilled workers. However, we do not find a significant role of regional amenities in the effect of services offshoring on high-end skilled workers shares. Interestingly, a firm's R&D intensity stimulates the positive effect of offshoring on management and R&D workers in headquarters.

Our results provide insights into the effects of regional amenities and services firms' liberalisation on labour market outcomes in the services industry in Korea, especially in attracting high-skilled human capital. First of all, our study confirms previous offshoring theories in manufacturing sectors by introducing new services firm data: a home firm slicing the value chain and offshoring its relatively unskilled tasks abroad leads to a rise in the share of skilled workers in services sectors, too. Our study also helps understand changes in the composition of skilled workers in Korean services industries with the trend of services liberalisation. In particular, policymakers can gain insight into the demand for skilled workers in the domestic market by tracking which tasks domestic firms offshore abroad between skilled and unskilled workers. This is because changes in demand for skilled domestic workers can be predicted based on the offshored task. To promote high-quality jobs in the domestic market along with services liberalisation, policymakers need to provide a policy that boosts services firms' competitiveness. This is because competitive services firms can specialise in high-skilled tasks in the value chain and offshore low-skilled tasks, thereby increasing jobs that require high-skilled workers.

Services sectors are traditionally considered non-tradable, so the outcome of services liberalisation has not been discussed much. A few superstar firms enjoying economies of scale can dominate manufacturing sectors via competition in the international market. Moreover, the global value chain in manufacturing sectors is reshaped amongst many East Asian countries

that support cheap and qualified workers. However, domestic services sectors are not exposed to world competition and are still supported by many domestic firms, so policymakers are still debating the pros and cons of services liberalisation. In this regard, our results shed light on the opportunities for firms to source services intermediate inputs globally, but the impact on the domestic labour market can lead to potential challenges for low-skilled workers. As services firms' demand for labour changes in response to increasing trade in services, low-skilled jobs can be offshored abroad. Therefore, public policy must enable workers to be reallocated smoothly in the jobs domestic firms focus on in their value chain.

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