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Articles

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Jinsoo Lee and Bok-Keun Yu 1

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Min Jung Kim 15

Why Are Peak Loads Observed during
Winter Months in Korea?

Jee Young Kim, Hyungna Oh, and Kyung-mee Choi 43

The Effects of Export Diversification on Macroeconomic Stabilization: Evidence from Korea

By JINSOO LEE AND BOK-KEUN YU*

This paper studies whether export diversification mitigated the negative effect of the global financial crisis on exports using the Korean case. Specifically, we use annual data on the exports of 24 Korean manufacturing industries from 2000 to 2016 and examine whether the negative effect of the crisis on exports was less prevalent in industries that were more diversified in terms of country and product. We also examine whether export competitiveness, as measured by the revealed comparative advantage index by industry, had a mitigating effect on trade during the crisis. In order to study these issues, we use panel regression with a fixed-effect model for 24 Korean manufacturing industries. From our empirical analysis, we find that country diversification weakened the negative impact of the global financial crisis on Korea's exports, whereas neither product diversification nor export competitiveness did so.

Key Word: Export Diversification, Global Financial Crisis,
Macroeconomic Stabilization

JEL Code: E60, F10, F40

I. Introduction

Exports account for a relatively large share of the Korean economy compared to other countries in the world. For example, Korea's export share of GDP (42.4%) was the second largest among G20 countries¹ in 2016 after that of Germany (46.1%), and was higher than those of Mexico (37.1%), Canada (31.0%), China (19.5%), India (19.2%) and Japan (16.2%). Therefore, it is worthwhile to take a close look at factors that could mitigate a negative impact on the export sector in the case of global real or financial shocks.

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¹The G20 countries include Argentina, Australia, Brazil, Canada, China, the European Union (EU), France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the UK and the US. This group accounted for 80% of global GDP and 77% of trade in 2016 (IMF and WTO).

According to the theory of diversification in the area of finance, the return of a portfolio becomes less volatile if the portfolio is more diversified. Empirical findings in this area are mostly consistent with this theory. In this paper, we analyze whether the same phenomenon can be found in the area of trade. Specifically, we examine whether export diversification in terms of country and product mitigated the negative effect of the global financial crisis on exports using annual data for 24 Korean manufacturing industries from 2000 to 2016.

By examining the annual growth rates of global merchandise and of exported Korean goods from 1991 to 2017 in Figure 1, we find that the global financial crisis had a major negative effect on not only the world's exports but also on Korea's exports. The annual growth rates of global merchandise and Korea's goods exports both decreased, by 22.3% and 15.9%, respectively, in 2009. Hence, our analysis focuses on this period, i.e., when the degree of trade collapse was most serious.

Our methodology basically employs the approach of Neto and Romeu (2011), who explored the effect of export diversification on exports during the global financial crisis (from the fourth quarter of 2008 through the first quarter of 2009) using export data from 14 Latin American countries during the period of 2000-2009. Given the different industrial structure and export competitiveness of Korea compared to Latin American countries, we attempt to derive policy implications for Korea through an empirical analysis. Unlike earlier work, we use industry-level data pertaining to the manufacturing sector in Korea. We also examine whether export competitiveness, as measured by the revealed comparative advantage (RCA) index by industry, had a mitigating effect on exports during the crisis.

From our empirical analysis, we find that country diversification weakened the negative impact of the global financial crisis on Korea's exports, though this was not the case for product diversification or export competitiveness.

The rest of paper is organized as follows. We provide a review of the literature in Section II. In Section III, we describe the data and introduce the methodology used

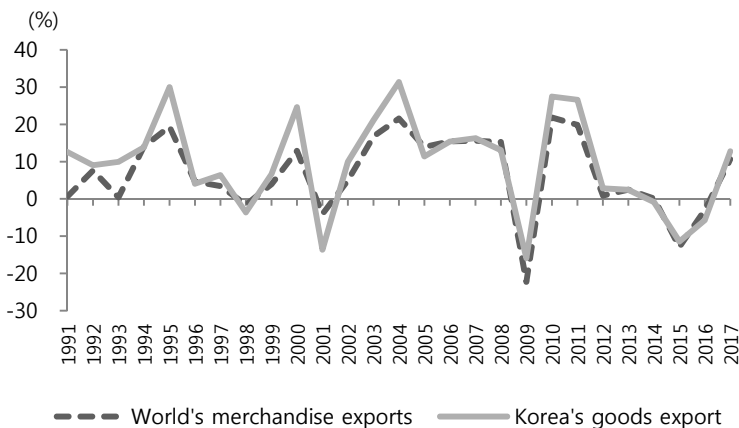


FIGURE 1. COMPARISON OF LABOUR MARKET PERFORMANCES

Note: Annual growth rates are based on US dollar.

Source: WTO and Bank of Korea.

in the analysis. We report the empirical results in Section IV and then conclude the paper in Section V.

II. Literature Review

According to a long-held tradition of trade theory, it is favorable for a country to specialize in a particular industry or product. The absolute and comparative advantage theories of Adam Smith and David Ricardo tell us that a country can benefit by producing items in which it has a comparative advantage and trading them with other countries. This implies that specialization in international trade can be a superior strategy to foster economic growth and to promote exports.

However, numerous studies have emphasized the positive effects of trade diversification on a national economy, disclaiming the above-mentioned theories. Prebisch (1950) and Singer (1950) are the pioneers in this regard. They stress the need for developing countries to diversify their export products, pointing out that specializing in the exports of primary products (raw materials) could have an adverse impact on economic growth in the long run because it can worsen the terms of trade with respect to manufacturing goods. The “Dutch Disease²” is another example highlighting the negative effect of an expansion in a country’s primary sectors into other tradable sectors, such as manufacturing. This phenomenon occurs due to the deterioration of the export competitiveness of the manufacturing sector and decreases in import goods via the appreciation of exchange rates. More recently, there have been various studies focusing on the relationship between export diversification and the stage of economic development. According to the well-known export diversification and nonlinear hypothesis on income level, export diversification has a positive effect on economic growth in developing countries, whereas export specialization is more effective in advanced countries (Imbs and Wacziarg, 2003; Farole *et al.*, 2010; Hesse, 2008; Cadot *et al.*, 2011).

Feenstra and Kee (2004) find that sectoral export diversity was important for country productivity in 34 countries from 1982 to 1997. For example, a 10% increase in export diversity in all industries resulted in a 1.3% increase in national productivity. Rath and Akram (2017) find that export diversification had a positive effect on total factor productivity growth in the South Asian region from 1995 to 2014. Melitz (2003) argues that more productive firms become exporters while less productive firms stay in the domestic market. Thus, causation arises, from productivity to export variety. Hinlo and Arranguéz (2017) study the effect of geographical diversification on the output growth for five ASEAN countries from 1980 to 2014. They stress that the diversification of market destinations is necessary to improve macroeconomic performance outcomes.

Several papers have investigated the effects of export diversification on macroeconomic stability. Jansen (2004) finds that export concentration affects the terms of trade volatility, which in turn increases the standard deviation of GDP

²This term was used by “The Economist” in 1977 to describe the detrimental situation of the manufacturing industry in the Netherlands after the discovery of large natural gas reserves in the North Sea in 1959 and the natural-gas exports that followed.

growth in small and developing economies. Bacchetta *et al.* (2007) document that export product diversification in developing countries lowers output volatility, while geographical diversification is more significant in developed countries. Buch *et al.* (2009) argue that inter-industry diversification is more important than intra-industry diversification in reducing output volatility. Papageorgiou and Spatafora (2012) find that export diversification in low-income countries with better institutions decreases output volatility. Vannoorenberghe *et al.* (2014) argue that the effect of export diversification on the volatility of foreign market sales varies by firm size. Stanley and Bunnag (2001) hold that export diversification can reduce export earnings instability.

A salient study of the effect of export diversification on trade was conducted by Neto and Romeu (2011). They analyze whether export diversification mitigated the effects on exports during the global financial crisis (from the fourth quarter of 2008 to the first quarter of 2009) using export data from 14 Latin American countries during the period of 2000-2009. For the empirical analysis, three Herfindahl indices according to inter-industry products, destinations and intra-industry products were employed as the export concentration measure. They find that product diversification of exports eased the trade-reduction effect of the global financial crisis. However, diversifying the geographical destinations of exports did not significantly mitigate the negative impact on trade during this period.

There are also several noteworthy studies of the various effects of export diversification in Korea. Lee and Wang (2004) analyze the impact of the trade structure on economic growth using panel data from 66 countries during the period of 1991-2001. They find that intra-industry trade has a positive effect on economic growth, whereas an increase in trade concentration negatively affects growth. Hwang *et al.* (2004) use the Gini coefficient to measure the degree of export diversification by country and to examine the relationship between export diversification and competitiveness in the manufacturing industry from 1990 to 1999. They find a negative correlation between the export market intensity and export competitiveness. They argue that export bargaining power and the ability to respond to exchange rate fluctuations could be enhanced under more diversified export market environments.

Kim and Park (2006) use data from 69 countries from 1970 to 2000 to analyze the effects of trade diversification and the economic conditions of trading partners on domestic economic growth. They find that faster economic growth is achieved in countries where import and export goods are highly diversified by product as well as by trading partner. They also discover that the economic growth of trade partners significantly affects a country's own economic growth.

Kim and Oh (2008) find that the export intensity of Korea's IT industry has an upward trend from 1996 to 2006, showing a higher level than that of Japan, the US and China. They also find through a regression analysis that the degree of export concentration has a positive effect on the export growth of the IT industry. Min *et al.* (2011) analyze export diversification patterns and related impacts on exports using data from 1995 to 2008. They find that the diversification indices in terms of both product and destination have U-shaped and non-linear trends and that the extensive margin is more significant than the intensive margin in explaining export diversification. They also argue that export diversification can affect the performance

and volatility of exports.

More recently, Kwon (2017) investigates the effects of diversification in foreign markets (exports) and in domestic markets on firm value as measured by “Tobin’s q ” using firm-level data from 2000 to 2010. They find that product diversification in exports positively affects firm value relative to product diversification in domestic markets.

III. Data and Methodology

We collect annual data on Korean exports to foreign countries in US dollars from the UN Comtrade database at the HS 6-digit code level from 2000 to 2016. For the classification of manufacturing industries for Korea, we use the Korean Standard Industrial Classification (KSIC, revision 9) provided by the Korea National Statistical Office following Lee and Yu (2018). There are 24 divisions (industries) for manufacturing in the KSIC (revision 9). Table A1 reports the codes and names for the 24 divisions (industries). We matched HS 6-digit codes to KSIC codes.

We compute the export amounts in US dollars between Korea and foreign countries for the 24 Korean manufacturing industries from 2000 to 2016. We then rank foreign countries according to the proportion of exports during the period and include foreign countries ranked from 1 to 77 in our sample. Exports from Korea to those 77 countries cover 95.0% of all exports of Korean manufacturing industries for the period. Table 1 reports the ranks and proportions of exports for those 77 countries in our sample during the period of 2000 to 2016.

TABLE 1—PROPORTION OF EXPORTS OF KOREAN MANUFACTURING INDUSTRIES
TO FOREIGN COUNTRIES FROM 2000 TO 2016

Rank	Country	Proportion (%)	Rank	Country	Proportion (%)
1	China	23.01	21	Marshall Islands	1.07
2	US	12.91	22	Canada	1.00
3	Japan	6.65	23	Turkey	0.94
4	Hong Kong	5.66	24	Iran	0.89
5	Singapore	3.37	25	Italy	0.87
6	Vietnam	2.84	26	Liberia	0.79
7	Germany	2.10	27	France	0.77
8	India	2.00	28	Panama	0.73
9	Indonesia	1.88	29	Poland	0.68
10	Mexico	1.80	30	Slovakia	0.63
11	Australia	1.56	31	Spain	0.60
12	Russia	1.53	32	Belgium	0.52
13	Malaysia	1.48	33	Chile	0.46
14	Philippines	1.44	34	Greece	0.46
15	UK	1.44	35	Norway	0.38
16	Brazil	1.35	36	South Africa	0.35
17	Thailand	1.34	37	Egypt	0.34
18	Saudi Arabia	1.23	38	Hungary	0.32
19	United Arab Emirates	1.18	39	Bahamas	0.29
20	Netherlands	1.09	40	Malta	0.28

TABLE 1—PROPORTION OF EXPORTS OF KOREAN MANUFACTURING INDUSTRIES
TO FOREIGN COUNTRIES FROM 2000 TO 2016 (*CONT'D*)

Rank	Country	Proportion (%)	Rank	Country	Proportion (%)
41	Nigeria	0.28	60	Qatar	0.18
42	Bermuda	0.28	61	Cyprus	0.17
43	Israel	0.26	62	Denmark	0.17
44	Uzbekistan	0.26	63	Ukraine	0.17
45	Czech Rep.	0.26	64	Libya	0.16
46	Bangladesh	0.26	65	Argentina	0.16
47	Finland	0.25	66	Switzerland	0.16
48	Colombia	0.24	67	Oman	0.15
49	Kuwait	0.23	68	Ireland	0.14
50	New Zealand	0.23	69	Ecuador	0.13
51	Angola	0.21	70	Syria	0.13
52	Iraq	0.21	71	Venezuela	0.13
53	Algeria	0.20	72	Kazakhstan	0.12
54	Peru	0.20	73	Myanmar	0.12
55	Jordan	0.19	74	Romania	0.11
56	Sweden	0.19	75	Portugal	0.11
57	Slovenia	0.19	76	Guatemala	0.11
58	Austria	0.18	77	Cambodia	0.09
59	Pakistan	0.18	Total		95.0

In order to examine whether export diversification in terms of country and product by industry had a mitigating effect on Korean manufacturing exports during the global financial crisis, we generally follow the methodology of Neto and Romeu (2011). We also examine the effect of export competitiveness, measured by revealed comparative advantage, on Korean manufacturing exports during the crisis. Specifically, we use panel regressions (1) and (2) with a fixed-effect model for the 24 Korean manufacturing industries as follows:

$$\begin{aligned}
 (1) \quad & \ln[Export_{i,j,t} / (GDP_{Korea,t} \times GDP_{i,t})] \\
 &= \alpha + \beta_{dist} \ln distance_{Korea,i} + \beta_{fx} (R_{fx,i,t} - R_{fx,Korea,t}) \\
 &+ \beta_{product} HI_{product,j,t-1} + \beta_{country} HI_{country,j,t-1} \\
 &+ \beta_{RCA} RCA_{Korea,j,t-1} + \varepsilon_{i,j,t}
 \end{aligned}$$

$$\begin{aligned}
 (2) \quad & \ln[Export_{i,j,t} / (GDP_{Korea,t} \times GDP_{i,t})] \\
 &= \alpha + \beta_{dist} \ln Distance_{Korea,i} + \beta_{fx} (R_{fx,i,t} - R_{fx,Korea,t}) \\
 &+ \beta_{product} HI_{product,j,t-1} + \beta_{country} HI_{country,j,t-1} \\
 &+ \beta_{RCA} RCA_{Korea,j,t-1} + \beta_{product,crisis} (HI_{product,j,t-1} \times CRISIS) \\
 &+ \beta_{country,crisis} (HI_{country,j,t-1} \times CRISIS) \\
 &+ \beta_{RCA,crisis} (RCA_{Korea,j,t-1} \times CRISIS) + \varepsilon_{i,j,t}
 \end{aligned}$$

In (1), $Export_{i,j,t}$ denotes exports from Korea to country i for manufacturing

industry j in year t . $GDP_{Korea,t}$ is the GDP for Korea in year t . $GDP_{i,t}$ is the GDP for country i in year t . $Distance_{Korea,i}$ is the distance in kilometers between the capital city of Korea and that of country i . $R_{fx,i,t}$ is the rate of change for the currency of country i against the US dollar in year t . $R_{fx,Korea,t}$ is the rate of change for the Korean won against the US dollar in year t . Hence, differences between the two rates indicate the degree of relative appreciation of the Korean won against the currency of country i . $HI_{product,j,t-1}$ is the Herfindahl index³ in terms of the HS-6 digit product for Korean manufacturing industry j in year $t-1$. $RCA_{Korea,j,t-1}$ is the revealed comparative advantage index⁴ for Korean manufacturing industry j in year $t-1$. The Herfindahl index and RCA index were used in $t-1$ instead of t in order to consider the time lag in the effect of these variables on exports and to alleviate endogeneity problems.

In (2), we interact $HI_{product,j,t-1}$, $HI_{country,j,t-1}$, and $RCA_{Korea,j,t-1}$ with a dummy variable, $CRISIS$, which takes a value of one for the year 2009 and zero otherwise. As the merchandise exports of the world declined by 22.3% in 2009, the negative effect of the global financial crisis on world trade was greatest among the period of 2000-2016.

We collect GDP data for Korea and the foreign countries from the World Development Indicators provided by the World Bank. Regarding the distance between the capital city of Korea and those of the foreign countries, we use data provided by Prof. Gleditsch of Essex University.⁵ We compute the rates of change for the Korean won and the currencies of the foreign countries against the US dollar using average official exchange rate data provided by the World Development Indicators. The Herfindahl indices in terms of product and country for the Korean manufacturing industries are computed with UN Comtrade data. Lastly, the RCA indices for the Korean manufacturing industries are also computed with UN Comtrade data.

Figure 2 shows the annual Herfindahl indices in terms of product and country for the Korean manufacturing industry for the period of 1999 to 2015. The Herfindahl index in terms of product tends to decline during the period. The Herfindahl index in terms of product decreased from 0.152 in 1999 to 0.125 in 2015. On the other hand, the Herfindahl index in terms of country was stable at around 0.280 during the period. The highest Herfindahl index in terms of country was 0.285, while the lowest one was 0.276 in 2008.

³ $H = \sum_{k=1}^n S_k^2$, where S_k is the share of each product with respect to the industry. The Herfindahl index ranges from 0 (highly diversified) to 1 (highly concentrated).

⁴ The RCA index is calculated by dividing exports in an industry of Korea/exports in the manufacturing industry of Korea by exports in an industry of the world/exports in the manufacturing industry of the world. If the value of the RCA index of an industry is greater than 1, the industry has a comparative advantage. On the other hand, if the value of the RCA index of an industry is less than 1, the industry has a comparative disadvantage.

⁵ Kristian Skrede Gleditsch (<http://kskgleditsch.com/data-5.html>).

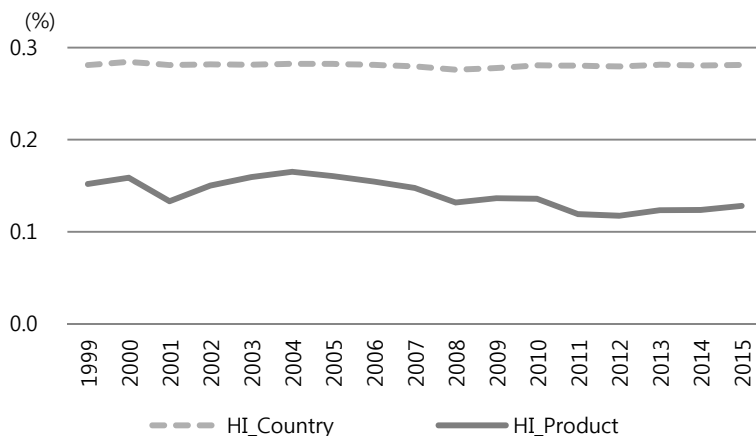


FIGURE 2. ANNUAL HERFINDAHL INDICES FOR KOREAN MANUFACTURING INDUSTRY FROM 1999 TO 2015

Figure 3 shows the annual average Herfindahl indices in terms of product and country for the 24 Korean manufacturing industries for the period of 1999 to 2015. For the Herfindahl indices in terms of product, the tobacco products industry (code 12, Herfindahl index of 0.959) shows the highest value, followed by the industry of coke, hard-coal and lignite fuel briquettes and refined petroleum products (code 19, Herfindahl index of 0.848) and the industry of printing and reproduction of recorded media (code 18, Herfindahl index of 0.598). For the Herfindahl indices in terms of country, the beverages industry (code 11, Herfindahl index of 0.329) exhibits the highest value, followed by the industry of wearing apparel, clothing accessories and fur articles (code 14, Herfindahl index of 0.208) and then the industry of chemicals and chemical products, except pharmaceuticals and medicinal chemicals (code 20, Herfindahl index of 0.202) with the second and third highest values, respectively.

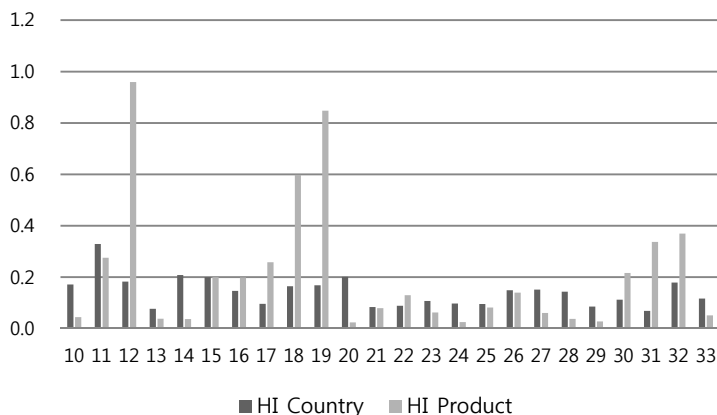


FIGURE 3. ANNUAL AVERAGE HERFINDAHL INDICES FOR KOREAN MANUFACTURING INDUSTRIES FROM 1999 TO 2015

Note: For industry code numbers, refer to Table A1.

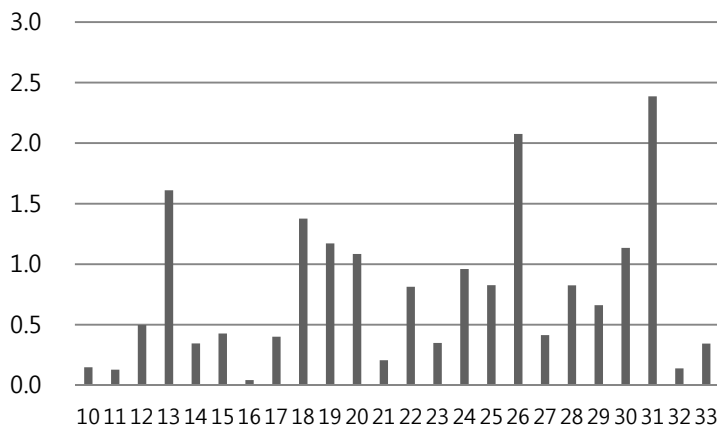


FIGURE 4. ANNUAL AVERAGE RCA INDICES FOR KOREAN MANUFACTURING INDUSTRIES FROM 1999 TO 2015

Note: For industry code numbers, refer to Table A1.

Figure 4 represents the annual average RCA indices for the Korean manufacturing industries for the same period. The industry of other transport equipment (code 31, RCA index of 2.387), the industry of electronic components, computer, radio, television and communication equipment and apparatuses (code 26, RCA index of 2.076), the industry of textiles, except apparel (code 13, RCA index of 1.611), the industry of printing and reproduction of recorded media (code 18, RCA index of 1.376), the industry of coke, hard-coal and lignite fuel briquettes and refined petroleum products (code 19, RCA index of 1.172), the industry of motor vehicles, trailers and semi-trailers (code 30, RCA index of 1.134), and the industry of chemicals and chemical products, except pharmaceuticals and medicinal chemicals (code 20, RCA index of 1.084) have higher values than one, suggesting that Korea has comparative advantages in these industries over competing countries.

IV. Empirical Results

Panel A of Table 2 reports the results of the regression analysis of specification (1) from Section III. In model 1, we include Herfindahl indices in terms of product and country. We find that both Herfindahl indices are negative and statistically significant at the level of one percent. Thus, we can conclude that if exports in a manufacturing industry are more diversified in terms of product and country, they tend to be larger in the Korean case. In addition, we find that the variable of distance between Korea and a foreign country is negative and statistically significant at the level of one percent. This finding implies that Korea exports more to a foreign country when the country is closer to Korea. Differences in the rate of change in the foreign exchange rate do not have any effect on exports for Korean manufacturing industries. In model 2, we add the RCA index as an independent variable in the regression and find that the RCA index is positive and statistically

TABLE 2—EFFECTS OF HERFINDAHL INDICES FOR PRODUCT AND COUNTRY AND THE RCA INDEX ON EXPORTS FOR KOREAN MANUFACTURING INDUSTRIES FROM 2000 TO 2016

[Panel A]

Independent variables	Dependent variable	
	ln(Annual exports from Korea to country i / $GDP_i \times GDP_{Korea}$)	
	Model 1	Model 2
ln(Distance between Korea and country i)	-1.245*** (-57.42)	-1.245*** (-57.66)
Difference in FX rate changes between country i and Korea	-0.095 (-1.07)	-0.100 (-1.11)
Herfindahl index for product	-0.735*** (-2.91)	-1.038*** (-4.13)
Herfindahl index for country	-1.700*** (-5.35)	-1.925*** (-6.13)
RCA index		0.716*** (10.18)
Industry effect	Yes	Yes
Year effect	Yes	Yes
N	28,151	28,151
Adjusted R ²	0.542	0.545

[Panel B]

Independent variables	Dependent variable	
	ln(Annual exports from Korea to country i / $GDP_i \times GDP_{Korea}$)	
	Model 3	Model 4
ln(Distance between Korea and country i)	-1.245*** (-57.43)	-1.245*** (-57.66)
Difference in FX rate changes between country i and Korea	-0.095 (-1.06)	-0.100 (-1.10)
Herfindahl index for product	-0.737*** (-2.90)	-1.029*** (-4.07)
Herfindahl index for country	-1.671*** (-5.26)	-1.901*** (-6.05)
RCA index		0.713*** (10.16)
Herfindahl index for product × Crisis	0.207 (0.66)	0.071 (0.22)
Herfindahl index for country × Crisis	-2.710*** (-2.64)	-2.318** (-2.39)
RCA index × Crisis		-0.019 (-0.16)
Industry effect	Yes	Yes
Year effect	Yes	Yes
N	28,151	28,151
Adjusted R ²	0.542	0.545

Note: 1) Numbers in parentheses are heteroscedasticity-robust t-statistics. 2) ***, ** and * denote statistical significance at the level of 1%, 5% and 10%, respectively.

significant at the level of one percent. This finding shows that a Korean manufacturing industry exports more when the industry is more competitive in the world market. For all of the other independent variables, we obtain results identical to those in model 1.

In Panel B of Table 2, we report the results of the regression analysis in specification (2) from Section III. In particular, we introduce a dummy variable for the global financial crisis and interact the dummy variable with the two Herfindahl indices and the RCA index in order to observe the effect of export diversification by country as well as by product and competitiveness on exports during the global financial crisis. In model 3, the variable of interaction between the Herfindahl index in terms of product and the crisis dummy variable is not significant at any conventional level of significance. On the other hand, the variable of interaction between the Herfindahl index in terms of country and the crisis dummy variable is negative and statistically significant at the level of one percent. In model 4, we add the variable of interaction between the RCA index and the crisis dummy variable and find that it is not significant. Thus, we can conclude that country diversification weakened the negative impact of the global financial crisis on Korea's manufacturing exports, but neither product diversification nor export competitiveness did so. For all of the other independent variables, we obtain results matching those in specification (1).

As indicated by the empirical results, the diversification of export destinations played a role in reducing the negative impact on Korean exports during the global financial crisis, while the diversification of export products and competitiveness did not. This may be due to increases in the composition of Korea's export destinations in Asia and Europe, such as China, the ASEAN countries, the European Union, and Eastern European countries, which suffered less of a negative impact due to the crisis than the US, the epicenter of the crisis. In addition, it appears that the expansion of FTAs between Korea and the rest of the world rather than the US contributed to the country's diversification of its exports.⁶ According to related studies (Kim, 2008; Kim and Kim, 2012; Cho *et al.*, 2013), it was found that Korea's FTAs with these economies were beneficial in that they led to increases in exports to the partner economies.

V. Conclusion

In this paper, we examined whether export diversification mitigated the negative effect of the global financial crisis on exports using annual data for 24 Korean manufacturing industries from 2000 to 2016. Specifically, we examined whether the negative effect of the crisis on exports was less prevalent in more diversified industries in terms of country and product. We also examine whether export competitiveness, as measured by the RCA index by industry, had a mitigating effect on exports during the crisis.

⁶Korea signed FTAs with Chile (April 2004), Singapore (March 2006), EFTA (Iceland, Liechtenstein, Norway and Switzerland; September 2006), and with the ASEAN countries (June 2007) before the global financial crisis of 2008-2009.

From our analysis, we find that if exports in a manufacturing industry are more diversified in terms of product and country, the amounts tend to be larger in the Korean case. In addition, a Korean manufacturing industry exports more when the industry is more competitive in the world market. However, during the global financial crisis, only country diversification weakened the negative impact of the global financial crisis on Korea's exports. Neither product diversification nor export competitiveness did so.

The empirical results imply with regard to policy that Korea could mitigate the negative impact of global economic shocks on its exports through export market diversification rather than product diversification. This suggests that it is critical to expand export markets to countries with high growth potential while maintaining export competitiveness in each industry. To this end, policymakers need to continue to make efforts to reduce the cost of new-market development for Korean firms by providing information on new markets and establishing co-marketing strategies.

APPENDIX

TABLE A1—KOREAN STANDARD INDUSTRIAL CLASSIFICATION (REVISION 9) FOR MANUFACTURING

Division Code	Name of Division
10	Food products
11	Beverages
12	Tobacco products
13	Textiles, except apparel
14	Wearing apparel, clothing accessories and fur articles
15	Tanning and dressing of leather, manufacture of luggage and footwear
16	Wood and products of wood and cork, except furniture
17	Pulp, paper and paper products
18	Printing and reproduction of recorded media
19	Coke, hard-coal and lignite fuel briquettes and refined petroleum products
20	Chemicals and chemical products, except pharmaceuticals and medicinal chemicals
21	Pharmaceuticals, medical chemicals and botanical products
22	Rubber and plastic products
23	Other non-metallic mineral products
24	Basic metal products
25	Fabricated metal products, except machinery and equipment
26	Electronic components, computer, radio, television and communication equipment and apparatuses
27	Medical, precision and optical instruments, watches and clocks
28	Electrical equipment
29	Other machinery and equipment
30	Motor vehicles, trailers and semi-trailers
31	Other transport equipment
32	Furniture
33	Other manufacturing

Note: This table is from Lee and Yu (2018).

Source: Korea National Statistical Office (Korean Standard Industrial Classification, 2008).

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Benefits and Concerns of the Sharing Economy: Economic Analysis and Policy Implications[†]

By MINJUNG KIM*

This paper economically analyzes the benefits and concerns of the sharing economy and derives policy implications that could help to achieve the expected benefits and respond appropriately to any concerns. Primary benefits anticipated from the sharing economy are the creation of new transactions and promotional and market testing opportunities, and the main concerns include the crowding out of existing transactions as well as transaction and social risks. How these benefits and concerns are being realized in Korea is empirically examined by conducting a survey on participation experiences with the sharing economy. The sharing economy is expected to contribute to the enhancement of social welfare with its wide range of benefits if risk factors can be properly controlled. Accordingly, an institutional framework is needed to support the stable growth of the sharing economy, and the unique characteristics of non-professional, peer-to-peer transactions should be reflected in tandem with regulatory equity between existing and sharing economy suppliers. To do this, transaction-volume-based regulations are recommended. Furthermore, to secure regulatory effectiveness and to alleviate transaction risks, the pertinent obligations must be imposed on sharing platforms.

Key Word: Sharing Economy, Peer-to-peer (P2P) Transaction,
Non-professional Supplier, Regulatory Equity
JEL Code: D16, L51, L81, M3

I. Introduction

The “sharing economy,” a term used to describe the renting of private assets online to others, has achieved explosive growth since the global financial

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crisis. Indeed, two sharing economy titans, Airbnb and Uber, were valued at \$30 billion and \$80 billion as of 2016, outranking global hotel chains such as Hilton and traditional carmakers such as Volkswagen and GM.¹ Considering that the assets required for transactions are not owned by the sharing economy firms, their growth is quite surprising.

As of yet, there remains no clear-cut definition of the sharing economy. In this paper, it is defined as an economy in which consumers of a particular service and suppliers who own idle assets that create a particular service become involved in market transactions through mediation by an ICT-based sharing platform, following Kim *et al.* (2016). Suppliers and consumers search for each other via a platform, and when a match and deal are made, the former provides the latter with access rights to the idle asset at the market price. What should be noted here is the reference to idle assets, which are assets that the owners have acquired for their own use but are not in use. In other words, assets that were bought for the purpose of renting are not regarded as idle assets. Hence, in the sharing economy, transactions basically occur between non-professional individuals. This definition may seem somewhat limited,² but the focus here is on the transaction pattern, which differs from those seen in the existing service industry and in e-commerce and thus requires a new policy approach. As shown in Table 1, the sharing economy can be classified into several sectors depending on the type of asset utilized.

Peer-to-peer transactions using privately owned assets are nothing new, but these transactions have increased dramatically in volume due to technological advances, typified by the internet and smart devices, and have grown into an industry. While the proliferation of the sharing economy is now an undeniable trend, it raises many issues with respect to current governmental systems and procedures due to differences with existing industries. This study thus economically analyzes key issues pertaining to the sharing economy, and based on the results, implications are presented for government policies to support its stable growth. In particular, empirical analyses of the benefits and concerns of the sharing economy are conducted to derive

TABLE 1—MAJOR SECTORS OF THE SHARING ECONOMY

Sector	Idle assets	Consumer	Supplier
Accommodation	Vacant house or room	Guest	Host
Car	Idle car, spare time	Passenger	Car owner
Finance (Crowdfunding)	Surplus money	Fundraiser	Investor
Space	Idle space, idle shop	Those who need space	Space holder
Talent	Spare time, labor, intellectual property	Those who need talent	Talented individual

¹Bloomberg, "Uber and Airbnb, It's Time to Get Real," 2016. 11. 7.

²According to the definition above, companies that hold large quantities of assets directly and rent them out to consumers, i.e., B2C-type platforms, are not included.

institutional measures that could help to achieve the expected benefits and respond appropriately to any concerns.

The paper initially discusses the logically anticipated benefits and concerns of the sharing economy and then analyzes how these benefits and concerns are being realized in Korea by conducting an extensive survey regarding the participation experience with the sharing economy. First, primary benefits expected from the sharing economy are the creation of new transactions and promotional and market testing opportunities, as evidenced in the survey results pertaining on reasons for participation. I also estimate an empirical model of the determinants of participation to determine which benefit actually motivates people to participate more in the sharing economy. Next, main concerns include the crowding out of existing transactions and transaction risks. The survey results will show how severe those risks have been in the market, and this is supplemented by a model analysis of participation satisfaction. Lastly, transaction-volume-based regulations are suggested as an institutional framework to achieve the expected benefits and respond appropriately to concerns.

Previous studies of the sharing economy similarly investigate its motivations and constraints using surveys. While most of them (see for example Bellotti *et al.*, 2015; Hamari *et al.*, 2015; Möhlmann, 2015; Tussyadiah, 2016; Böcker and Meelen, 2017; Guttentag *et al.*, 2017) only deal with motivations, constraints are also examined in Tussyadiah (2015), So *et al.* (2018), and Tussyadiah and Pesonen (2018). They analyze how motivations and constraints affect attitudes, behavioral intentions or satisfaction and are mostly limited to the accommodation sharing sector. However, the present paper is distinguished from these earlier studies in how it analyzes the effects of benefits and concerns as they relate to actual participation intensity and satisfaction, comparing the three main sharing economy sectors of accommodation sharing, car sharing and crowdfunding.

The remainder of the paper is organized as follows. Section 2 discusses the types of benefits expected from the sharing economy and presents relevant empirical evidence, including the model analysis results. Section 3 is similarly organized, focusing instead on concerns in the sharing economy. Policy suggestions for the sharing economy are provided in Section 4.

II. Benefits of the Sharing Economy

A. Creation of New Transactions

The sharing economy contributes to enhancing the welfare of its participants by creating new transactions that are based on the efficient use of underused assets, made possible by the reduction of transaction costs using ICT technology. Consumers can enjoy low prices, diverse options and greater convenience while suppliers can earn additional income owing to the low entry barriers. In particular, it can also have distributive value by offering low-income households/individuals opportunities to take part as suppliers. Meanwhile, sharing platforms profit by receiving brokerage fees for matching consumers and suppliers.

TABLE 2—REASONS FOR PARTICIPATING IN SHARING ECONOMY TRANSACTIONS

(UNIT: %)

Accommodation sharing				Car sharing		Crowdfunding			
Consumer (Guest)		Supplier (Host)		Consumer (Passenger)		Consumer (Fundraiser)		Supplier (Investor)	
Low price	62.0	Additional income	41.6	Low price	42.2	Curiosity	36.0	Appealing backstories or business ideas	52.7
Cultural experience	34.0	Curiosity	31.9	Curiosity	35.4	Interaction with investors	28.0	Curiosity	38.7
Curiosity	32.4	Abundant guest information	21.2	Recommendation by friends or reviews	34.4	Short fundraising period	28.0	High return	26.7
Diverse selection	27.8	Trust in the platform	18.6	Convenience in platform use	27.0	No other channels possible	26.7	Various investment opportunities	24.3
Recommendation by friends or reviews	23.2	No other channels possible	15.9	Service quality	26.0	Low price (interest rate)	20.7	Recommendation by friends or reviews	16.7
Accommodation quality	13.2	Interaction with guests	15.0	Trust in the platform	15.8	Thick market	19.3	Short payback period	12.7
Interaction with hosts	12.4	Recommendation by friends or reviews	15.0	Interaction with drivers	3.2	Recommendation by friends or reviews	16.7	Trust in the platform	11.3
Trust in the platform	10.6	Low user fee	13.3			Trust in the platform	15.3	Convenience in platform use	10.3
Convenience in platform use	9.6	Convenience in platform use	11.5			Convenience in platform use	15.3	Interaction with fundraisers	9.7
								Abundant fundraiser information	7.3
								Interaction with other investors	3.3

Note: Multiple answers (3 max.) were allowed.

A survey³ was conducted among 1,563 Korean participants in the sharing economy, consisting of 500 consumers and 113 suppliers for accommodation sharing, 500 consumers for car sharing,⁴ and 150 consumers and 300 suppliers for crowdfunding (see Table A1 for the associated demographic profile). Table 2 shows the results of the survey on reasons for participating in each sharing economy sector. Obviously, certain psychological factors are present, such as curiosity about the sharing economy, as more than 30% of the participants chose “curiosity” regardless of the sector or participant type. However, as noted above, participants are also motivated strongly by the expected benefits, i.e., low prices for

³The survey was conducted online using the Macromill Embrain panel from Oct. 24 to Nov. 7, 2016. Respondents were limited to those aged 19 and older and to those with participation experience as a consumer or a supplier in (at least) one of the three sharing economy sectors listed above. Refer to Kim *et al.* (2016) for further details.

⁴Individuals are not allowed to participate as a car sharing supplier in Korea, and hence no survey information on the supplier side is available.

consumers and additional income for suppliers – prominently for accommodation and car sharing (top-ranked reason). Respondents also chose diverse options (the fourth most popular reason for accommodation sharing consumers and crowdfunding suppliers) and items related to better quality (“accommodation quality,” car sharing “service quality,” and “short fundraising/payback period”) and convenience (“convenience in platform use” in all cases) – all of which contribute to improving participant welfare – as the main reasons behind their participation.

B. Other Expected Benefits

Businesses participating in the sharing economy can also expect promotional and market testing effects. In the rudimentary phase of business, participants are given opportunities to promote and test new goods or business ideas without incurring substantial costs. These benefits are highly anticipated in the sectors of crowdfunding and space and talent sharing, some of which have been realized. Indeed, Table 2 shows that 28% of consumers in the crowdfunding sector chose “interaction with investors and testing and improving business ideas via such interactions” as their main reason for participating, while 53% of suppliers chose “appealing backstories or business ideas.”

In addition, the fact that the actual provision and use of the services transpire offline in most sectors of the sharing economy means that region-based transactions could help stimulate local economies. Examples include Yeosu and San Francisco. Both used to be challenged by a lack of accommodation for travelers. However, when BnBHero (Korea) and Airbnb (US) started offering accommodation sharing services, the two cities were able to secure sufficient accommodation to host the World Expo in 2012 and Super Bowl 50 in 2016, respectively. Other than economic efficiency, the sharing economy is also expected to reduce environmental costs. In particular, car sharing services such as carpooling could reduce air pollutant emissions. Fundamentally, contributions to environmental sustainability can be expected in all sectors of the sharing economy, as it helps conserve finite resources by increasing the utilization rate of produced assets.

C. Empirical Analysis of Participation Intensity

In this subsection, I analyze which benefits actually motivate consumers and suppliers to participate more in the sharing economy. This is done by estimating a model with regard to the determinants of participation intensity based on the survey results. The dependent variable here is how many times the respondents have participated in sharing economy transactions, as reported in Table 3. A significant proportion of accommodation and car sharing consumers (guests and passengers) use sharing economy services repeatedly, but in other cases the respondents mainly consist of novice participants, as more than half of them reported that they have participated in this market only once. Ordered logit models are then used to examine how demographic characteristics and participation reasons (summarized in Table 2) affect actual participation intensity. Tables 4 and 5 report the estimated results for consumers and suppliers, respectively.

TABLE 3—PARTICIPATION INTENSITY

(UNIT: %)

Instances of participation	Accommodation sharing		Car sharing	Crowdfunding	
	Consumer (Guest)	Supplier (Host)	Consumer (Passenger)	Consumer (Fundraiser)	Supplier (Investor)
Once	35.6	54.0	28.0	62.7	50.3
Twice	34.2	29.2	29.8	26.0	28.7
Three times and more	30.2	16.8	42.2	11.3	21.0

1. Determinants of Participation Intensity for Consumers

An examination of Table 4 reveals that some common demographic variables influence the participation decision of consumers across sectors. Consumers with higher income levels are more likely to participate in the market for accommodation and car sharing, possibly because either they spend more on accommodation and transportation in general or they are more likely to be an early adopter, or both. For crowdfunding, instead, a negative relationship is expected because consumers in this case are actually fundraisers or borrowers (the coefficient is not significant, though). Moreover, as the daily use of SNS increases, they are likely to participate more in accommodation sharing and crowdfunding transactions. Some occupations also affect participation decisions positively despite the fact that detailed patterns differ across sectors. These cases are freelancers and temporary employees (other); health, legal and education professionals; students; self-employed workers; and managers for accommodation sharing. For car sharing, the occupations are science and engineering professionals, while for crowdfunding the occupations are unemployed; and culture, arts and sports professionals. The last result is interesting because donation and reward types of crowdfunding are said to be most active in the culture and art industry. It also implies that crowdfunding is used as a means of financing one's living, especially for the unemployed.

Next, and more importantly, reasons for participating in the sharing economy affect the participation intensity of consumers, except for crowdfunding. For accommodation sharing, the effects of many motivations are found to be positive, in the order of "Convenience in platform use," "Diverse Selection," "Interaction with suppliers," "Cultural experience," "Quality" and "Low price." For car sharing, the benefits related to the platforms of "Trust in the platform" and "Convenience in platform use" are most influential in the positive direction, followed by "Quality" and "Recommendation by friends or reviews." When compared with Table 2, which does not distinguish between initial participation and re-participation, this result shows that motivations or expected benefits encouraging consumers to participate repeatedly may differ. The effect of "Curiosity" is negative and is therefore not a motivating factor in terms of re-participation, which is intuitive. Moreover, the service characteristics inherent to accommodation sharing of "Interaction with suppliers" and "Cultural experience" or the benefits related to car

sharing platforms stand out more than a typical example such as “Low price.” This implies that sharing economy firms should pay more attention to the former factors as the industry matures, with the retention of existing customers becoming more important.

TABLE 4—ESTIMATION RESULTS OF PARTICIPATION INTENSITY FOR CONSUMERS

Variables	Accommodation sharing		Car sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
(Demographics)						
Dummy for male	-0.047	(0.199)	0.121	(0.220)	-0.027	(0.501)
Age	0.007	(0.012)	-0.012	(0.011)	0.020	(0.024)
Dummy for being married	0.164	(0.301)	-0.597	(0.311)*	0.783	(0.759)
Number of children	-0.018	(0.157)	0.089	(0.132)	0.022	(0.278)
Dummy for high education	0.287	(0.280)	-0.279	(0.247)	0.438	(0.669)
Income	0.118	(0.054)**	0.145	(0.062)**	-0.153	(0.155)
Dummies for occupation						
Student	0.911	(0.384)**	-0.218	(0.390)	0.800	(0.978)
Self-employed	0.906	(0.451)**	-0.014	(0.351)	-0.179	(1.015)
Manager	0.808	(0.376)**	0.066	(0.352)	1.078	(0.697)
Sales and service	0.605	(0.397)	0.112	(0.404)	0.338	(1.034)
Blue collar	0.496	(0.629)	0.368	(0.418)	0.579	(1.418)
Housewife	0.291	(0.335)	-0.353	(0.366)	-0.393	(0.734)
Business and finance professional	0.209	(0.545)	0.324	(0.744)	0.186	(0.952)
Health, legal and education professional	1.040	(0.346)***	0.020	(0.474)	0.457	(0.855)
Culture, arts and sports professional	0.458	(0.530)	0.244	(0.616)	1.755	(1.011)*
Science and engineering professional	0.608	(0.655)	2.219	(1.093)**		
Other	1.468	(0.881)*	0.613	(0.858)		
Unemployed	0.719	(0.461)	0.296	(0.586)	3.393	(1.612)**
Internet use	-0.058	(0.075)	-0.005	(0.088)	-0.099	(0.204)
SNS use	0.210	(0.068)***	0.056	(0.071)	0.490	(0.189)***
(Participation reasons)						
Curiosity	-0.105	(0.201)	-0.445	(0.203)**	-0.060	(0.462)
Interaction with suppliers	0.531	(0.276)*	0.248	(0.503)	0.223	(0.515)
Cultural experience	0.512	(0.197)***				
Diverse Selection	0.775	(0.207)***				
Low price	0.449	(0.200)**	0.300	(0.188)	0.061	(0.564)
Quality	0.508	(0.269)*	0.762	(0.214)***		
Trust in the platform	0.478	(0.298)	0.972	(0.269)***	0.726	(0.580)
Convenience in platform use	0.854	(0.308)***	0.962	(0.218)***	-0.159	(0.605)

TABLE 4—ESTIMATION RESULTS OF PARTICIPATION INTENSITY FOR CONSUMERS (*CONT'D*)

Variables	Accommodation sharing		Car sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
(Participation reasons)						
Recommendation by friends or reviews	0.086	(0.220)	0.513	(0.208)**	-1.129	(0.712)
No other channels possible					-0.810	(0.602)
Thick market					0.547	(0.520)
Short fundraising period					0.124	(0.478)
Number of observations	500		500		150	
Pseudo R ²	0.0707		0.1061		0.1919	

Note: 1) “High education” refers to an education level of college graduation and above. 2) Income, internet use and SNS use are ordinal variables defined as shown in Table A1. 3) The base group for occupation dummies is set to clerks. 4) Regional dummies are also included in the estimation but are not reported. 5) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

TABLE 5—ESTIMATION RESULTS OF PARTICIPATION INTENSITY FOR SUPPLIERS

Variables	Accommodation sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.
(Demographics)				
Dummy for male	-0.344	(0.519)	0.383	(0.298)
Age	5.98e-06	(0.034)	-0.008	(0.015)
Dummy for being married	1.706	(0.725)**	-0.613	(0.436)
Number of children	-0.507	(0.358)	0.186	(0.215)
Dummy for high education	0.603	(0.649)	0.021	(0.456)
Income	0.026	(0.154)	-0.031	(0.079)
Dummies for occupation				
Student	-2.425	(1.326)*	-0.523	(0.568)
Self-employed	1.303	(0.833)	-0.031	(0.482)
Manager	-0.665	(1.040)	0.103	(0.496)
Sales and service	0.100	(0.955)	0.074	(0.592)
Blue collar	0.624	(1.240)	-0.082	(0.762)
Housewife	-0.184	(0.927)	0.427	(0.548)
Business and finance professional	1.102	(1.567)	0.364	(0.779)
Health, legal and education professional	0.150	(0.989)	-0.724	(0.588)
Culture, arts and sports professional	-1.595	(1.067)	1.147	(0.653)*
Science and engineering professional	1.128	(1.366)	0.281	(0.755)
Other			-0.009	(0.966)
Unemployed	3.551	(1.884)*	-1.168	(0.776)
Internet use	0.161	(0.237)	0.272	(0.125)**
SNS use	0.070	(0.207)	0.204	(0.101)**

TABLE 5—ESTIMATION RESULTS OF PARTICIPATION INTENSITY FOR SUPPLIERS (*CONT'D*)

Variables	Accommodation sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.
(Participation reasons)				
No other channels possible	-1.050	(0.733)		
Curiosity	-1.076	(0.642)*	0.814	(0.276)***
Additional income (High return)	2.147	(0.594)***	0.888	(0.345)**
Interaction with consumers	-0.363	(0.756)	1.151	(0.426)***
Interaction with other investors			2.037	(0.657)***
Abundant consumer information	-0.184	(0.653)	0.056	(0.463)
Low user fee	-0.584	(0.738)		
Trust in the platform	0.475	(0.713)	0.271	(0.382)
Convenience in platform use	1.200	(0.839)	0.567	(0.442)
Recommendation by friends or reviews	-0.673	(0.804)	-0.385	(0.367)
Appealing backstories or business ideas			0.502	(0.308)
Various investment opportunities			-0.062	(0.316)
Short payback period			1.293	(0.404)***
Observations	113		300	
Pseudo R ²	0.2157		0.1151	

Note: 1) “High education” refers to an education level of college graduation and above. 2) Income, internet use and SNS use are ordinal variables defined as shown in Table A1. 3) The base group for occupation dummies is set to clerks. 4) Regional dummies are also included in the estimation but are not reported. 5) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

2. Determinants of Participation Intensity for Suppliers

Table 5 shows that some occupational variables affect the participation decisions of suppliers as well. Accommodation sharing suppliers are likely to participate less if they are students but are likely to participate more if they are jobless. The latter finding supports the contention that the sharing economy has the expected benefit of offering low-income households/individuals opportunities to take part as suppliers and thus to earn income. Culture, arts and sports professionals have a greater tendency to participate in crowdfunding, implying that they are more motivated to support fundraisers in the same field. In addition, the use of the internet and SNS increases suppliers’ participation intensity in crowdfunding, as it does for accommodation sharing and crowdfunding consumers.

The benefit motivating accommodation suppliers to participate more is “Additional income,” which was also the top-ranked reason in Table 2. However, the effect of “Curiosity” (which ranked second) is again significantly negative. “Additional income” positively affects participation intensity for crowdfunding suppliers as well, but it is notable that the benefits of interaction with fundraisers or other investors have more prominent effects. “Curiosity” has a positive coefficient in the case of crowdfunding suppliers, contrary to the other cases.

III. Concerns of the Sharing Economy

A. Conflict with Existing Businesses: *Crowding out of Existing Transactions and Regulatory Arbitrage*

One of the most marked issues during the process of introducing the sharing economy is the conflict with existing business sectors. As sharing economy transactions substitute for certain existing transactions providing similar services, this will likely gnaw at the profits of incumbent businesses. Out of this concern, the existing accommodation and taxi industries are strongly opposed to accommodation and car sharing services. Several attempts have been made to analyze the impact of accommodation sharing quantitatively on the existing hotel industry, centering on the prominent Airbnb service (see Zervas *et al.*, 2017; Lee and Kim, 2016). For example, Lee and Kim's (2016) analysis of Korea concluded that there was a loss of approximately 0.16% in the hotel industry's room sales for every 10% increase in the supply of accommodation facilities via Airbnb.

This study also finds empirical evidence that a certain degree of the crowding out effect is taking place in existing businesses through the aforementioned survey. Table 6 shows the impact of the sharing economy on traditional transactions across sectors. When asked which type of existing transactions they have reduced mainly through the use of sharing services, almost 90% of accommodation and car sharing consumers, respectively, reported that they reduced certain existing transactions. These were, for example, hotels at 33.6% for accommodation sharing consumers and taxis at 23.2% for car sharing consumers. The fact that only 11-12% did not reduce their use of existing services suggests that accommodation and car sharing may actually be placing competition pressure on existing businesses. In addition, approximately 60% of crowdfunding suppliers reported they invested less in other financial means after their participating in crowdfunding. The degree of substitutability in crowdfunding appears to be comparatively smaller⁵ than in other areas, but its impact has been confirmed.

These findings imply that concerns over existing business profits are not entirely groundless, but this is not a problem solely limited to the sharing economy. Every innovation arrives with some disruption to the traditional industry. However, the negative impact on existing industries can devolve into fundamental issues when regulations on existing businesses are not applied fairly to new sharing economy suppliers or platforms.⁶ For instance, many 'hosts' on accommodation sharing platforms are not officially registered business operators and hence are not subject to safety and tax-related regulations, unlike existing accommodation suppliers. In fact, some even argue that the sharing economy is not a special innovation but was rather formed and grew because it could take advantage of regulatory loopholes.

⁵Table 2 shows that for crowdfunding, more consumers chose "interaction with investors and verifying and improving business ideas via such interaction" and "no other channels possible" over "low price (interest rate)," and much more suppliers chose "appealing backstories or business ideas" and "various investment opportunities" as their main reasons for participation. This implies that crowdfunding may differentiate from other areas and, rather than crowding out the existing financial market, will eventually help to expand the entire market.

⁶If existing suppliers are socially underprivileged, the decline in their welfare could be a problem in itself and hence policy consideration may be needed.

TABLE 6—IMPACT OF THE SHARING ECONOMY ON TRADITIONAL TRANSACTIONS
(Q: WHICH TYPE OF EXISTING TRANSACTION DID YOU MAINLY REDUCE DUE TO SHARING TRANSACTIONS?)

(UNIT: %)

Accommodation sharing consumers (Guests)		Car sharing consumers (Passengers)		Crowdfunding suppliers (Investors)	
Type	%	Type	%	Type	%
Hotel	33.6	Public transportation	29.8	Bank saving	38.0
Bed & Breakfast / Pensions / Guest house	31.6	Taxi	23.2	Stock	26.0
Motel / Inn	12.4	Own car	23.0	Fund	11.0
Resort / Condo	11.2	Rented car	12.0	Derivatives / Bond / FX	10.0
Did not reduce	11.2	Did not reduce	12.0	Did not reduce	40.7

Note: 1) The survey was presented to participant types who are given a certain or high level of autonomy to choose between sharing and existing transactions, in this case consumers in accommodation and car sharing and suppliers in crowdfunding. 2) With regard to crowdfunding suppliers, multiple answers (max. of two) were allowed.

Indeed, if the sharing economy is distorting competition by exploiting regulatory arbitrage while providing low-quality services, this may lead to a qualitative decline of the overall market and to the deterioration of social welfare. Hence, the government must take into consideration regulatory equity when formulating policies that pertain to sharing economy.

B. Transaction and Social Risks

In most cases, the sharing economy involves non-face-to-face transactions of nonstandardized services between unspecified individuals, meaning there are several transaction risks. Above all, due to the high level of information asymmetry, consumers find it difficult to determine the service quality level while providers also have difficulties in knowing and observing the consumer. This could lead to moral hazard, and depending on the sector, could entail property damage, criminal activity (e.g., theft, sexual violence), traffic accidents, defaults and other issues. Furthermore, in the event of the actual occurrence of a transaction risk, dealing with the situation may be problematic, as the current institutional foundations are too weak to provide concrete solutions such as insurance coverage or legal protection. There are also problems with trust when using sharing platforms, as they play a significant role in mediating the transfer of money and information.

If the sharing economy triggers negative external effects beyond the scope of the participants, it could even endanger social safety: in accommodation sharing, the negative external effects could include noise pollution, fire and housing instability;⁷

⁷Housing prices may rise due to the increased demand for new residential buildings or 'office-tels' (multi-purpose buildings with residential and commercial units in Korea) for the primary purpose of accommodation sharing. Moreover, renters may decide to evict existing tenants, preferring a sharing arrangement. San Francisco,

TABLE 7—EXPOSURE TO TRANSACTION AND SOCIAL RISKS

(UNIT: %)

Sector	Type	Transaction / social risk	Percentage of experience
Accommodation sharing	Consumer (Guest)	Fire, crime	4.4
	Supplier (Host)	Property damage	25.7
		Noise, crime	17.7
Car sharing	Consumer (Passenger)	Accident, crime	5.4
Crowdfunding	Supplier (Investor)	Delay, default	14.3

in car sharing, there could be more car accidents; and in crowdfunding, there could be the risk of large-scale financial insolvency.⁸

Table 7 presents the percentage of participants who actually experienced transaction and social risks using sharing economy services. Thus far, the experience rate for consumers remains at about 5%, which does not appear to be very high. However, that for suppliers is quite high, in double digits, meaning that damage to supplier assets or local communities caused by consumer moral hazard may be a serious issue that cannot be overlooked.

C. Empirical Analysis of Participant Satisfaction

In this section, I analyze how the satisfaction of participants is affected by their sharing economy experiences, especially by the experience of exposure to transaction risks. This will be supplemented by a model analysis of the impact of satisfaction on intention to participate again. Table 8 compares the degree to which participants were satisfied after having used sharing economy services, which will be used as the dependent variable (an ordinal variable that has a value of 1=very dissatisfied to 5=very satisfied), and their intention to participate again in the corresponding sharing economy sector. Variables related to their situations of use (summarized in Tables A2-A6) are included as explanatory variables in addition to demographic characteristics and participation reasons, and ordered logit models are estimated. The estimation results for consumers and suppliers are reported in Tables 9 and 10, respectively.

New York and Berlin recently tightened regulations on accommodation sharing mainly in relation to housing instability.

⁸When sharing involves human assets (e.g., talent sharing and car sharing), this could raise employment instability issues. To prepare for the emergence of such sharing transactions in Korea, the government must be equipped with legal interpretations regarding the relationship between the platform and the supplier and policy countermeasures.

TABLE 8—SATISFACTION AND INTENTION TO PARTICIPATE AGAIN

(UNIT: %)

Sector	Type	Satisfaction					Intention to participate again
		Very dis-satisfied	Dis-Satisfied	Average	Satisfied	Very satisfied	
Accommodation sharing	Consumer (Guest)	1.0	7.0	37.2	45.2	9.6	91.2
	Supplier (Host)	0.9	16.8	61.1	17.7	3.5	83.2
Car sharing	Consumer (Passenger)	0.6	4.2	43.4	43.4	8.4	88.6
Crowdfunding	Consumer (Fundraiser)	4.7	30.7	50.0	13.3	1.3	58.0
	Supplier (Investor)	1.3	9.7	50.0	35.3	3.7	83.3

1. Determinants of Consumer Satisfaction

The focus of this section is on the effects of experience situations, including exposure to transaction risks, on satisfaction, which will be discussed first. A common finding in both the accommodation and car sharing markets is that consumers are more satisfied with their sharing economy experiences abroad than at home. Also, it is noteworthy that the experience of exposure to transaction risks negatively affects the satisfaction level. If combined with the analysis results in Table A7, which showed that the intention to participate again is significantly determined by satisfaction, transaction risk experience has an indirect negative impact on intention to participate again as well (no direct impact was found in separate estimations). This means that transaction risks not only affect transaction participants but also may affect the sustainability of the market itself. For crowdfunding consumers, transaction risks are not well defined and are therefore not included in the estimation. Instead, successful fundraising experiences have a positive impact on satisfaction, as expected.

Regarding consumer satisfaction, demographic characteristics have little influence on it, as reported in Table 9. However, the impact of participation reasons remains present. Participation reasons that have a significantly positive coefficient largely overlap with those in the participation intensity estimation for accommodation and car sharing. With reference to crowdfunding, several reasons for participation now have a significant impact on satisfaction, in this case those related to crowdfunding platforms “Trust in the platform” and “Convenience in platform use,” and the benefit of a “Thick market.”

2. Determinants of Supplier Satisfaction

Supplier satisfaction is influenced by few variables pertaining to demographics and participation reasons; therefore, only the effects of experience situations are discussed here (Table 10). In the case of accommodation sharing, suppliers providing certain types of accommodation are less satisfied than others, specifically those providing part of a house or an entire office-tel when these spaces are the

TABLE 9—ESTIMATION RESULTS OF PARTICIPATION SATISFACTION FOR CONSUMERS

Variables	Accommodation sharing		Car sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
(Accommodation sharing)						
Dummy for overseas destination	0.442	(0.206)**				
Dummy for tourism and recreation purpose	-0.153	(0.356)				
Travel period	0.190	(0.148)				
Dummies for companion type						
Family	0.766	(0.332)**				
Friend/Lover	0.405	(0.305)				
Colleague at work	0.654	(0.472)				
Dummy for transaction risk experience	-1.448	(0.495)***				
(Car sharing)						
Dummy for overseas location			1.446	(0.469)***		
Dummies for purpose						
Commute			-0.528	(0.585)		
Travel			-0.036	(0.226)		
Duration			0.078	(0.111)		
Dummy for transaction risk experience			-1.096	(0.419)***		
(Crowdfunding)						
Dummies for crowdfunding type						
Donation					-1.082	(0.459)**
Reward					0.286	(0.446)
Lending					1.002	(0.429)**
Equity					0.331	(0.496)
Dummies for fundraising purpose						
Business					-0.186	(0.693)
Medical expenses					-0.489	(0.703)
Education expenses					-0.326	(0.718)
Living expenses					0.405	(0.622)
Marriage preparation					0.794	(0.833)
Deposit					0.132	(0.950)
Property purchase					0.051	(0.814)
Conversion of loan					-0.793	(0.884)
Other					-0.821	(1.439)
Average target amount					-0.178	(0.161)
Dummy for success experience					1.030	(0.544)*

Note: 1) Travel period for accommodation sharing and Duration for car sharing are ordinal variables defined as shown in Table A2 and Table A4, respectively. 2) The base group for the companion-type dummies is set to “alone.” 3) The base group for purpose dummies for car sharing is set to “everyday life.” 4) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

TABLE 9— ESTIMATION RESULTS OF PARTICIPATION SATISFACTION FOR CONSUMERS (*CONT'D*)

Variables	Accommodation sharing		Car sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
(Demographics)						
Dummy for male	-0.184	(0.207)	-0.287	(0.222)	-0.111	(0.495)
Age	0.015	(0.013)	-0.008	(0.012)	0.004	(0.025)
Dummy for being married	-0.492	(0.325)	-0.169	(0.316)	0.202	(0.767)
Number of children	-0.076	(0.169)	0.032	(0.132)	-0.112	(0.271)
Dummy for high education	-0.410	(0.284)	0.006	(0.248)	0.418	(0.667)
Income	0.048	(0.055)	0.040	(0.060)	-0.009	(0.151)
Dummies for occupation						
Student	0.290	(0.388)	0.187	(0.378)	-0.153	(0.898)
Self-employed	0.045	(0.440)	-0.311	(0.359)	0.553	(0.855)
Manager	0.265	(0.399)	-0.395	(0.371)	0.939	(0.718)
Sales and service	0.066	(0.418)	-0.783	(0.425)*	0.298	(1.022)
Blue collar	0.486	(0.672)	-0.535	(0.423)	2.540	(1.412)*
Housewife	0.048	(0.356)	-0.078	(0.380)	-0.661	(0.759)
Business and finance professional	-0.739	(0.552)	-2.024	(1.002)**	-1.122	(1.013)
Health, legal and education professional	0.150	(0.353)	0.603	(0.493)	0.788	(0.921)
Culture, arts and sports professional	-0.770	(0.578)	0.067	(0.628)	1.735	(0.993)*
Science and engineering professional	-0.467	(0.683)	0.135	(0.635)	2.301	(1.784)
Other	0.349	(0.881)	0.195	(0.790)		
Unemployed	0.380	(0.499)	0.150	(0.578)	2.910	(1.775)
Internet use	0.100	(0.078)	-0.075	(0.088)	-0.302	(0.195)
SNS use	0.050	(0.071)	0.099	(0.074)	0.151	(0.175)
(Participation reasons)						
Curiosity	0.147	(0.205)	0.124	(0.209)	0.315	(0.464)
Interaction with suppliers	1.112	(0.288)***	-0.114	(0.521)	0.554	(0.544)
Cultural experience	0.678	(0.205)***				
Diverse Selection	0.588	(0.212)***				
Low price	0.827	(0.209)***	-0.067	(0.190)	0.584	(0.555)
Quality	1.178	(0.290)***	1.133	(0.219)***		
Trust in the platform	0.820	(0.318)**	0.340	(0.269)	1.496	(0.600)**
Convenience in platform use	0.578	(0.318)*	0.827	(0.217)***	1.078	(0.629)*
Recommendation by friends or reviews	0.963	(0.230)***	0.248	(0.213)	0.392	(0.641)
No other channels possible					-0.833	(0.570)
Thick market					0.963	(0.561)*
Short fundraising period					0.058	(0.504)
Number of observations	500		500		150	
Pseudo R ²	0.1085		0.1074		0.2352	

Note: 1) “High education” refers to an education level of college graduation and above. 2) Income, Internet use and SNS use are ordinal variables defined as shown in Table A1. 3) The base group for occupation dummies is set to clerks. 4) Regional dummies are also included in the estimation but are not reported. 5) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

suppliers' own residences. The former seems to capture the inconvenience caused by the sharing of one's personal space with guests. Moreover, crowdfunding suppliers are more satisfied when they have participated in reward-type crowdfunding. It is important to emphasize here that exposure to transaction risks (property damage for accommodation sharing and delays or defaults for crowdfunding) negatively affects satisfaction and hence intention to participate again for sharing economy suppliers as well (again, not directly but indirectly). This result indicates that transaction risks can indeed be a real concern in the sharing economy.

TABLE 10—ESTIMATION RESULTS OF PARTICIPATION SATISFACTION FOR SUPPLIERS

Variables	Accommodation sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.
(Accommodation sharing)				
Dummies for accommodation type				
One's own residence, part of the house	-1.733	(0.852)**		
One's own residence, whole detached house	-0.741	(0.778)		
One's own residence, whole apartment	-0.151	(0.786)		
One's own residence, whole office-tel	-1.305	(0.763)*		
Not one's own residence, part of the house	-1.469	(0.976)		
Not one's own residence, whole detached house	-1.073	(1.194)		
Not one's own residence, whole apartment	-0.997	(1.117)		
Not one's own residence, whole office-tel	1.655	(1.279)		
Registered accommodation	-0.444	(1.200)		
Average daily room charge	0.315	(0.342)		
Total period of accommodation offering during last year	-0.112	(0.383)		
Total income from accommodation sharing during last year	0.448	(0.410)		
Dummies for transaction risk experience				
Property damage	-1.665	(0.755)**		
Noise or crime by guests	0.680	(0.894)		
(Crowdfunding)				
Dummies for crowdfunding type				
Donation			-0.053	(0.270)
Reward			0.587	(0.268)**
Lending			0.336	(0.323)
Equity			-0.528	(0.324)
Average investment amount			0.125	(0.152)
Total investment amount			-0.100	(0.145)
Share of crowdfunding in total financial assets			0.221	(0.146)
Dummy for transaction risk experience			-0.842	(0.372)**

Note: 1) Average daily room charge, Total period of accommodation offering and Total income from accommodation sharing are ordinal variables defined as shown in Table A3. 2) Average investment amount, Total investment amount and Share of crowdfunding in total financial assets are ordinal variables defined as shown in Table A6. 3) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

TABLE 10— ESTIMATION RESULTS OF PARTICIPATION SATISFACTION FOR SUPPLIERS (CONT'D)

Variables	Accommodation sharing		Crowdfunding	
	Estimate	S.E.	Estimate	S.E.
(Demographics)				
Dummy for male	-0.618	(0.616)	-0.297	(0.296)
Age	-0.008	(0.037)	-0.016	(0.015)
Dummy for being married	-0.307	(0.784)	0.062	(0.433)
Number of children	-0.081	(0.399)	0.112	(0.219)
Dummy for high education	0.040	(0.717)	-0.305	(0.427)
Income	0.396	(0.156)**	-0.007	(0.081)
Dummies for occupation				
Student	0.460	(1.154)	0.477	(0.552)
Self-employed	-0.650	(0.931)	0.789	(0.476)*
Manager	-0.377	(1.280)	-0.514	(0.491)
Sales and service	-1.893	(1.199)	0.374	(0.567)
Blue collar	0.969	(1.396)	0.172	(0.729)
Housewife	0.626	(1.063)	0.566	(0.543)
Business and finance professional	-3.095	(2.114)	-0.394	(0.751)
Health, legal and education professional	-0.539	(1.091)	-0.500	(0.530)
Culture, arts and sports professional	-0.724	(1.053)	0.356	(0.785)
Science and engineering professional	-1.113	(1.730)	-1.314	(0.789)*
Other			0.478	(0.986)
Unemployed	0.482	(2.168)	-0.189	(0.753)
Internet use	0.568	(0.261)**	0.040	(0.124)
SNS use	-0.143	(0.232)	0.198	(0.105)*
(Participation reasons)				
No other channels possible	0.944	(0.799)		
Curiosity	0.198	(0.782)	0.129	(0.278)
Additional income (High return)	-0.247	(0.583)		
Interaction with consumers	0.099	(0.844)	0.590	(0.423)
Interaction with other investors			0.648	(0.656)
Abundant consumer information	0.609	(0.752)	0.341	(0.466)
Low user fee	-0.576	(0.835)	0.352	(0.341)
Trust in the platform	-1.139	(0.826)	0.274	(0.380)
Convenience in platform use	0.695	(1.006)	-0.371	(0.435)
Recommendation by friends or reviews	-0.121	(0.901)	0.265	(0.353)
Appealing backstories or business ideas			0.908	(0.302)***
Various investment opportunities			0.382	(0.335)
Short payback period			-0.253	(0.411)
Number of observations	113		300	
Pseudo R ²	0.2606		0.0890	

Note: 1) “High education” refers to an education level of college graduation and above. 2) Income, Internet use and SNS use are ordinal variables defined as shown in Table A1. 3) The base group for occupation dummies is set to clerks. 4) Regional dummies are also included in the estimation but are not reported. 5) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

IV. Policy Suggestions

The paper discussed anticipated benefits and concerns as they pertain to the sharing economy and provided empirical evidence of how these benefits and concerns are being realized in Korea by analyzing survey results regarding the participation experience of both consumers and suppliers.

The sharing economy is accompanied by diverse expected benefits. Through the creation of new transactions, consumers can enjoy low prices, diverse options and better quality and convenience, and suppliers can earn additional income, all of which contribute to the welfare of the participants. The empirical analysis of participation intensity shows that service or platform characteristics inherent to the sharing economy motivate consumers to re-participate more than low prices, providing managerial implications for sharing economy firms. Businesses participating in the sharing economy can also benefit from promotional and market testing opportunities, which is highly anticipated in the sectors of crowdfunding and space and talent sharing. Moreover, other expected benefits include vitalization of the local economy and reduced environmental costs.

However, there are also concern factors. The sharing economy could crowd out certain existing transactions that provide similar services. The empirical evidence suggests this is likely to be more pronounced in accommodation and car sharing than in crowdfunding. It is also discussed that the crowding out effects will exacerbate when regulations are applied unfairly to suppliers from existing and sharing businesses. In addition, the sharing economy encompasses several transaction risks, including information asymmetry, uncertainty in ex-post handling and weak trust in the platforms. Thus far, the experience rate of transaction risks is considered to be high only for suppliers, but it negatively affects intention to participate again through satisfaction for both consumers and suppliers, implying that transaction risks must be considered in the sharing economy.

Those concern factors should be controlled properly for the sharing economy to contribute to the enhancement of social welfare with its wide range of benefits. To this end, the government must lay the institutional foundation to support the stable growth of the sharing economy, which will entail a new approach that takes into account its uniqueness. Although each sector differs in terms of development status, prospects and key issues, as examined throughout the paper, and each therefore requires specific action plans, here I intend to suggest a general policy direction that could be applied across the spectrum.

First, we reconsider the definition of the sharing economy. In most cases, suppliers in the sharing economy, unlike those in the traditional economy, are non-professional and engage in transactions temporarily or irregularly. However, the existing regulatory system regards suppliers as professional business operators, and as such, if the same regulations were applied to the sharing economy, non-professional individual suppliers will have difficulties in meeting the regulatory standards, which will in turn force them from the market. This can inevitably cause consumers and suppliers to leave the market sequentially and irreparably damage the sharing economy, as explained in Hwang (2016). Indeed, Table 11 shows that in accommodation sharing and crowdfunding, only half of respondent suppliers answered

TABLE 11—IMPACT OF APPLYING REGULATIONS IDENTICAL TO THOSE OF EXISTING SUPPLIERS ON SHARING ECONOMY SUPPLIERS

(Q: WILL YOU STILL PARTICIPATE IN THE SHARING ECONOMY IN THE FOLLOWING HYPOTHETICAL REGULATORY ENVIRONMENT?)

(UNIT: %)

Sector	Regulatory situation	Still participate
Accommodation sharing supplier (Host)	Must pay the same tax as existing accommodation suppliers for the income from accommodation sharing	52.2
	Must take out compensation insurance for guests	53.1
	Must follow the same safety regulations, such as installing fire extinguishers, as existing accommodation suppliers	63.7
	Must register with the government as an accommodation sharing supplier	51.3
Crowdfunding supplier (Investor)	Must register with the government as an investor	54.7
	Must periodically report income earned through crowdfunding	52.0

positively about participating as a supplier if regulations become similar to those for existing suppliers. This implies that there is a necessity for the government to differentiate regulations if it intends to bolster the sharing economy.

However, to respond to the concerns of conflicts with existing businesses properly, the government should guarantee regulatory equity so that existing and sharing economy suppliers can compete on a level playing field. When regulatory equity is considered in tandem with the unique characteristics of the sharing economy, regulations must be linked to the volume of transactions, as proposed in Kim *et al.* (2016). In other words, a transaction limit should be set and those who exceed the limit should be categorized as ‘professional, regular operators,’ making them subject to traditional supplier regulations, while those who do not are categorized as ‘non-professional, temporary operators’ and are subject to eased regulations. Existing suppliers wishing for fewer regulations can opt to reduce their transaction volume and new suppliers wanting to become regular operators can do so by meeting traditional regulatory requirements. Transaction-volume-based regulations guarantee the autonomous right of choice to respective suppliers while demanding them to pay the price for the benefit of eased regulations, i.e., a reduced transaction volume.

Major countries such as the US and UK are the frontrunners in the sharing economy, but even they are in the incipient stages of institutionalization. Currently, institutionalization is most active for accommodation sharing, and as shown in Table 12, the process has been mainly carried out at the city level. Accommodation sharing is mostly restricted to residential areas and buildings and to main occupants, and transaction-volume-based regulations are being imposed. In all cases, the host must reside on-site during the guests’ stay (meaning only a part of the host’s residence can be shared) or the total period of renting through accommodation sharing must be limited to 60-180 days per year. Moreover, tax regulations in some countries are linked to the transaction volume and those with fewer transactions are given tax exemptions on their rental income. If their transaction volumes are below

TABLE 12—INSTITUTIONALIZATION STATUS IN MAJOR COUNTRIES: ACCOMMODATION SHARING

City, Country	Registration · Authorization requirement	Rental period limit		Income tax on suppliers
		Condition ¹⁾	Permitted days per year	
San Francisco, US	Registration required	Host present	Unlimited	
		Host absent	90 days	
Santa Monica, US	Authorization required	Host present	Unlimited	Tax exemption for transaction volume of \$ 40,000 or lower
		Host absent	Illegal	
Paris, France	Not required ²⁾		120 days	
UK	Not required ³⁾		90 days	Tax exemption for transaction volume of £ 7,500 or lower
Amsterdam, Netherlands ⁴⁾	(Vacation rental) Not required		60 days	
	(B&B) Registration required	Host present ⁵⁾	Unlimited	
	(Short stay) Authorization required		180 days	
Hamburg, Germany	Not required ⁶⁾	Host present ⁷⁾	Unlimited	
		Host absent	180 days	
Catalonia (Barcelona), Spain ⁸⁾	Authorization required		4 months	

Note: 1) The conditions of host present or absent indicate whether or not the host resides on site during the guests' stay. Therefore, host present means that only part of the host's residence is shared. 2) Authorization is required for rentals in some regions and for the rental of non-residential facilities. 3) Authorization is required for stays if the maximum number of rental days is exceeded. 4) Short stay corresponds to a rental with a minimum of seven days at a time. In all cases, up to four guests are allowed at a time. With regard to tenants, vacation rentals are possible only with permission from the homeowner. 5) A host must occupy 60 percent or more of the total residential area. 6) Authorization is required for rentals of residential assets other than the primary residence. 7) No limit on rental periods for guests occupying less than 50% of the total residential area. 8) Maximum of two bedrooms for up to five guests per room.

the limit and they are thus classified as a 'supplier in accommodation sharing,' they will be subject to relaxed regulations on registration or authorization requirements, fire safety requirements, taxes and others as compared to existing accommodation operators.

The enforcement of transaction-volume-based regulations involves difficulties. To ensure effectiveness, regulators would need information about the transaction volumes of the respective suppliers. However, sharing economy suppliers have an incentive to under-report their transaction volumes in order to benefit from the eased regulations. Moreover, it is very difficult for regulatory authorities to identify false reports and violations given the very numerous suppliers and to impose meaningful sanctions, as doing so would lead to excessive administrative costs. Even major countries with more advanced systems for accommodation sharing have yet to establish effective enforcement means for transaction-volume-based

regulations. Instead, some cities have simply attempted temporary measures such as reserving accommodation at suspected operators' offerings and conducting surprise inspections.

Accordingly, to strengthen the effectiveness of transaction-volume-based regulations, certain obligations must be imposed on sharing platforms. Because such platforms possess detailed data on all sharing transactions and have a relatively low incentive to report falsely, sharing platforms should be obligated to submit relevant transaction information regularly, on behalf of the suppliers, to the government. Once registration and taxation standards for sharing economy participants are set, sharing platforms can also operate online services through which suppliers can register with the government before initiating transactions, or that enables withholding income and consumption taxes of each transaction. This could significantly cut administrative costs and secure regulatory effectiveness. In San Francisco, where the institutionalization of accommodation sharing is most advanced, the so-called "Airbnb law" was adopted in 2015 and with several revisions since, the city is now imposing some obligation on sharing platforms.

Next, transaction risks can be basically resolved somewhat via market mechanisms such as self-regulation by platforms and collective intelligence. The profit of sharing platforms relies on the transaction volume via the platform, meaning that there is an incentive to create a reliable environment with low transaction risks to safeguard users. In fact, there are a number of studies confirming that sharing platforms and their participants are working together to regulate consumers and suppliers voluntarily and to reduce transaction risks significantly through various means, such as reviews and reputation and ex-ante screening by self-operated or third-party verification agencies.⁹ In this context, when dealing with these risks, government policies need to play a supplementary role while focusing on regulating platforms rather than on participants.

⁹Refer to Kim and Lee (2016), who empirically analyzed the transaction risks and roles of market mechanisms in the market for lending-based crowdfunding in Korea.

APPENDIX

TABLE A1—DEMOGRAPHIC PROFILE OF THE SURVEY SAMPLE

Variable	Category	Proportion (%)	Variable	Category	Proportion (%)
Gender	Male	49.3	Occupation	Student	14.1
	Female	50.7		Self-employed	8.2
Age	20-29	32.6		Manager	7.8
	30-39	25.9		Sales and service	5.7
	40-49	17.0		Blue collar	4.1
	50-59	17.3		Housewife	10.8
	60 and over	7.2		Business and finance professional	2.4
Marital status	Single	48.3		Health, legal and education professional	6.4
	Married	51.8		Culture, arts and sports professional	3.2
Number of children	0	53.1		Science and engineering professional	2.1
	1	14.0		Other	1.1
	2	26.9		Unemployed	3.2
	3	4.4	Internet use (hour)	Less than 0.5	0.9
	4	1.1		0.5-1	8.9
	5 and more	0.5		1-2	23.9
Education	High school and undergraduate	24.3		2-3	28.3
	College degree and above	75.8		3-5	20.7
Monthly household income (10 thousand won)	Under 100	3.1		5 and more	17.3
	100-200	7.6	SNS use (hour)	None	5.4
	200-300	15.4		Less than 0.5	21.1
	300-400	17.5		0.5-1	26.7
	400-600	27.8		1-2	25.1
	600-800	15.0		2-3	12.4
	800-1,000	7.0		3-5	5.1
	1,000 and over	6.7		5 and more	4.2

Note: This sample includes all 1,563 survey respondents.

TABLE A2—EXPERIENCE SITUATIONS – ACCOMMODATION SHARING CONSUMERS

Variable	Category	Proportion (%)	Variable	Category	Proportion (%)
Destination	Domestic	52.8	Purpose	Business	13.6
	Overseas	47.2		Tourism, recreation	86.4
Travel period (# night)	Less than 3	72.0	Companion	Alone	14.0
	4-7	22.2		Family	32.0
	8-14	3.0		Friend/Lover	47.8
	15 and more	2.8		Colleague at work	6.2

Note: Percentage of those who choose each answer among 500 accommodation sharing consumers.

TABLE A3—EXPERIENCE SITUATIONS – ACCOMMODATION SHARING SUPPLIERS

Variable	Category	Proportion (%)	Variable	Category	Proportion (%)
Accommodation type	One's own residence, part of the house	38.9	Total period of accommodation offering during last year (# days)	Less than 30	55.8
	One's own residence, whole detached house	16.8		30-60	26.5
	One's own residence, whole apartment	21.2		60-90	10.6
	One's own residence, whole office-tel	23.9		90-120	4.4
	Not one's own residence,	13.3		120-180	1.8
	Not one's own residence,	8.0		180 and more	0.9
	Not one's own residence,	8.0	Total income from accommodation sharing during last year (10 thousand won)	Under 10	10.6
	Not one's own residence,	6.2		10-100	56.6
	Registered accommodation	5.3		100-500	23.0
Average daily room charge (10 thousand won)	Under 5	23.9		500-1,000	7.1
	5-10	46.9		1,000-2,000	0.9
	10-20	23.9		2,000-5,000	1.8
	20-30	2.7		5,000 and over	0.0
	30 and over	2.7			

Note: 1) Percentage of those who choose each answer among 113 accommodation sharing suppliers. 2) For accommodation type, multiple-choice questions were used; hence, the total may not equal 100.

TABLE A4—EXPERIENCE SITUATIONS – CAR SHARING CONSUMERS

Variable	Category	Proportion (%)	Variable	Category	Proportion (%)
Location	Domestic	95.0	Duration	less than 1 hour	16.4
	Overseas	5.0		1-6 hours	42.8
Purpose	Everyday life	40.0		6 hours-1 day	20.6
	Commute	2.6		1-3 days	18.6
	Travel	57.4		3 days-1 week	1.6
				1 week and more	0.0

Note: Percentage of those who choose each answer among 500 car sharing consumers.

TABLE A5—EXPERIENCE SITUATIONS – CROWDFUNDING CONSUMERS

Variable	Category	Proportion (%)	Variable	Category	Proportion (%)
Crowdfunding type	Donation	59.3	Fundraising purpose	Business	37.3
	Reward	46.7		Medical expenses	13.3
	Lending	46.0		Education expenses	24.7
	Equity	38.7		Living expenses	34.7
Average target amount (10 thousand won)	Under 100	12.0		Marriage preparation	8.7
	100-200	14.7		Deposit	8.7
	200-500	16.0		Property purchase	17.3
	500-1,000	19.3		Conversion of loan	8.7
	1,000-2,000	20.0		Other	2.7
	2,000-5,000	9.3			
	5,000 and over	8.7			

Note: Percentage of those who choose each answer among 150 crowdfunding consumers.

TABLE A6—EXPERIENCE SITUATIONS – CROWDFUNDING SUPPLIERS

Variable	Category	Proportion (%)	Variable	Category	Proportion (%)
Crowdfunding type	Donation	46.3	Share of crowdfunding in total financial assets (%)	Under 5	65.0
	Reward	61.3		5-10	19.7
	Lending	31.0		10-20	9.0
	Equity	25.3		20-30	3.7
				30-50	1.7
				50-75	0.7
				75 and over	0.3
Average investment amount (10 thousand won)	Under 5	26.0	Total investment amount (10 thousand won)	Under 10	24.7
	5-10	23.0		10-50	21.7
	10-50	16.3		50-100	13.0
	50-100	13.3		100-200	12.0
	100-200	12.0		200-500	12.3
	200-500	5.0		500-1,000	8.7
	500-1,000	3.0		1,000-5,000	6.7
	1,000 and over	1.3		5,000 and over	1.0

Note: Percentage of those who choose each answer among 300 crowdfunding suppliers.

TABLE A7—ESTIMATION RESULTS OF THE IMPACT OF SATISFACTION ON INTENTION TO PARTICIPATE AGAIN

Variables	Accommodation sharing		Car sharing	Crowdfunding	
	Consumer (Guest)	Supplier (Host)	Consumer (Passenger)	Consumer (Fundraiser)	Supplier (Investor)
Satisfaction	1.847*** (0.256)	0.541 (0.374)	1.103*** (0.215)	0.757*** (0.236)	1.147*** (0.236)
Constant	-3.434*** (0.746)	-0.009 (1.109)	-1.629** (0.693)	-1.741*** (0.659)	-1.957*** (0.716)
Number of observations	500	113	500	150	300
Pseudo R ²	0.2462	0.0216	0.0848	0.0566	0.1023

Note: 1) Results of the logit model with the base outcome set to 'not participating again'. 2) ***, ** and * denote significance levels of 1%, 5% and 10%, respectively.

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Why Are Peak Loads Observed during Winter Months in Korea?

By JEE YOUNG KIM, HYUNGNA OH, AND KYUNG-MEE CHOI*

Since 2009, electricity consumption has developed a unique seasonal pattern in South Korea. Winter loads have sharply increased, and they eventually exceeded summer peaks. This trend reversal distinguishes these load patterns from those in the USA and the EU, where annual peaks are observed during the summer months. Using Levene's test, we show statistical evidence of a rise in temperature but a decrease in variance over time regardless of the season. Despite the overall increase in the temperature, regardless of the season there should be another cause of the increased demand for electricity in winter. With the present study using data from 1991 to 2012, we provide empirical evidence that relatively low electricity prices regulated by the government have contributed significantly to the rapid upward change in electricity consumption, specifically during the winter months in the commercial sector in Korea.

Key Word: Electricity Demand, Energy Demand, Commercial Sector,
Price Elasticity
JEL Code: L94, Q41, Q48, Q51, Q54

I. Introduction

Climate change affects societies and natural ecosystems in different ways, and these effects influence human behavior and economic performance as people adapt to climate change (De Cian *et al.*, 2013). Electricity generation is also significantly influenced by climate change, as cooling and heating are significant quantities of electricity loads in most advanced economies. A statistical link between temperature changes and electricity consumption has been tested for the UK (Henley and Peirson, 1998), Norway (Vaage, 2000), China (Asadoorian *et al.*, 2006), the USA (Mansur *et al.*, 2008; Zarnikau, 2003), and South Korea (Kim *et al.*, 2016). Initially, we aimed to evaluate the impact of weather variations on

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electricity consumption in South Korea (henceforth Korea). In summarizing the data, we find that winter loads increased by 7.83 percent annually during 1991-2012, greater than the annual growth rate of summer loads (7.17 percent). This implies that the rapid increase in electricity consumption is not solely attributed to weather changes, as the rise in the temperature is observed not only in the summer months but also during the winter months. Thus, we conducted a closer investigation to find other driving forces that could cause a sharp rise in winter loads. From our empirical analysis, we find that the main drivers accelerating electricity demand are changes in the temperature and the relatively low electricity prices compared to substitute fuel prices in Korea. This influences winter loads more than summer loads considering that there are no substitute fuels for cooling whereas some substitute fuels do exist with regard to heating in winter. As electricity becomes less expensive, people heat their homes and workplaces using electricity. Consequently, due to the low opportunity cost of electricity, winter loads increased more than summer loads during the sample period, although winters are getting warmer in Korea. Of course, summer loads are also increasing due to temperature changes associated with global warming.

The increase in the demand for electricity caused by the relative price disparity can be an environmental problem because Korea's electricity production relies on thermal power generation, which represents 66.7 percent of all electricity generated as of 2014. The generation structure causes harmful gas emissions, including carbon dioxide (CO₂) and PM10 microparticles due to the burning of fossil fuels to generate electricity.

Data from various sources are employed in this study, including monthly temperature data during the period of 1991-2012 from the Korea Meteorological Administration, electricity consumption by sector from the Korea Energy Economics Institute (Korea Energy Statistics Information System), sector-specific electricity and gas prices (henceforth, natural gas prices) from the Korea Power Exchange (Electric Power Statistics Information System), and social and economic data from Statistics Korea (Korea Statistics Information Service).

The remainder of the paper is organized as follows. Section 2 illustrates the characteristics of electricity loads and prices in Korea and tests whether or not a significant weather change which increased the winter load occurred. Section 3 explains the assessment model, and the estimation results are presented in Section 4. Finally, Section 5 concludes this study and presents policy implications.

II. Weather Change and Electricity Demand in Korea

A. Unique Seasonal Pattern of Electricity Loads in Korea

In line with the steady economic growth of the country over the past few decades, electricity consumption in Korea has also increased (see Figure 1). From 1991 to 2012, total electricity consumption grew at an annual growth rate of 7.39%. It is important to note that all of the growth rates exceeded the GDP rate (4.37%).

On the other hand, it is of interest to observe that annual peaks in the total

demand were observed in summer months in the past but more recently have occurred during the winter months.¹ Figures 2 and 3 show that a trend reversal in the peak load has occurred since 2009 and that monthly electricity demand had the highest electricity loads during the winters of the years 2011 and 2012 compared to previous years (1991 and 1992). This seasonal pattern is unique because peak loads are usually observed in summer months in most advanced economies with climatic and economic conditions similar to those of Korea.

The economic literature provides possible drivers of electricity consumption. These can include weather changes (Pardo *et al.*, 2002; Madlener and Alt, 1996; Parti and Parti, 1980; De Cian *et al.*, 2013), changes in the relative prices between electricity and its substitutes (Silk and Joutz, 1997; Crowley and Joutz, 2005), increases in populations and/or numbers of households (Holtedahl and Joutz, 2004),

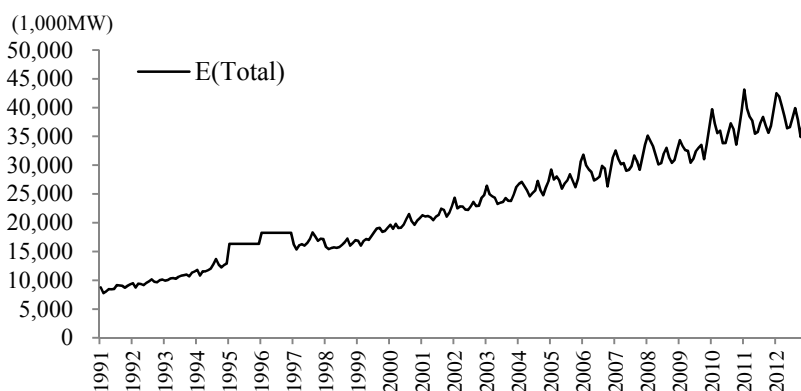


FIGURE 1. TREND OF KOREA'S ELECTRICITY CONSUMPTION (1991-2012)

Source: Korea Electric Power Corporation.

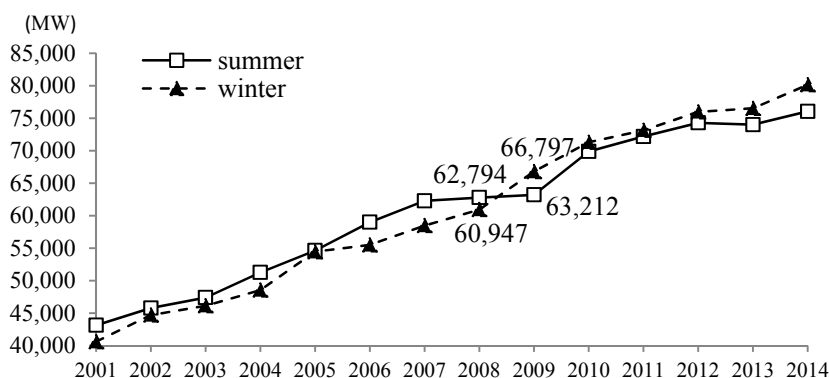


FIGURE 2. SEASONAL TREND REVERSAL OF PEAK LOADS (2001-2014)

Source: Electric Power Statistics Information System.

¹The annual growth rate of average winter load during winter months was 7.83 percent from 1991 to 2012, which was larger than that of the average summer load (7.17 percent). For more detailed information about growth rates by sector, see Table 1.

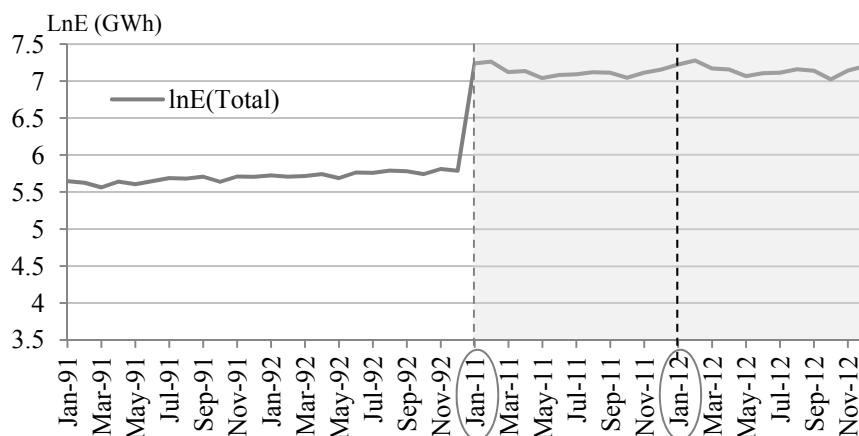


FIGURE 3. MONTHLY ELECTRICITY DEMAND (1991-1992 vs. 2011-2012)

Source: Korea Electric Power Corporation.

and structural transformations from primary industries to manufacturing sectors and/or from less energy-intensive sectors to energy-intensive sectors (Lin *et al.* 2014); increases in income and demand for electronic instruments (Bose and Shukla, 1999; Medlock and Soligo, 2001; Filippini and Pachauri, 2004). In the case of Korea, existing studies of the factors pertaining to electricity demand mainly deal with demand forecasting according to the climate and temperature and the price effects on aggregate demand (Kim *et al.*, 2011; Kim *et al.*, 2015). There are few studies that attempt to quantify the effects of electricity prices and relative prices on demand in the commercial sector.

B. Features of Electricity Load in the Commercial Sector

Although the overall peak demand during recent years has undergone a trend reversal, as described in Section 2.A., the rate of consumption growth varies across sectors. Electricity demand in the commercial sector has attracted our attention owing to the rapid growth rates as well as the clear seasonal patterns that developed in the early 2000s.

With regard to the annual growth rates of electricity loads in different sectors, the highest is observed in the commercial sector (10.48%), while the rate for the industrial sector stands at 6.59%. The residential sector records the lowest growth rate of 5.79%. The commercial sector records the highest growth rates when the rates are divided into summer months and winter months (11.57% for winter loads and 9.80% for summer loads; see Table 1).

Consequently, the electricity consumption shares for the commercial sector increased from 15.6% in 1991 to 28.3% in 2012 (see Figure 4). The industrial sector's proportion with reference to total electricity consumption was still highest in 2012 (53.5%) but was lower than the 1991 level (62.5%). The residential sector also shows a decrease in the consumption share, which stood at 13.6% compared to the 1991 level (18.7%).

Figure 5 shows a clear seasonal pattern in the electricity demand in the

TABLE 1—SUMMARY OF ELECTRICITY CONSUMPTION AND ANNUAL GROWTH RATES BY SECTOR

	Mean(StD) (Unit = 1,000KW)	Annual Growth Rate (%)		
		All	Summer	Winter
Total	23,000 (9,146)	7.39	7.17	7.83
Industrial Sector	12,288 (4,350)	6.59	6.51	6.76
Commercial Sector	6,266 (3,328)	10.48	9.80	11.57
Residential Sector	3,530 (1,129)	5.79	5.83	5.93

Source: Author's own calculations; Korea Electric Power Corporation.

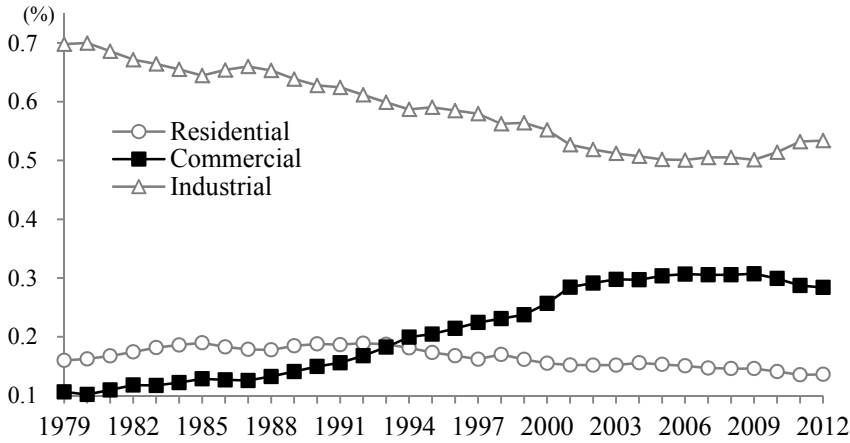


FIGURE 4. ELECTRICITY CONSUMPTION SHARE BY SECTOR

Source: Korea Electric Power Corporation.

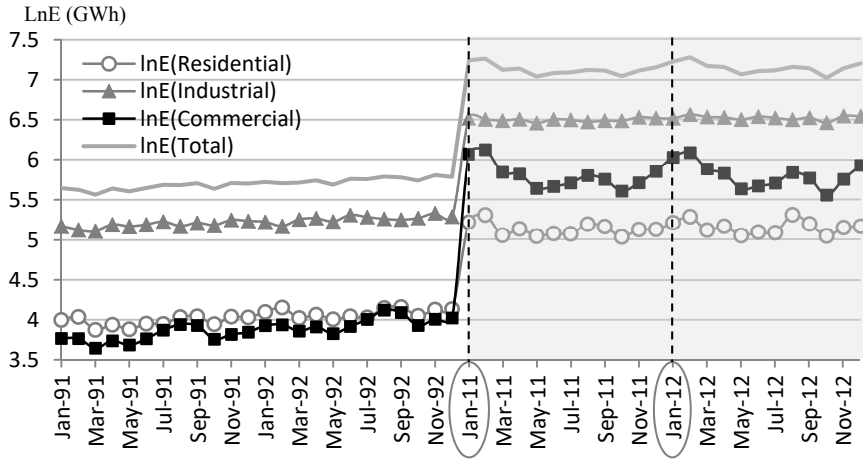


FIGURE 5. SEASONAL TREND OF ELECTRICITY CONSUMPTION BY SECTOR (1991-92 vs. 2011-12)

Source: Korea Electric Power Corporation.

commercial sector. The electricity load in the commercial sector had the highest peak in summer in the earlier years of our sample period (1991 and 1992), but the peak occurred in winter in more recent years (2011 and 2012). Meanwhile, electricity consumption in the industrial sector does not show any seasonal patterns. This figure implies that the trend reversal in the total demand is associated with an apparent change in the trend of the commercial sector.

C. Testing Changes in Temperature with Daily Data from 1973 to 2012

Temperature changes may explain the recent peak loads during the winter months. If winters have been getting colder over recent years compared the past, the more recent lower temperatures may have increased the demand for power during the winter months. A comparison between present and past temperatures is conducted in this section.

The weather data employed in this paper are derived from a database maintained by the Korea Meteorological Administration (KMA). Daily weather data is available for an extended period, from 1972 to 2012, longer than the period for electricity data (1991- 2012). Daily temperature records are compared over the summertime (wintertime) between the most recent data years, 2003-2012, and the earliest, 1973-1982.²

Table 2 presents a summary of the daily mean weather variations over the summertime, i.e., from June to August, and the wintertime, from December of one year through February of the next throughout the study period of interest. As shown in the table, the daily mean temperatures appear to have increased by 0.67°C and 0.57°C on average in wintertime and summertime, respectively, which may reflect global warming.

The means and variances for the summer daily maximum temperature during the two periods, denoted by *Highest* in Table 2, describe summer temperatures as higher and the heat as more persistent for the recent period as compared to the past because the recent summer mean is higher than that of the past. However, the order is opposite for the variance. At the same time, the mean of the winter daily lowest temperature, denoted by *Lowest*, is higher and the variance is smaller for recent years than for the past. This means that the recent winter cold is less severe and that

TABLE 2—WEATHER SUMMARY FOR THE PAST AND RECENT PERIODS (1973-1982 AND 2003-2012)

Period	Description	N	Mean (°C)	Standard Deviation	Std. Error Mean
1973-1982	<i>Lowest</i>	902	-6.7305	5.0374	0.1677
	<i>Highest</i>	920	32.025	2.8299	0.0933
2003-2012	<i>Lowest</i>	903	-6.0637	4.5634	0.1519
	<i>Highest</i>	920	32.5913	2.5371	0.0837

Note: The number for *Lowest* is smaller than the number for *Highest* because there are fewer days in February, belonging to the *Lowest* category, compared to the other months.

Source: Korea Meteorological Administration (KMA).

²Weather records prior to 1973 are available but have very limited accuracy, with missing values. For this reason, they are not analyzed here.

TABLE 3—THE RESULT OF THE T-TEST OF THE MEAN DIFFERENCE FOR THE PAST (1973-1982) AND RECENT PERIOD (2003-2012)

		Levene's Test for Equality Variances		<i>t</i>	DF	Sig(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig						Lower	Upper
<i>Lowest</i>	1)	7.046	0.008*	2.947	1803	0.003*	0.667	0.226	0.223	1.111
	2)			2.947	1785	0.003*	0.667	0.226	0.223	1.111
<i>Highest</i>	1)	10.826	0.001*	4.519	1838	0.000*	0.566	0.125	0.321	0.812
	2)			4.519	1816	0.000*	0.566	0.125	0.321	0.812

Note: 1) Equal variances assumed, 2) Equal variances not assumed, 3) * Significant at $\alpha=0.05$, 4) H_0 = for equality of mean temperature.

there have been fewer extremely cold days in recent years compared to the past. Winters have been less cold for consumers, and they have experienced warmer temperatures in summer as well.

Using Levene's test, we evaluate whether these differences are statistically significant. The test results are summarized in Table 3. At the 5% significance level, extreme weather events have significantly unequal variances over the two decades of wintertime. This can be evidence explaining that the recent surge in the demand for electricity in winter cannot be explained by temperature changes. Hence, there should be other factors. Given the fact that consumers have experienced winters which have been less cold, there should have been compelling reasons for the change in behavior. We assume that there should be a change in the choice of heating fuel by which to create electricity from other fuels.

D. Testing Monthly Temperature Data for our Sample Period (1991-2012)

Temperature is one of the important drivers of electricity consumption because heating and cooling purposes account for a large share of end-use energy consumption. Heating demand in winter accounts for 24% of the total demand, and 80% of the heating demand came from the commercial sector in 2011.³ Temperature effects are asymmetric because higher temperatures decrease the demand for heating and increase the demand for cooling at the same time. In order to adjust for this asymmetry problem, heating degree days (*HDD*) and cooling degree days (*CDD*) are widely used variables for testing climate change-driven effects in the electricity demand model. The more extreme the temperature is, the higher the *HDD* or *CDD* number becomes. A high *HDD* or *CDD* number represents higher corresponding levels of heating and cooling demand associated with extreme temperatures.

In our electricity demand model proposed in Section 3, we trace the *HDD* and *CDD* metrics for weather variables and include monthly summations of *HDD* and *CDD* along with other monthly variables. These are defined below.

$$(1) \quad HDD = \sum_{i=1}^N h_i \quad \text{and} \quad CDD = \sum_{i=1}^N C_i$$

³Ministry of Knowledge Economy (later, the Ministry of Trade, Industry and Energy), Press Release, January 12, 2011 (http://www.motie.go.kr/motie/ne/rt/press/bbs/bbsView.do?bbs_seq_n=65872&bbs_cd_n=16).

TABLE 4—DESCRIPTIVE STATISTICS OF *HDD* AND *CDD*

Variable	Description	Mean	Std	Annual Growth Rate (%)
HDD	Monthly Sum of HDD	215.46	214.57	0.209
CDD	Monthly sum of CDD	50.42	78.42	0.739

Source: Korea Meteorological Administration (KMA).

Here, $h_i = (T_0 - T_i, 0)$, $c_i = \max(T_i - T_0, 0)$, T_i is the daily mean temperature of day i , $T_0 = 18^\circ\text{C}$, and N is the number of days in a month.

Summary statistics for these two variables for 22 years from 1991 to 2012 are shown in Table 4. During the sample period, the aggregate values of *CDD* increased by 0.739 percent annually (from 577.41 in 1991 to 673.9 in 2012). However, there was little change (0.209%) in *HDD* (yearly aggregates are 2,664.24 and 2,784.02 in 1991 and 2012, respectively).

While *HDD* remained relatively stable over the period, the increase in *CDD* implies that electricity consumption is expected to increase more for cooling than for heating during the same period. However, the annual growth rate for the average winter loads during 1991- 2012 (7.83 percent) shows the opposite and exceeds the growth rate of the average summer load by more than 0.6% (see Table 1).

E. Electricity Prices and Relative Prices to Competing Fuels

A loose relationship between electricity loads and weather variables (*CDD* and *HDD*) indicates that there exist non-weather factors that drive the increase in electricity consumption. In this paper, special attention has been paid to the effects of electricity prices and the corresponding relative prices on electricity demand. Retail electricity rates in Korea are supposed to reflect the various costs of serving customers over a year or season (Braithwait *et al.*, 2007). However, the actual pricing practice in Korea is different. Due to the Price Stabilization Act in Korea, which sought to stabilize consumer price levels and support price competitiveness in the international market, retail electricity prices are regulated, and its cost recovery rate has been lower than 1, as shown in Figure 6.

As addressed in Section 2.B., the surge in winter electricity demand was observed in the commercial sector. When electricity prices are compared by sector, the commercial sector price (in real terms) has considerably declined since 2000, and the largest price gap between the residential and commercial sectors was recorded from 2000 to 2010 (see Figure 7). This trend stands in contrast to that of the energy consumption share by sector. The difference in the energy consumption share by sector was smallest over the same period (see Figure 4).

A comparison of the electricity price versus the price of alternative fuels in the commercial sector suggests a link between the relatively low costs of electricity and the level of demand. Figure 8 presents the prices of electricity and natural gas in the commercial sector from 1991 to 2012. Electricity prices continued to be regulated at a stable level between 50 to 100 KRW/kWh during the same period. However, natural gas prices continued to climb because the prices of other fuels are determined by the market. Natural gas prices and electricity prices reversed around 1997. The seasonal trend reversal, as described in Figure 5 in Section 2.B., could

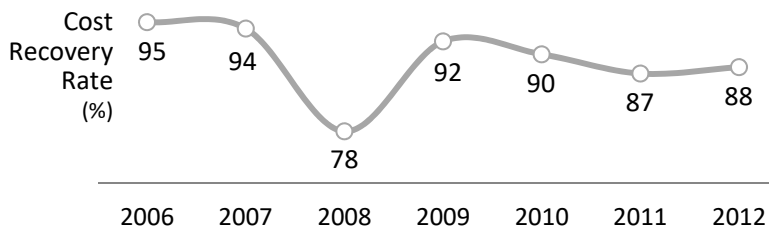


FIGURE 6. COST RECOVERY RATES OF ELECTRICITY PRICES

Source: Korea Electric Power Corporation.

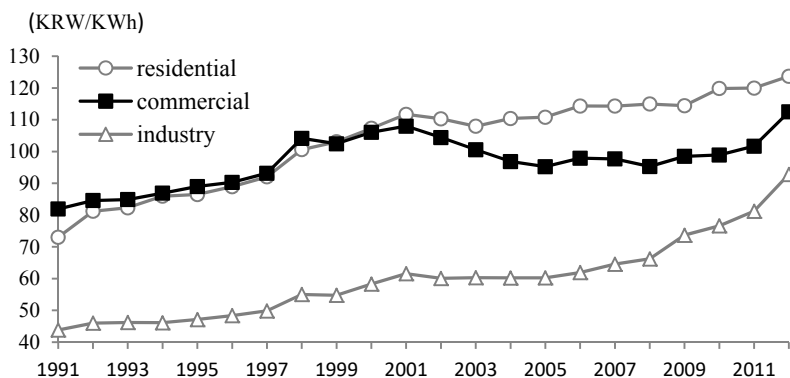


FIGURE 7. ELECTRICITY PRICE BY SECTOR IN KOREA (1991-2012)

Source: Electric Power Statistics Information System.

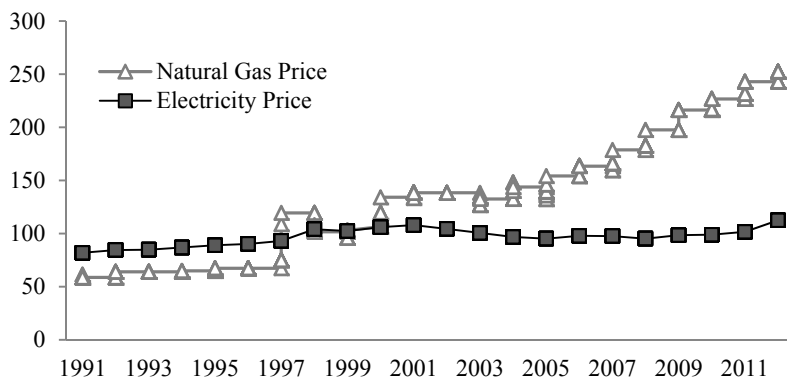


FIGURE 8. ELECTRICITY PRICES AND NATURAL GAS PRICES IN COMMERCIAL SECTOR (1991-2012)

Source: Korea City Gas Association; Electric Power Statistics Information System.

be a result of a switch in the heating fuel choice from natural gas to electricity⁴ by the operators of commercial buildings.

⁴We propose the hypothesis which holds that due to the extremely low price of electricity and Korea's preference for floor heating, hot water mats and electric heating mats have become competitors in the heating market.

Therefore, our focus here is on the commercial sector, which experienced a major increase in the consumption share and a price decline at the same time during 1991 and 2012. We analyze the effects of price and the relative price of electricity on consumption in the commercial sector in Section 3.

III. Assessment Model

In this study, we established a model which estimates monthly electricity consumption in the commercial sector during the years of 1991-2012. Our estimation model is specified in equation (2), similar to Contreras, Smith, and Fullerton (2011), who analyzed the impacts of weather variables, *HDD* and *CDD*, on commercial electricity demand in the United States.

$$(2) \quad \ln E_{it} = \beta_0 + \beta_{PE} \ln P_{it} + \beta_{PR} PR_{it} + \beta_{PRW} PRW_{it} + \beta_{HHY} \ln HHY_{it} \\ + \beta_{HH} \ln HH_{it} + \beta_{SH} \ln SH_{it} + \beta_{HDD} HDD_{it} + \beta_{CDD} CDD_{it} + \beta_T T_{it} + \varepsilon_{it}$$

In equation (2), E represents the consumption of electricity in sector i at time t . i is the commercial sector in this paper. *HDD* and *CDD* are heating degree days and cooling degree days, respectively. In Contreras, Smith, and Fullerton (2011) and in Denton, Mountain, and Spencer (2003), the statistical impacts of the prices and the relative prices of electricity were evaluated. Following them, we employ two price variables, the electricity price (P) and the price ratio of electricity to natural gas (PR).⁵ PRW is the interaction term for PR and heating degree days ($PR_{it} \times HDD_{it}$), which measures the impact of the relative price of electricity to natural gas on the heating load in winter.⁶ In Korea, people have stressed the importance of the price of electricity relative to that of natural gas in wintertime. However, to the best of our knowledge, only a few empirical studies have estimated its impact. Therefore, both PR and PRW are included in the explanatory vector to calculate the impact of the price ratio between natural gas and electricity in our study.

Fell *et al.* (2010) and Qiu (2014) argued that an instrumental variable approach should be used to avoid the endogeneity bias associated with price variables. In the present study, we ignore the endogeneity issue because electricity prices are pre-determined in Korea by the government. We are not the first to use this strategy, but some studies have ignored the potential price endogeneity issue (Newell and Pizer 2008; Andrews and Krogmann 2009a; 2009b).

The inclusion of income variables is very common in the literature on electricity consumption. To measure the income effect, we use household income (HHY).

$$^5 PR = \frac{\text{Electricity price}}{\text{Natural gas price}}$$

⁶One way to measure winter demand (=heating demand) for electricity is to use a monthly dummy variable indicating winter (December, January and February). However, considering that heating demand can occur in November and March as well as in December, January and February, the *HDD* variable, a measure of the degree of demand, is used to represent the relative price of heating demand in winter.

TABLE 5—DESCRIPTIVE STATISTICS OF EXPLANATORY VARIABLES (1991-2012)

Variable	Description	Mean	StD	Annual Growth Rate (%)
<i>E</i>	Electricity Consumption in the Commercial Sector (Mwh/month)	6,266,154	3,328,256	10
<i>P</i>	Electricity Price in the Commercial Sector (KRW/kWh)	96.87	7.93	1.45
<i>PR</i>	Price Ratio between Electricity and Natural Gas	0.88	0.35	-0.052
<i>PRW</i>	Price Ratio between Electricity and Natural Gas in Winter months	190.31	215.94	-0.049
<i>HHY</i>	Quarterly Household Income (Million KRW, Nominal)	2.76	0.95	7.17
<i>HH</i>	Number of Households (Thousand)	14,882	1,920	2.12
<i>SH</i>	Proportion of Single Person Households (%)	0.16	0.05	4.76
<i>HDD</i>	Monthly Sum of <i>HDDs</i>	215.46	214.57	0.209
<i>CDD</i>	Monthly Sum of <i>CDDs</i>	50.42	78.42	0.739

Note: Electricity prices for commercial sector, converted with 2010 values.

Source: Bank of Korea; Statistics Korea; Korea Meteorological Administration (KMA).

HH and *SH* denote the numbers of households and the share of single person households, respectively. These variables will capture the impact of changes in household characteristics on electricity demand.

One factor driving the electricity load is the increase in the proportion of single-person households. Many of these consumers live in commercial office buildings, which are exempt from progressive taxes and allow residents to enjoy the modern city lifestyle. A greater number of single-person households will mean a larger number of commercial office buildings and higher per capita electricity consumption. In Korea, the share of single households increased from 9% in 1991 to 24% in 2012, and this rate of growth has increased rapidly in recent years. Lastly, T denotes the year, a trend variable, and ε_{it} is the disturbance term.⁷ The basic descriptive statistics are presented in Table 5.

IV. Results and Robustness Test

The estimation results are summarized in Table 6. A Prais-Winsten regression (Prais and Winsten, 1954) is adopted to control for heteroscedasticity associated with serially correlated errors. The Durbin-Watson statistic demonstrates that the Prais-Winsten method successfully controls the AR (1) process of error terms.

As shown in column (1) in Table 6, when either *CDD* or *HDD* increases by one unit, the electricity demand increases by 0.007 percent. As expected, summer heat and winter cold, represented by *CDD* and *HDD*, increase the corresponding levels of electricity demand.

⁷Variables representative building characteristics are employed in some studies. For example, Otsuka (2015) analyzed the commercial sector using panel data for the period of 1990–2010 in Japan. He attributed the demand of the commercial sector to an increase in commercial floor space and advances in office automation. Due to a lack of relevant data, we cannot include these variables in equation (1).

The estimated coefficient of $\ln P_{it}(\hat{\beta}_{PE})$ represents price elasticity in the commercial sector (-0.602). This indicates that the level of electricity demand is price responsive in the commercial sector and that the price elasticity of electricity demand is expected to be negative, as the law of demand dictates. This effect should have no endogeneity bias (or simultaneity bias). The price of electricity in Korea can be considered as exogenous because it is provided through regulated fixed tariffs based on anticipated operation and fuel costs.

While $\hat{\beta}_{PE}$ measures the own-price elasticity of demand when other things are constant,⁸ $\hat{\beta}_{PR}$ indicates the cross-price elasticity, measuring the effect of relative prices between natural gas and electricity. The results show that $\hat{\beta}_{PR}$ is not statistically significant. However, the relative price during the winter months has a statistically significant negative effect on electricity demand ($\hat{\beta}_{PRW} = -0.00047$). The significant estimator implies that demand has been responsive to changes in

TABLE 6—RESULTS FROM ORDINARY LEAST SQUARE (OLS) AND PRAIS-WINSTEN ESTIMATION TESTS

Variable	(1) OLS Estimation	(2) Prais-Winsten Estimation
$\ln P$	-0.602** (0.236)	-0.604** (0.245)
PR	0.119 (0.142)	0.122 (0.146)
PRW	-0.00047*** (0.00014)	-0.0005*** (0.0001)
$\ln HHY$	0.399* (0.219)	0.386* (0.226)
$\ln HH$	11.834*** (1.376)	11.889*** (1.423)
SH	0.773 (0.972)	0.782 (1.008)
HDD	0.0007*** (0.0001)	0.0007*** (0.0001)
CDD	0.0007*** (0.0002)	0.0007*** (0.0002)
$Year$	-0.193*** (0.024)	-0.193*** (0.025)
<i>Intercept</i>	203.029*** (35.238)	202.971*** (36.533)
# of observation	264	264
Adjusted R ²	0.938	0.932
Rho		0.0406
Original DW statistic		1.919
Adjusted DW Statistic		2.001

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, *p<0.1.

⁸In general, the elasticity of demand for a product describes what happens when the price of the product changes, holding constant the prices of all other products.

relative fuel prices in winter months and the negative sign indicates that the level of demand increases when the electricity price is relatively low compared to that of natural gas in the winter months. These findings support our assumption that the peak demand during the winter months in Korea can be attributed to the price difference between electricity and its substitutes.

On the other hand, the total price effect has two components: (i) the (direct) absolute effect ($\hat{\beta}_{PE}$), and (ii) the (indirect) relative effect with respect to the prices of competing products, $(\hat{\beta}_{PR} + \hat{\beta}_{PRW} \times HDD) \times PR$, when the partial derivative of the electricity price is given by $\hat{\beta}_{PE} + (\hat{\beta}_{PR} + \hat{\beta}_{PRW} \times HDD) \times PR$.⁹ Table 7 shows the change in the total price effect on the two periods before and after 2002. As the price of electricity relative to that of natural gas decreased in the second period,¹⁰ the total price effect decreased from 0.72 to 0.66 during the same period. This result demonstrates the importance of relative energy prices in determining electricity demand. In Korea, the retail price of natural gas is regulated by local governments, but wholesale prices supplied by the Korea Gas Corporation reflect the international fuel price through the mechanism of fuel-electricity price linkage. On the other hand, the linkage mechanism has scarcely been implemented in determining the price of electricity. The electricity price is a major component of price-stabilization measures that have taken up a higher position than the fuel-electricity price linkage mechanism in Korea's policy domain. As a result, the difference between the two prices has increased, as described in Figure 8.

We also found that the increase in the number of households has increased the demand for electricity by 11.83 percent (HH). Electricity consumption becomes larger with an increase in household income (HHY) by nearly 0.4 percent. Other characteristic variables such as the share by single person households (SH) are not statistically significant in this study.

Because the unit root and the spurious regression problem have been accounted for in times series data of electricity consumption, unit root tests are performed to check for non-stationary behavior. The well-known standard ADF (Augmented-Dickey-Fuller) test is applied in this study. The T-test statistic for the lagged value of commercial electricity consumption is -3.084 and the p-value is 0.0277. Because the test statistic is smaller than the critical value of the confidence level at 5%

TABLE 7—TOTAL PRICE ELASTICITY OF ELECTRICITY DURING TWO PERIODS (1991-2001 vs. 2002-2012)

Period	Mean Values		Total Price Elasticity			
	HDD	PR	Winter Months		Non-Winter Months	
			Value	95% Confidence Level	Value	95% Confidence Level
1991-2001	216.3	1.1802	-0.7220	[-0.9107, -0.2523]	-0.6020	[-0.7907, -0.1323]
2002-2012	215.6	0.5848	-0.6613	[-0.7548, -0.4285]	-0.6020	[-0.6955, -0.3692]

⁹A partial derivative of the electricity price can be derived from equation (2) in Section 3. In non-winter months (when $HDD=0$), $\hat{\beta}_{PR} + \hat{\beta}_{PRW} \times HDD$ will be $\hat{\beta}_{PR}$.

¹⁰The relative price is greater than one in the first period and less than one in the second period.

(-2.879), electricity demand in the commercial sector allows us to reject the unit root null hypothesis at the 5% significance level, meaning that electricity demand in the commercial sector is stationary in Korea.

V. Conclusion

Given the global interest in climate change, the impacts of weather variations on electricity demand and greenhouse gas (GHG) emissions have been discussed in many countries. At the Paris meeting in 2015 (COP21), Korea reset the target for its GHG emissions, targeting a 37 percent change from the business-as-usual (BAU) measure by 2030. To achieve this reduction, demand management in the power sector is a must given that the proportion of the power sector emissions to those at the national level exceeded 40 percent in 2013. However, electricity demand in Korea has increased over time and a reduction in GHG emissions by the power sector appears to be a mere hope that can never be reached.

In the present study, we investigate factors that cause increments in load levels and test whether or not electricity policies, specifically the price policy, are set to comply with Korea's mitigation target. Using statistical tests, we provide empirical evidence that temperatures have increased over time in Korea. When we take the temperature impact on electricity demand into account, the winter load for heating should have decreased while the summer demand for cooling should have increased. Opposite to this expectation, the winter demand level has dramatically increased over time.

Few empirical studies have investigated the impacts of climate change and price variation on electricity demand levels in Korea. We attempt to fill this gap in the literature by employing an econometric model and quantifying both the effects of weather variations in terms of temperature and price factors on the demand for electricity. After controlling for the effects of GDP growth and changes in populations and family types on electricity demand, we find statistically significant contributions of temperature changes and electricity prices on electricity demand. Our analysis finds that the consumption increase of electricity of the commercial sector in wintertime is the result of relatively low electricity prices compared to the prices of its substitute heating energy source, which is natural gas.

Our empirical finding calls for a policy change regarding electricity prices to achieve the GHG reduction goals announced by the international society. Furthermore, relative prices are likely to have an impact on summer electricity demand, as well as winter electricity demand, in the future because there is no adequate alternative fuel source for cooling demand in summertime. There is a high possibility of summer peaks arising with abnormal increases in both temperature and income levels. This conclusion stresses the importance of the relative prices of energy sources contributing to the mitigation of GHG emissions in the future.

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