Pharmaceutical Spending and Policy Implications for South Korea vs. OECD Countries

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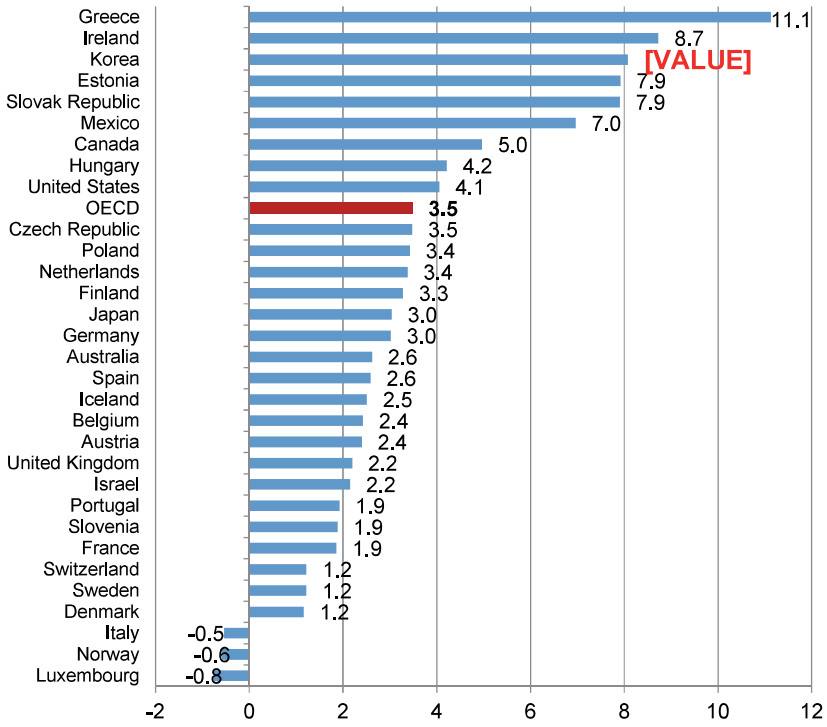
To curb rapidly rising pharmaceutical expenditures, the Korean government launched a series of drug price policies during 1999-2012. However, these supply-side policies were not successful. To better understand the reasons behind the unsuccessful outcomes, we develop a modeling framework with which to analyze the growth rate of pharmaceutical expenditure in Korea. To date, few studies have examined the effects of the Korean price policies on future pharmaceutical expenditure. Our model considers Korean society's characteristics in terms of demographic changes, prescription practices, medical technology, and lifestyle risks. Our results reveal policy impacts on the changing face of the Korean pharmaceutical market.

INTRODUCTION

Between 2001 and 2009, South Korea averaged double-digit growth per year in total healthcare expenditure on national health insurance. Korea's real per capita pharmaceutical spending increased even more rapidly than most Organization for Economic Cooperation and Development (OECD) nations during the same period. To curb these rising expenditures, the Korean government launched its Separation of Prescribing and Dispensing (SPD) Reform in 2000. Subsequently, between 2001 and 2010, Korea experienced double-digit rates of annual growth in pharmaceutical expenditure, particularly in national health insurance (NHI) prescription drug expenditure (Bae et al., 2014). Through the reform, private community pharmacy costs have shifted to public prescription costs (Lee, Bloor, Hewitt, and Maynard, 2012).

Amid strong influence from Korean interest groups, supply-side drug price regulations have not reduced the rapidly growing pharmaceutical and health expenditures. In contrast to other OECD countries, Korea's health expenditure as a share of GDP has continued to climb, with health expenditure rising faster than GDP (OECD, 2014). The annual healthcare spending per capita in Korea was 9.3 percent, on average, between 2000 and 2009, representing the fastest growth rate among the OECD countries (KMHW, 2013). According to OECD Healthcare Quality Review (2012), this trend makes Korea's NHI program unsustainable, and may push the program into further debt. As shown in Figure 1 below, the annual growth rate of real per capita pharmaceutical expenditure in Korea was 8.1 percent during 2000-2009, while the OECD nations experienced on average 3.5 percent.

FIGURE 1
ANNUAL GROWTH RATE OF REAL PER CAPITA PHARMACEUTICAL EXPENDITURE, 2000-2009



Source: OECD, 2011

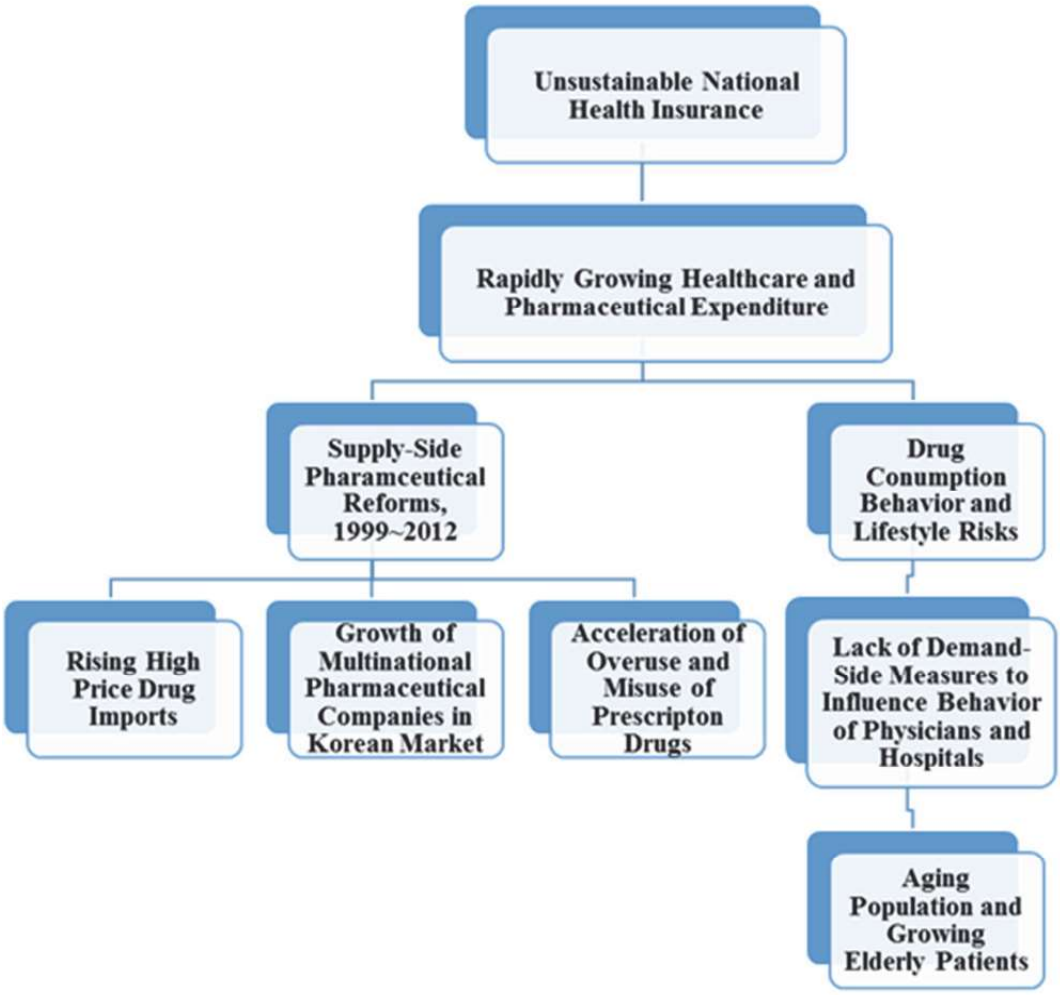
Korea's pharmaceutical spending per capita increased significantly between the years 1992 and 2012, while the change in Korea's pharmaceutical expenditure as a percentage of health expenditure was minimal during the same period. The Korean government rather expected lower pharmaceutical expenditure to reduce national healthcare costs. To better understand the key reasons behind the drug price policies' lack of success, this study develops a model framework with which to analyze the growth rate of pharmaceutical expenditure per capita in South Korea, particularly between 1992 and 2012. This is the most relevant period in terms of the series of drug price control policies.

In the next section, we review the background to the modeling and, in particular, our rationale for choosing the factors we include in the pharmaceutical expenditure model. Next, we explain our model, and then discuss the empirical results and implications of our findings for the drug price policies. Finally, we conclude by examining the lessons to be learned from Korea's drifting drug price control policies.

BACKGROUND OF THE STUDY

Korea has experienced rapid growth in its annual pharmaceutical expenditure, despite a series of drug price control policies since 2000. Pharmaceutical spending per capita in Korea increased at an annual rate of 8.1 percent between 2000 and 2009, which ranked as the third fastest growth rate among OECD countries (OECD, 2011). Furthermore, Korea's pharmaceutical expenditure as a percentage of health expenditure stood at 21% in 2012, which was much higher than the average of 16 percent among other OECD nations (OECD, 2014).

FIGURE 2
DEMAND-SIDE VS. SUPPLY-SIDE PHARMACEUTICAL SPENDING ISSUES IN KOREA



As illustrated in Figure 2, there are demand-side vs. supply-side pharmaceutical spending issues in Korea. In this section, we closely examine these issues that are entangled with each other by focusing on the key demand and supply factors behind the unsuccessful drug pricing policy. Coupled with the growing demand-side issues, unbalanced supply-side policies fail to rein in rapidly growing healthcare and pharmaceutical expenditure, and consequently resulting in unsustainable national health insurance.

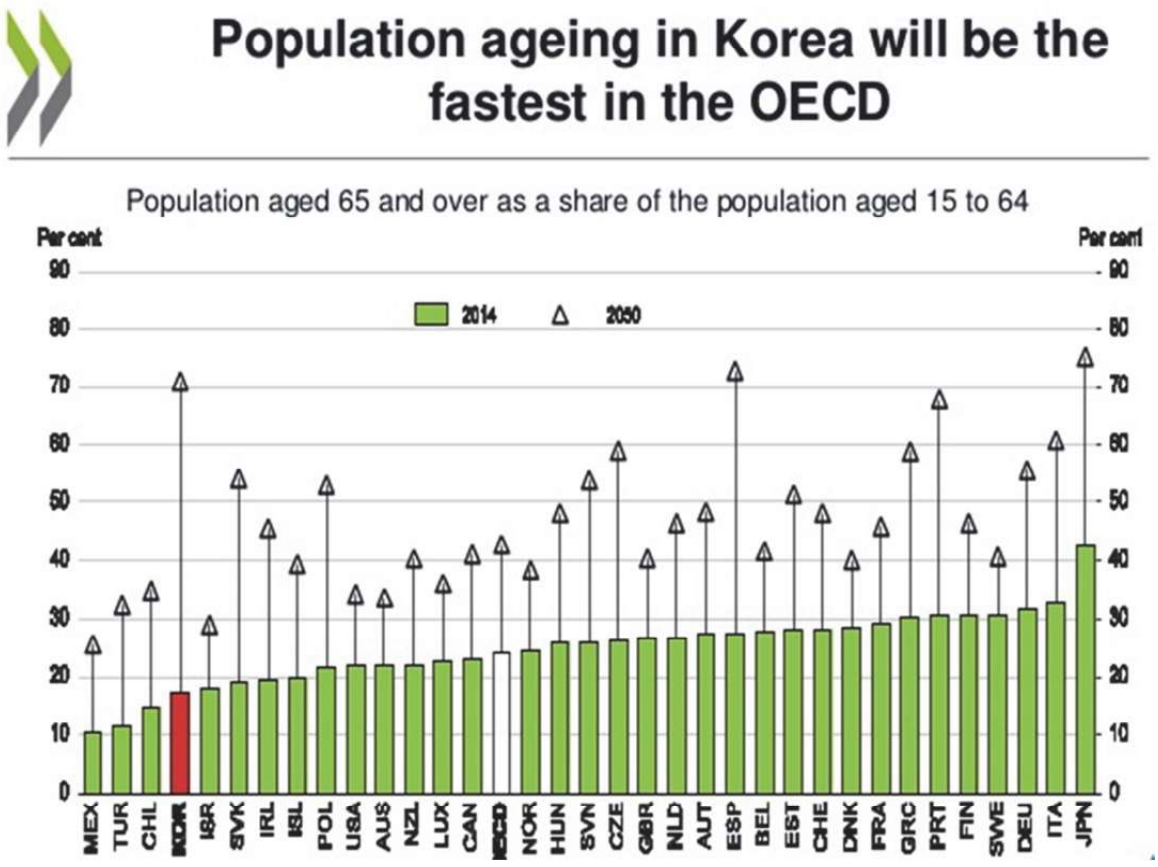
Demographic Structural Changes

As Korea has advanced to become a developed economy, we have seen a dramatic shift in the population structure. The increasing Korean median age reflects the country's low fertility rate and aging society. Korea's fertility rate has fallen from being one of the highest among the OECD nations in the 1960s to the lowest in 2005 (Jones, 2010). The annual growth rate of the number of people aged 65 and older in Korea has increased markedly since 2000. The proportion of senior citizens older than 65 in Korea in 2010 was 11 percent, a figure that is expected to more than triple by 2050 (KMHW, 2013). According to OECD Economic Survey (2016), the Korean

elderly population aged 65 and over as a percentage of the population aged 15 to 64 is expected to soar from 17.3 percent in 2014 to 71 percent in 2050. This gigantic increase suggests Korea becoming the fastest aging society among OECD nations as depicted in Figure 3.

The Korean median age climbed from 19.0 in 1950 to 37.9 in 2010 (OECD, 2012), whereas the OECD average rose from 28.9 to 38.6 in the same period. There is also a rising trend in Korean life expectancy, which has increased from 52.4 years in 1960 to 81.3 years in 2012. This increase represents the largest gain among the OECD nations (Yang, Bae, and Kim, 2008).

FIGURE 3
EXPLOSION OF THE ELDERLY POPULATION IN OECD, 2014-2050



Source: OECD, 2016

In 1960, the average life expectancy in the OECD countries was 16 years greater than in Korea. However, in 2012, the Korean life expectancy surpassed the OECD average by one year. Korea's aging population is expected to be a key driver of pharmaceutical expenditure growth. Hence, demographic structural changes, in particular, the fast growing aging population represents a key demand factor we consider in Korea's pharmaceutical expenditure model.

Prescription Practices

Prescription practices represent a key supply factor we consider in our model. In 1999, the Korean government introduced an Actual Transaction Price (ATP) model. At the time, pharmaceutical expenditure represented less than a third of NHI expenditure. Under this model, hospitals were reimbursed based on the actual drug price they pay. Prior to this drug reform, hospitals were reimbursed based on the official list price. Therefore, when suppliers discounted drugs, hospitals and doctors made a profit. The ATP model eliminated this profit opportunity, and reduced reimbursement prices substantially during 1999–2000. However, it did not encourage doctors to trim total prescriptions, nor to prescribe less costly, but equally productive drugs. Consequently, brand name prescription drug prices more than doubled during 2000–2001. This further deepened the NHI deficit (Kim and Ruger, 2008).

The Korean median age climbed from 19.0 in 1950 to 37.9 in 2010 (OECD, 2012), whereas the OECD average rose from 28.9 to 38.6 in the same period. There is also a rising trend in Korean life expectancy, which has increased from 52.4 years in 1960 to 81.3 years in 2012. This increase represents the largest gain among the OECD nations (Yang, Bae, and Kim, 2008). In 1960, the average life expectancy in the OECD countries was 16 years greater than in Korea. However, in 2012, the Korean life expectancy surpassed the OECD average by one year. Korea's aging population is expected to be a key driver of pharmaceutical expenditure growth. Hence, demographic structural changes, in particular, the fast growing aging population represents a key demand factor we consider in Korea's pharmaceutical expenditure model.

The Korean government expected to reduce pharmaceutical expenditure by implementing the SPD policy in 2000. However, the Korean Ministry of Health, Welfare, and Family (MOHW) bowed to pressure from doctors, who strongly opposed the SPD reform in 2000, and granted a 500 percent increase in prescription fees. At the same time, multinational pharmaceutical companies were giving non-cash benefits to doctors to promote their products. As a result, Korean doctors increasingly prescribed multinational brand name drugs rather than cheaper generic drugs. After the implementation of the SPD reform, multinational pharmaceutical companies saw their market share in Korea increase from 9.6 percent in 1999 to 22.7 percent in 2000, with an increase in drug imports of more than 58 percent, which were covered by the Korean NHI (Chung and Kim, 2005). These multinational pharmaceutical companies successfully lobbied the Korean government to influence what is now the world's 10th largest pharmaceutical market, enabling them to sell high cost, imported drugs, and to promote their drugs through Korean doctors (Lee, 2003). The Korean government was subsequently criticized by politicians, who accused the government of being manipulated by the foreign pharmaceutical companies (Suh, 2012).

The SPD reform led to a consistent and large increase in the total sales of drugs from multinational pharmaceutical companies, which rose 139 percent between 1999 and 2002. At the same time, the percentage of patients using high price drugs rose from 26 percent in 2000 to 54 percent in 2001 (Kim and Ruger, 2008). The percentage of public expenditure on health went up from 36.1 percent in 1992 to 53.4 percent in 2013. In particular, the percentage jumped from 49 percent in 2000 to 55.3 percent in 2001. The clear reason for this acceleration is the SPD reform, which offered doctors little economic incentive to reduce total prescriptions, and the high price of brand name drugs (Lee et al., 2012). Concomitantly, these doctors' prescription practices are expected to drive Korea's pharmaceutical expenditure growth.

Medical Technology Progress

Another supply factor we consider in our model is medical technology progress. Korea has successfully built a world-leading health information technology infrastructure. The latest medical technologies are also more available in Korean hospitals than in most other OECD countries. According to OECD Healthcare Quality Review (2012), Korean hospitals are better equipped with advanced diagnostic technologies using computed tomography (CT) scanners than most other OECD countries. There has been the widening gap between the availability of CT scanners in Korea and the OECD average, although the availability has increased in most OECD countries since the 1990s (OECD, 2011).

The availability of CT scanners in Korea grew dramatically, by 210 percent, between the years 1993 and 2013. This is more than four times the OECD average of 50 percent over the same period.

In addition, Korea has one of the most extensive drug utilization review (DUR) systems among the OECD countries. DUR systems prevent inappropriate prescribing by interpreting drug use patterns (Choi and Park, 2011). The Korean government has been promoting its nationwide electronic health records (EHR) system to improve healthcare efficiency (Cho et al., 2010). The potential benefits of operational efficiency and cost savings are encouraging governments such as the United States, Germany, India, and Korea to invest in digital medicine. A better performing healthcare system should reduce pharmaceutical expenditure. Hence, progress in cost-efficient technology is expected to be a key factor in controlling pharmaceutical expenditure.

Lifestyle Risks

Besides the demographic structural changes, another demand factor we consider in our model is lifestyle risks such as alcohol consumption patterns. Korea's annual per capita alcohol consumption rose slightly, by 2.2 percent, from 1992 to 2012, with the annual consumption increasing slightly from 8.9 liters in 1992 to 9.1 liters in 2012. Korea's average per capita annual alcohol consumption was 9.0 liters during the period 1992–2012, while the OECD average was 9.1 liters in the same period.

Alcohol consumption has mixed health effects. Moderate alcohol consumption can decrease the risk of cardiovascular disease (Klatsky, 1999). The impact of a drinking lifestyle on health is closely related to nutritional patterns. For example, wine drinkers who maintain healthy nutrition may decrease the incidence of all-cause mortality (Ferrières, 2004). However, an increase in the amount and frequency of drinking can potentially raise hypertension, which is a key risk factor for cardiovascular disease (So and Choi, 2010). Therefore, annual alcohol consumption patterns are expected to influence Korea's pharmaceutical expenditure.

KOREAN PHARMACEUTICL EXPEENDITURE MODEL

We analyze the aforementioned factors affecting pharmaceutical expenditure using the following variables: aging, prescribing, medical technology, and alcohol trend. We convert the variables to natural logarithms to obtain an elasticity estimate, as well as to mitigate the heteroscedasticity of the coefficients (Tchoe and Nam, 2010). Thus, the elasticities of the variables denoting pharmaceutical expenditure per capita in Korea are derived from the following model, in natural log form:

$$LNPharmexpt = b1 + b2LNAgingt + b3LN\,Prescribingt + b4LNMedtecht + b5logAlcoholt,$$

Where the variables are defined as follows:

LNPharmexpt: The natural log of total expenditure on pharmaceuticals and other medical non-durables, per capita, in US$ purchasing power parity, 1992–2012.

LNAgingt: The natural log of the life expectancy of the overall population at birth, in years, 1992–2012.

LNPrescribingt: The natural log of out-of-pocket payments of households, per capita, in US$ purchasing power parity, and health expenditure by financing agents/schemes, 1992–2012.

LNMedtecht: The natural log of the number of computed tomography scanners per million population, 1993–2013.

LNAlcoholt: The natural log of the annual consumption of pure alcohol, in liters, per capita (aged 15 years old and over), 1992–2012.

*b*1–*b*5: The empirically estimated parameters.

In the model, *t* denotes the year. We selected the most relevant two decades, which included the series of drug price control policies. We obtained our data from the OECD Health Statistics 2014. Note that, since this data set does not provide 1992 data for the Med Tech variable, we chose the closest year for this variable, namely 1993.

EMPIRICAL RESULTS AND DISCUISSION

We perform a multiple regression analysis of our model using Minitab Statistical Software. The empirical results are summarized in Table 1.

TABLE 1
PHARMACEUTICAL SPEDNING PER CAPITA MODEL ESTIMATES

	Coefficients	Stand Error	T Stat	P-value
Constant	**-51.59**	**9.320**	**-5.54**	**0.000****
Aging	**11.63**	**2.410**	**4.83**	**0.000****
Prescribing	**0.85**	**0.157**	**5.40**	**0.000****
Med Tech	**-0.36**	**0.089**	**-4.00**	**0.001****
Alcohol	**-0.13**	**0.413**	**-0.30**	**0.765**
Adjusted R-Square: 0.9963				
**** Significant at or below the 0.01 level.**				

Overall, the model explains almost all the variation in the trends of per person pharmaceutical spending rates over the two most recent decades, as indicated by the very high adjusted R-square value. Heteroscedasticity is not present. Since autocorrelation is typically present in time series data, we apply the Box–Cox transformation in Minitab (Osborne, 2010). The Durbin–Watson statistic, d = 2, indicates there is no autocorrelation. When we use time series data for multiple regression, we tend to encounter multicollinearity. Although the variables "Prescribing" and "Med Tech" are highly correlated with "Aging," this is not serious because the overall coefficients are statistically significant, and the model accounts for a high portion of the variance in per person pharmaceutical spending rate. We prefer a more precise forecasting model than one with less multicollinearity, but large forecast errors.

The aging population has a large and significant influence on the per capita pharmaceutical spending rate. Life expectancy, a proxy for the aging population, has a coefficient with the expected sign: the per capita pharmaceutical spending rate in Korea is positively associated with life expectancy. For example, if the life expectancy increases by 1 percent in Korea, we estimate an 11.63 percent increase in per capita pharmaceutical expenditure. The results indicate that an aging population is an overriding determinant of per capita pharmaceutical spending rate. As we described earlier, Korea has experienced a dramatic shift in its population structure. The fertility rate has fallen to its lowest rate, while life expectancy at birth has increased the most among the OECD nations (Yang, 2010). Since the aging variable has an impact 12 times greater than that of the prescribing variable, the Korean government should address this major underlying cause of its increasing pharmaceutical expenditure and implement more population policy interventions.

We find that the coefficient for the prescribing variable has the expected sign: the prescribing pattern is positively related to the per capita pharmaceutical spending rate in Korea. Individuals' out-of-pocket health costs are a proxy for prescribing patterns. If individuals' out-of-pocket health costs increase by 1 percent, we estimate a 0.85 percent increase in per person pharmaceutical spending. Thus, the prescribing pattern is a significant determinant of the per capita pharmaceutical spending rate. This has important implications for Korea's drug policies. The current drug reforms have actually encouraged doctors to prescribe costly prescriptions using brand name drugs. Furthermore, the 2000 SPD reform had unplanned consequences after the MOHW gave in to pressure from doctors and the successful lobbying of

multinational pharmaceutical companies. The MOHW's drug policies have led to the growth of multinational pharmaceutical companies in the Korean market, and failed to curb the nation's high pharmaceutical expenditure. Consequently, patients' out-of-pocket health costs increased significantly during the study period.

The number of CT scanners per million of the population is a proxy for progress in cutting-edge medical technology. Medical technology seems to be significant at the 1 percent significance level, but the elasticity is 0.36, which is not large in magnitude. We estimate that per capita pharmaceutical spending may decrease by 0.36 percent if the number of CT scanners increases by 1 percent. Between the years 1993 and 2012, Korea had an average of 28 CT scanners, and the country's average per capita pharmaceutical spending was U.S $256, in purchasing power parity, over the same period. The majority of OECD nations had fewer CT scanners than the Korean average during this period, while their average pharmaceutical spending per capita exceeded that of Korea. This indicates that advanced and costly medical technology does not necessarily increase pharmaceutical spending per capita.

The number of CT scanners per million of the population in Korea grew by more than four times the OECD average between the years 1993 and 2013. The Korean government invested in a cutting-edge medical complex in 2008 (Jang, 2010), and has also been promoting its nationwide EHR system to improve healthcare efficiency (Cho et al., 2010). The Kaiser Permanente EHR system, involving over 225,000 members, has demonstrated its operational efficiency (Chen, 2009). The potential benefits of such operational efficiency and cost savings are encouraging governments to invest in digital medicine.

The influence of annual alcohol consumption patterns on the per capita pharmaceutical spending rate appears weak, as indicated by the insignificant coefficient of the alcohol trend variable, a proxy for drinking lifestyle. Then, there is a negative association between alcohol consumption patterns and per person pharmaceutical spending rate. The negative sign of the alcohol trend variable suggests that higher annual alcohol consumption does not directly increase the per person pharmaceutical spending rate. Alcohol consumption has mixed effects on health. For example, wine consumption in France and Denmark has decreased all-cause mortality by 24~31% (Ferrières, 2004). On average, people in France aged 15 years and over consumed an annual amount of 13.7 liters of alcohol between the years 1992 and 2012, while the Korean average was 9.0 liters over the same period.

The impact of drinking lifestyle on health is related to a person's general nutritional pattern. In Korea, people traditionally have a diet that is high in carbohydrates and low in fat. Korean traditional dietary patterns are characterized by a high consumption of rice, beans, vegetables, fermented vegetables known as kimchi, and fish. A data analysis of Korean teenagers shows that Korean traditional dietary patterns are negatively associated with metabolic syndrome risk factors, such as obesity, whereas Western dietary patterns are positively associated with these risk factors (Joung, 2012). According to OECD Healthcare Quality Review (2012), the Korean diet is changing as a result of Western influence and lifestyle risk factors are increasing. The Korean government needs to promote healthy lifestyles, including healthy nutritional patterns, to decrease the rising pharmaceutical expenditure associated with chronic diseases.

CONCLUDING REMARKS

Every empirical model is a simplification of a complex reality. Hence, we need to exercise caution when interpreting the results based on our model. First, the variables used to estimate demographic structural changes, prescription practices, medical technology progress, and drinking lifestyle are limited, and could be refined further. For example, it would be interesting to examine variations in prescription drug consumption, healthy lifestyles, and so on, for men and women separately. Second, the estimated equation does not account for growth in biotechnology and digital medicine. Finally, it would be preferable to employ nutritional patterns that consider the quality of diet. This would enable us to better define people's food and drinking lifestyle.

Bearing these limitations in mind, the results of this study provide new evidence on the determinants of pharmaceutical expenditure per capita in South Korea. The study focused on two decades that included the series of drug price control policies, and raised a number of implications for drug policy. Our results

show that the aging population has a far greater impact on the per capita pharmaceutical expenditure rate in Korea than do prescribing patterns. We expect that the global elderly population will continue to grow, which will drive the growth of the pharmaceutical market. This global demographic trend poses growing socio-economic and healthcare challenges (UNFPA and HelpAge International, 2012).

As high price prescription drugs significantly affect pharmaceutical expenditure in Korea, the government should actively implement demand-side measures to enhance the rational use of generic drugs. Policies that promote generic drugs are necessary to encourage cost-effective drug consumption, as many Korean patients lack confidence in the quality of cheaper generic drugs (Lee et al., 2012). Research has shown that the increased use of low-cost generic drugs in Scotland and Netherlands seems to have helped to contain their future drug expenditure, while maintaining quality care (Kwon, Hong, Godman, and Yang, 2013). The relationship between pharmaceutical expenditure and drug consumption behavior is also important from a broader perspective. These trends will benefit drug manufacturers and will further expand their pharmaceutical market in Korea. At the same time, improved intellectual property rights (IPR) through Korea–US and Korea–EU Free Trade Agreements (FTA) will make the Korean market more attractive to foreign investment by multinational pharmaceutical companies. As a result, the generic-dominated Korean pharmaceutical industry is seeking major collaborations with multinational pharmaceutical companies through licensing agreements and joint ventures (Jang, 2010).

Valuable lessons can be learned from these expected outcomes. Governments are susceptible to lobbying by multinational pharmaceutical giants. This study suggests that drug policy actions have a significant impact on future pharmaceutical expenditure per capita. Korea's supply-side drug reforms might have been more successful if the government had offered more diverse demand-side measures, such as the right financial incentives for doctors and drug consumers, educational programs, and generic drug promotions, as Germany did (Bae, 2014). In order to learn more about drug pricing policies, we need expanded models that compare long-term series data in Korea and other OECD nations. Such data would allow a significant advancement in the global pharmaceutical expenditure research.

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