Distribution Systems and Efficiency of Life Insurers in Korea

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Abstract

This study investigates the technical efficiencies of all life insurance companies in Korea using data environment analysis (DEA) for the sample of 2006 – 2017. During the sample period studied, new life policy sales by cyber marketing and traditional face-to-face sales have significantly increased and sales by other distribution methods have parred or decreased. The estimates of average technical efficiency measures of Korean life insurers are about 18 percent higher than those of foreign life insurers. Among competing regression models, a random effects model is found to be an appropriate model and shows that cyber marketing and tele-marketing have a statistically significant positive impact on insurers' efficiency, while there is a statistically significant negative relationship between the capital input and the efficiency. The findings of this suggest that insurers should strive to increase their operational efficiency by reevaluating and restructuring their distribution channels.

JEL Classification: G14, G22, L11
Keywords: Data Envelopment Analysis, Efficiency, Distribution Systems, Insurance Companies

I. Introduction

Increase in labor costs, technological advancement, competition, and changes in consumers' buying behavior for insurance and financial service products have compelled insurers to employ other ways to market their products. As personal selling has become less attractive and more costly to insurers, more and more insurers have adopted non-traditional distribution systems to market their products. The utilization of multiple distribution systems by insurers has been well-documented in the American market (Park, et al., 2009; Regan & Tennyson, 1996) and the Korean market (Park & Park, 2015). However, personal selling has been and will continue to be the main promotional effort to encourage sales to consumers for insurance and financial services products due to the product complexity.

The efficiency of insurance companies is important and critical for various stakeholders, including, but not limited to investors, regulators, and policyholders because their efficiency is highly related to their profitability and eventually survivorship (Greene & Segal, 2004) and in creating capital liquidity as a financial intermediary (Choi, et al., 2016). Types of distribution systems used by insurers are expected to be highly correlated to insurers' efficiency. Joskow (1973) documents that the independent agent system is substantially less efficient than the exclusive agency system and recommends that attempts be made to incorporate direct writing whenever possible. Since then, many studies have documented reasons for the coexistence of independent and exclusive agency systems (Park, et al., 2009; Berger et al. 1997; and Regan & Tennyson, 1996). As the direct writing system provides comparative advantages over agency-based distribution systems, more and more insurers have adopted the direct writing system. Dumm and Hoyt (2003)

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report that a direct writing system has gained a significant market share among personal line insurers in the U.S. market in 2001.

Insurance policies and other financial products marketed by insurers are too complex for consumers by themselves to determine whether a product is appropriate for their needs. This is why standardized homogenous insurance policies have been well marketed via the Internet and direct marketing. Even with an insurance agent's help, consumers often purchase without a deep understanding of their rights and restrictions associated with the products they purchase. Accountability and credibility of salesforces are very critical in protecting both rights of policyholders and the reputation of the insurer and personal selling method.

The Korean life insurance market is a great candidate to study the efficiency of distribution systems for three reasons. First, various distribution systems have coexisted in the Korean life insurance market. Personal selling through exclusive agents has been the backbone of marketing insurance products in Korea. Each life insurer had built up its own network of exclusive agents since the 1970s and the distribution system has become the main channel for selling their products. Exclusive agents not only evaluate risks faced by consumers, but also provide solutions including insurance and other financial products offered by the insurer they represent. Therefore, the insurers' competitiveness and market share have been determined by the size of exclusive agents each insurer utilized. Although insurance distribution systems in Korea have gone through phases of significant changes, Korean insurers continued to maintain the exclusive distribution system even at high costs and decreasing profitability associated with the system due to a lack of alternatives. Since April 1996 and April 1997, the independent agency system was allowed for non-life and life insurance markets, respectively. The brokerage system was also allowed for both industries a year later. Entering the 2000s, new distribution systems are introduced to the Korean insurance market, including *bancassurance*, *cardassurance*, tele-marketing, home shopping networks, cyber marketing, and general agency. Foreign life insurers, to challenge and compete with the well-established exclusive agent system used by Korean insurers, started utilizing independent agents and the general agency system that are popular in their home country or advanced market. Other factors affecting the distribution changes include advancements in technological infrastructure and high-speed Internet, and consumers' buying behavior for insurance. Jeon, et al. (2013) report that *bancassurance* was surveyed as the most preferred method to obtain insurance products due to the convenience to the consumers. Jeong, et al., (2018) report that *bancassurance* accounts for more than 50% of the market since 2012.

Table 1 shows the first year premium earned on new policies by various distribution types for selected years between 2005 and 2017. As noted earlier, face-to-face (F2F) sales include all forms of personal selling, including exclusive agents, employees, *bancassurance*, general agency, and independent agents. The continuous dominance of F2F sales is attributed to *Bancassurance*, independent agents, and general agencies. Tele-marketing (T/M) has marginally increased and sales by Home Shopping channels (H/S) have decreased at the same time. Interestingly, the sales by cyber-marketing (C/M), or the Internet, have significantly increased between 2014 and 2017, when sales by all other distribution channels have decreased. Cho (2019) reports the life insurance market in Korea has continued to contract since 2015 and the contraction is expected to continue in 2020, due to decreasing interest rates, increasing household debt, market saturation, and slowing economic growth. Traditional life insurance products and savings life insurance products are expected to contract by 14.1% and 18.8% measured by compound annual growth rate (CAGR), respectively, between 2017 and 2020 (Cho, 2019).

Table 1. 1st Year Earned Premium from New Policies by Interaction Type for Selected Year (₩billions in KRW)[a]

Year	F2F	T/M	H/S	C/M
2005	3,825.8	125.8	34.0	3.1
2006	6,591.7	143.6	23.5	2.3
2011	14,651.3	198.0	15.5	1.7
2014	18,295.0	163.3	17.9	5.4
2017	12,184.5	160.4	12.7	10.7

Source: Korean Insurance Statistics Information Services
[a]F2F – Face-to-Face (i.e., exclusive and independent agents, general agencies, bancassurance, etc.), T/M – Tele-Marketing, H/S – Home Shopping Networks, and C/M – Cyber Marketing

Second, the Korean life insurance market is a competitive and open market even to global insurers, and it is an important industry to the economy. Korean life insurance market is the seventh largest market in the world based on the total premium volume in 2017 (Staib, et al., 2019). There are 24 life insurers (15 domestic and 9 foreign insurers), of which five domestic life insurers are listed on the Korea Exchange. In addition, foreign life insurers have steadily increased their market shares from 13.1% in 2014 to 19.3% in 2018 (KIRI, 2019). When it comes to market concentration, the top three life insurers account for 46.5% of the market, down from 49% in 2014. Life insurance penetration ratio, premiums as a percentage of GDP, are 6.1% in 2018, which is the fifth in the world (Staib, et al., 2019). Although one may criticize that the number of life insurers in Korea is not large enough to create a competitive market, the life insurers are directly competing with 20 non-life insurers in various insurance products. Life insurers are allowed to sell indemnity-type insurance, such as personal accident, disease, and long-term care products, which enabled them to compete with property and casualty (P&C) insurers as well under the same regulatory conditions. In return, P&C insurers were allowed to sell long-term insurance products with an unrestricted policy period, which escalated competition with life insurers.

Third, Korean regulators and life insurers have collected extensive data about sales and distribution systems utilized by insurers and made them publicly available. The data include sales volume generated by each distribution system by insurer, the methods of premium collection, and detailed demographic information about exclusive agents, to name a few. For example, insurers utilizing exclusive agents regularly report the number of exclusive agents by geographic region, gender, and years in service. No advanced markets have collected such data.

Efficiency is a measure of an individual firm's performance relative to other firms in the same industry, and it has been recognized as an important strategic and managerial measure for organizations, including insurance firms. The present study uses Data Envelopment Analysis (DEA) to measure the life insurer's efficiency. DEA, based on the observed data, identifies a set of efficient DMUs to create a "best-practice frontier" (Charnes, Cooper, and Rhodes, 1978) and the efficiencies of other DMUs are relatively estimated to the best-practice frontier. DEA has been a widely used and effective technique to measure the relative efficiency of a set of DMUs, which utilize the same inputs to produce the same outputs, even for studies of financial institutions (Lin, et al., 2009 and Greene & Segal, 2004). Due to the lack of study on the matter of life insurers' returns to scale that they operate, life insurers' efficiency is measured under both a constant-returns-to-scale (CRS) and a variable-returns-to-scale (VRS) assumption. Although both assumptions are similar in the sense of constructing a frontier with a data set and comparing each decision-making unit (DMU) to gauge relative efficiency, the efficiency measures under the CRS model reflect both technical efficiencies (TE) and scale efficiencies (SE), while the VRS model yields pure TE without SE.

The main contribution of the present study is to shed some light on the relationship between distribution systems and insurers' efficiency by empirically investigating how personal selling performs compared to non-personal selling, using life insurers in Korea. As noted, much of the focus of the study of insurance distribution systems has been primarily on the difference between two traditionally competing personal selling methods - exclusive agency and independent agency systems. More and more insurers, however, in advanced and emerging markets have adopted non-personal selling systems such as CM to promote and market their products and the insurers' reliance on non-personal selling systems will continue to grow.

The findings of the study extend some important operational implications. In light of the increasing cost of the exclusive agency and the increasing role of *Bancassurance* and CM, life insurers should strive to increase their operational efficiency by reevaluating their distribution systems. In addition, the findings of the present study can be of interest to insurers in both advanced and emerging economies, especially those insurers who are continually seeking operational efficiency improvement via modifying traditional personal selling systems and adopting non-personal selling systems.

The rest of the paper is organized as follows. Section 2 reviews the methods to measure efficiency, followed by the discussion of inputs and outputs to measure efficiency in Section 3. Section 4 presents data and empirical results, and Section 5 concludes.

II. Measuring Efficiency

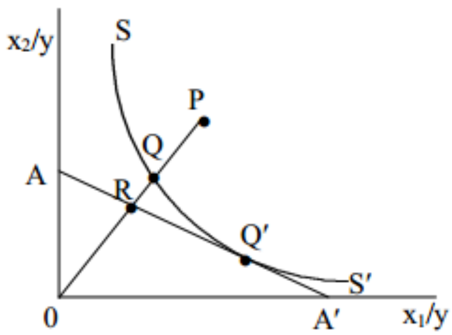
Various efficiency methodologies used in the literature across all disciplines can be dichotomized into nonparametric Data Envelopment Analysis (DEA) and parametric Stochastic Frontier Analysis (SFA). Among 16 studies surveyed by Cummins and Weiss (2000), nine employ parametric approaches, including 6 SFAs and 3 deterministic parametric analyses (DFAs), five employ nonparametric DEA approaches, and two use both approaches.

SFA is based on maximum likelihood or other classical or Bayesian, fully parametrized econometric techniques, while DEA is the conventional approach to deterministic frontier estimation handled by linear programming techniques. This is one of the main differences between them. In the case of DEA, no restrictive assumptions about technology have to be made and it does not require any distributional assumptions about efficiency. Due to no stochastic specification, all variations among DMUs may be interpreted as inefficiency during the estimation process (Sun & Chang, 2011). On the other hand, a main attraction of the SFA model is the possibility it offers a richer specification, particularly in the case of panel data. The choice between different approaches must be based on trade-offs concerning the purpose of the study, type of data, technology characteristics, etc. The empirical application of these two methods is well-established and comprehensive reviews and extensions of the two models can be found in Kumbhakar and Lovell (2000) and Hjalmarsson, et al., (1996).

This study uses DEA for the following reasons. First, DEA is simple and easy to estimate the efficiency without specifying a functional form, especially for industries where the particular production function is hard to be estimated or unknown. A misspecification of functional form becomes more serious with SFA and DEA (Gong & Sickles, 1992). Second, DEA is supposed to be appropriate with small samples due to the reason that DEA measurement is sensitive to the difference between the number of DMUs and the total number of inputs and outputs applied. Third, the noise in the Korean data is expected to be minimal due to the nature of the Korean life insurance market, reliable macroeconomic and institutional factors, and standardized data centrally collected. Fourth, SFA is sensitive to a priori assumption, and the efficiency measure depends on a pre-specification of the functional form and an explicit distributional assumption for the efficiency term (Coelli, 1996).

DEA is originated by Farrell (1957) and advanced by Charnes, et al., (1978) based on CRS, commonly known as the CCR model, and Banker, et al., (1984) based on VRS, commonly known as the BCC model. A CRS model is most appropriate when DMUs are operating at an optimal scale. Thus, when DMUs are not operating at their optimal scale due to imperfect competition, internal and external constraints, etc., the CRS model's efficiency scores may reflect both technical efficiencies (TE) and scale efficiencies (SE). On the other hand, a VRS model calculates the efficiencies of DMUs with a similar scale and thus the efficiency scores represent the pure TE without SE effects.

Figure 1. Technical and Allocative Efficiencies (Coelli, et al., 1998, p. 135)



Given two inputs (x_1 and x_2) and one output (y) as an example, Figure 1 shows a production function under the assumption of CRS. DMUs on the isoquant SS' are considered fully efficient, while other DMUs located to the right of the isoquant SS', such as point P, are regarded relatively inefficient. In reality, the fully efficient firm's isoquant is not known and thus must be empirically estimated from observations with a sample of firms in the industry. The DMU P can become efficient when it can reduce the amount of inputs by the distance QP used to produce the same level of output.

The technical efficiency (TE) under the assumption of CRS is measured by the ratio of the distance between 0Q and 0P (TE = 0Q / 0P), which is equal to one minus QP/0P.[1] If the input prices are known, represented by the line AA' in Figure 1, the allocative efficiency (AE), measured by the ratio of the distance between 0R/0Q, can be estimated. Lastly, the total economic efficiency (EE) of the DMU P can be calculated as the ratio of the distance between 0R and 0P, where the distance RP can be regarded as a possible cost. That is, the product of TE and AE becomes EE under input-oriented efficiency measures.

In DEA, for efficiency measures to have good discriminatory power among DMUs in the sample, the choice and the number of inputs, outputs, and the DMUs are very critical. It is important to include as many DMUs as possible to increase the probability of identifying perfectly

[1] The efficiency measure discussed here is an input-oriented measure. See Coelli, et al., (1998) for discussion of output-oriented measures and the variable returns to scare DEA models.

efficient DMUs that would determine the efficient production function. However, a large data set may include non-homogeneous DMUs whose efficiency measures may be impacted by other factors that are less relevant to other homogeneous DMUs in the sample (Golany & Roll 1989). To discriminatory power out of DEA models, extant studies suggest a minimum number of DMUs when estimating the efficiencies. The minimum number of DMUs is based on the number of inputs and outputs and the lower bound is determined by the multiple of the number of inputs and the number of outputs (Boussofiane, et al., 1991), twice the number of inputs and outputs (Golany & Roll, 1989), three times the number of inputs and outputs (Bowlin, 1998), and two times the products of the number of inputs and outputs (Dyson, et al., 2001). Given three inputs and three outputs, for example, the minimum number of DMUs ranges from nine (9) to eighteen (18). If there is not enough discriminatory power due to a relatively small sample size in DEA estimation, the model may reduce the number of inputs and outputs by eliminating highly correlated inputs and outputs, respectively.

III. Inputs and Outputs

Existing insurers' efficiency literature commonly uses three input categories; labor, capital, and materials and business services. The numbers of employees and sales force, when identifiable, are commonly used as labor input (Park & Park, 2015; Cummins, Weiss, & Zi, 1999; and Cummins & Zi, 1998). Equity capital and debt capital, as proxies for capital input, are commonly used (Cummins & Zi, 1998; Cummins et al., 1999; and Cummins, Tennyson, & Weiss, 1999). Insurers issue little or no corporate bonds or other forms of debt instruments to raise additional capital and the majority of their debts results from the unique cash flow timing related to risk pooling and bearing services. Insurers receive premiums in advance to pay for uncertain future losses. Once a loss is reported to an insurer, the insurer sets aside a reserve specific to the reported loss, and the reserve is used to pay for the loss when the loss is settled. In addition, insurers set aside reserves at the end of a financial statement reporting period for losses that are incurred but not reported (IBNR) to the insurer. These reserves are the largest debt to the insurer and the most important source of capital. The last input, business services, captures all aspects of insurers' business operations other than labor and capital expense and is commonly proxied by operating expenses (Greene and Segal, 2004).

Defining output for life insurers has been challenging and different measures have been used, including the nominal dollar value of premiums (Gardner & Grace, 1993), changes to reserves (Yungert, 1993), and the amount of insurance sold (Greene & Segal, 2004). One commonly accepted practice to measure outputs for financial institutions is based on the value-added approach, where any category having meaningful value added to an insurer is considered an important output. This approach identifies risk pooling and risk bearing, financial intermediation, and other real financial services to insureds as commonly appropriate outputs (Berger, et al., 1997; Cummins & Zi, 1998; Boonyasai, et.al., 2002; and Greene & Segal, 2004). The extent of risk pooling/bearing services is measured differently due to the timing gap between sales of policies and claims paid. That is, claims paid today are related to policies that were underwritten in the past.

Financial intermediation is associated with the extent of investment activities that result in liquidity creation/de-creation depending on the insurers' investment decisions and choices (Choi, et al., 2016). Extant studies have used either the amount of invested assets or investment income as a proxy for financial intermediation output (Cummins, et al., 2006 and Choi, et al., 2016).

Actual investment is a more appropriate proxy for financial intermediation than the investment income since the latter is a profit from a positive spread between the actual return and the return promised for various life insurance contracts, which is a price rather than output.

This study uses three input proxies; (1) sum of the number of employees and exclusive agents, (2) total assets, and (3) operating expenses, and three output proxies; (1) payments to insureds/claimants, (2) invested assets, and (3) total face value of new and reinstated policies and contacts.[2] While the amount of new and reinstated contracts accounts for risk pooling/bearing output for the current period, payments represent another aspect of risk pooling/bearing output as they are actual services provided to and on behalf of their insureds for policies and contracts sold in the past. In addition, a significant portion of payments is related to real financial services output as Korean insurers sell policies and contracts that pay dividends during the policy period and a predetermined lump-sum amount at maturity, which is not the refund of premiums.[3] Financial intermediation output is proxied by the amount of invested assets as is commonly done among extant studies.

IV. Data and Empirical Findings

This study uses annual financial statements filed by life insurance companies in Korea available from the Korea Life Insurance Association for the sample period of 2006 – 2017. The number of life insurers operating in Korea has increased from 22 in 2006 to 25 life insurers in 2017, resulting in a total of 284 annual observations.[4]

Table 2 shows the mean values of inputs and outputs by year. The average size measured by total assets of life insurers in Korea has grown by 2.7 times, from ₩12,415 billion KRW in 2006 to ₩33,313 billion KRW in 2017. Meantime, the average labor input, measured as the sum of the number of employees and exclusive agents, has decreased by almost 19 percent. This input decrease can be inferred from the increased role of CM and the relaxed regulation on agency establishment, which results in the transition of exclusive agents to independent agents. As of 2017, four life insurers do not use exclusive agents to market their products, including a pure internet-based Kyobo Lifeplanet Life Insurance that commenced its operation in 2013. Risk sharing and risk pooling output proxy variables show a mixed result. Total payments measured as the sum of incurred losses, payments at maturity, and dividends, have increased by 64 percent, while another proxy, the total face value of new and reinstated policies, has decreased by 23 percent from ₩16,495 billion KRW in 2006 to ₩12,787 billion KRW in 2017.

The average values of efficiency estimates and other inputs and outputs related variables are presented and compared in Table 3. The mean technical efficiency (TE) measures of Korean domiciled life insurers are higher than those of foreign life insurers under both scale assumptions. Although there have been variations during the sample periods, the overall efficiency has slowly decreased during the sample periods. One interesting observation to note is that the insurers' efficiency had improved a couple of years following the 2008 global financial crisis. One

[2] In addition to all general operational expenses, operating expenses include policy sales, services and maintenance related expenses as well.

[3] Park and Park (2015) also discuss this type of insurance products/contracts offered by Korean property and casualty insurers.

[4] The fiscal year for the Korean insurers is from April 1 to March 31 of the following year until 2013, which has changed to Jan. 1 to Dec. 31 from 2014. The list of life insurers studied in this study is presented in Appendix A with estimates of their efficiency measures by year during the sample period.

explanation can be found in Table 2, where the mean labor input has decreased by almost 18 percent from 2009 to 2011, while other inputs and outputs do not show such a reverse trend.

Table 2. Descriptive Statistics of Inputs and Outputs (₩billion in KRW except for Labor)[a]

		Inputs			Outputs		
Year	N	Total Assets	Operating Expenses	Labor (Person)	Total Payments	Invested Assets	New and Reinstated Policies
2006	22	12,415	197	7,108	1,276	8,735	16,493
2007	22	13,882	228	7,691	1,565	9,476	18,134
2008	22	14,924	231	9,043	1,615	10,071	18,241
2009	22	16,933	237	8,567	1,439	11,542	18,065
2010	23	18,115	245	7,486	1,346	12,463	15,440
2011	24	20,691	246	7,577	1,345	14,760	15,520
2012	24	23,743	300	7,648	1,654	17,269	17,661
2013	25	23,899	229	6,892	1,198	17,557	11,569
2014	25	26,483	322	6,290	1,716	19,689	15,793
2015	25	28,996	322	6,119	1,771	21,729	15,951
2016	25	31,286	333	6,122	1,903	23,702	14,625
2017	25	33,313	347	5,821	2,092	25,147	12,787

[a] Due to the change in the fiscal year, Year 2013 is for 9-month of operation between March 2013 and December 2013.

As shown in Table 3, Korean life insurers are on average more than 3 times larger than foreign life insurers, any t-test to compare the mean difference between them with nominal values is meaningless. Thus t-tests are done after all financial-related variables are standardized by total assets while labor-related variables are standardized by total payments. Foreign life insurers on average have relatively more *Operating Expenses* as standardized by total assets. In terms of labor, Korean life insurers hire relatively more employees per total payment, while both groups of insurers have similarly relied on exclusive agents to market their products. Among outputs, Korean life insurers have more financial intermediary activity, proxied by *Invested Assets*. Although the mean difference for the risk-bearing and pooling output, proxied by *Total Payments*, is statistically insignificant, two sub-components, *Incurred Losses* and *Dividends* are higher for Korean life insurers. The relative mean comparison of *New and Reinstated Policies* is higher for foreign insurers, suggesting that foreign insurers are aggressive to penetrate the life insurance market in Korea. This is consistent with KIRI (2019), which reports the steadily increasing market share by foreign insurers in Korea during the sample periods and this finding may explain the relatively higher operating expenses by foreign insurers.

Table 3. Mean Comparison between Foreign and Korean Life Insurers (₩billion in KRW except for Labor)

Variable	Foreign Life Insurers (n = 108)		Korean Life Insurers (n = 176)		t-test[a]
Technical Efficiency, CRS	0.755		0.895		***
Technical Efficiency, VRS	0.795		0.936		***
Inputs					
1. Total Asset	9,526.5		30,301.3		***
2. Labor (person)	3,569		9,354		
a. Exclusive Agents	2,991	83.8%	7,973	85.2%	
b. Employees	578	16.2%	1,380	14.8%	***
3. Operating Expenses	192.5		320,409		***F
Outputs					
1. Total Payments	639.5		2,162.2		
a. Incurred Losses	68.7	10.7%	386.7	17..59%	**
b. Payments at Maturity	568.1	88.8%	1,758.7	81.3%	
c. Dividends	2.7	0.4%	16.9	0.8%	***
2. New and Reinstated Policies	9,765.1		19,463.0		***F
a. New Policies	9,327.6	95.5%	18,942.4	97.3%	***F
b. Reinstated Policies	437.6	4.5%	520.7	2.7%	***F
3. Invested Assets	6,264.1		22,446.5		***

[a] *** denotes statistical significance at 1% and ** denotes statistical significance at 5%. F denotes that foreign life insurers have a larger standardized mean value. The mean difference tests for variables, except for efficiency measures and total assets, are performed after they are standardized by total assets for financial variables and standardized by total payments for labor variables.

To investigate how distribution methods to market insurance products affect the insurers' efficiency, technical efficiency estimates under the variable returns scale assumption from DEA are regressed on various distribution methods with other input variables as control variables. Results in Table 4 are regression estimates using a random effects model as supported by the Hausman test. The labor input, measured as the sum of the number of employees and exclusive agents, is positively significant, while the total assets, is negatively associated with technical efficiency estimates. This finding suggests that the larger the life insurers in Korea by capital, the less efficient, while the more labor, the more efficient. Between employees and exclusive agents, employees are found to be the driving force for the insurers' efficiency. This is expected as more and more insurers are incorporating cyber marketing and other direct marketing methods, which require significant investment in employee training and information technology on a firm level. The statistical insignificance of exclusive agents may explain the decreasing trend of the number of exclusive agents used by life insurers. However, it is beyond the scope of this study to investigate the causal relationship between them.

Table 5 shows the results of how different types of distribution methods are related to the insurer's technical efficiencies after controlling for two non-labor outputs and ownership. Consistent with the results shown in Table 4, new policies acquired by tele-marketing (T/M) and cyber marketing (C/M) are positively associated with insurers' efficiency, while the face-to-face

(F2F) method, which includes sales by exclusive agents, employees, and *Bancassurance*, is insignificant.

Table 4. Relationship of DEA Technical Efficiency Estimates with Inputs of Life Insurers in Korea, Random Effects Model[a] (Dependent variable is technical efficiency estimates under the variable returns to scale, n=284)

	Coefficient Estimates	Std. Error	Coefficient Estimates	Std. Error
Intercept	1.59423	0.1418***	1.65663	0.1410***
Total Assets	-0.04884	0.0117***	-0.05526	0.0119***
Operating Expenses	-0.01118	0.0159	-0.01078	0.0158
Labor	0.01879	0.0091**		
Employees			0.03130	0.0107***
Exclusive Agents			-0.00293	0.0066
Domiciled	0.08390	0.0359**	0.09416	0.0355***
Hausman Test	4.76 (Pr. > 0.3125)		5.33 (Pr. > 0.3769)	
R-Square	0.1581		0.1731	

[a] The right-hand side variables in the models are log values. *** denotes statistical significance at 1% and ** denotes statistical significance at 5%.

Table 5. Relationship of DEA Technical Efficiency Estimates with Distribution Methods of Life Insurers in Korea, Random Effects Model[a] (Dependent variable is technical efficiency estimates under the variable returns to scale, n=284)

	Coefficient Estimates	Std. Error	Coefficient Estimates	Std. Error
Intercept	1.69160	0.1438***	1.63092	0.1488***
Total Assets	-0.05015	0.0119***	-0.05043	0.0121***
Operating Expenses	-0.00449	0.0161	-0.00010	0.0166
New Policy by Face to Face	-0.00476	0.0035	-0.00331	0.0033
New Policy by Cyber Marketing	0.00563	0.0022***	0.00523	0.0022**
New Policy by Tele-Marketing, Total	0.00477	0.0025*		
New Policy by Tele-Marketing, Direct			0.00046	0.0046
New Policy by Tele-Marketing, Independent Agents			0.00479	0.0022**
New Policy by Tele-Marketing, H/S			0.00000	0.0020
Domiciled	0.09358	0.0362**	0.10047	0.0358***
Hausman Test	7.39 (Pr > 0.2864)		7.40 (Pr > 0.4940)	
R-Square	0.1768		0.1808	

[a] The right-hand side variables in the models are log values. [a] *** denotes statistical significance at 1%, ** denotes statistical significance at 5%, and * denotes statistical significance at 10%.

The result indicates that in a market with a well-established technology infrastructure as in the Korean market, e-commerce for financial service products can be as efficiently and effectively marketed as they have been done through personal selling.

V. Conclusions

This paper measures the estimates of technical efficiencies of all life insurers in Korea using data envelopment analysis (DEA) with three inputs and three outputs during the sample period of 2006 – 2017. The Korean insurance market is a good candidate to study the relationship between various distribution systems and the efficiency of life insurers for three reasons. First, Korean regulators have collected rich and extensive distribution-related data and made them publicly available. Second, the life insurance market has gone through significant changes since the late 1990s and various competing distribution systems, both personal and non-personal distribution systems, have been utilized by life insurers. Third, the Korean life insurance market is competitive and open with full of innovation, even to global insurers. In addition, artificial intelligence has more deeply integrated into the industry, and insurers have positioned themselves to respond to the changing business landscape.

This study documents evidence to support the importance of personal selling in insurance sales and efficiency, but non-traditional personal selling, such as *Bancassurance*, has accounted for more sales. In addition, insurers' reliance on traditionally dominating exclusive agents has continually decreased because insurers' operational efficiency by exclusive agents does not seem to improve, if not deteriorate. Using a random effects model, this study finds that labor input, especially employees rather than exclusive agents, is statistically positively significant while capital input is statistically negatively significant to life insurers' efficiency in Korea. Among distribution systems, cyber marketing and tele-marketing are statistically positively significant to the technical efficiency of life insurers in Korea, even after controlling for other inputs used in DEA and ownership of life insurers.

The findings of this study extend some important operational implications to life insurers and regulators. In light of the increasing cost of the exclusive agency and the increasing role of *Bancassurance* and cyber marketing, life insurers should strive to increase their operational efficiency by reevaluating and restructuring their distribution channels, particularly with cyber marketing, tele-marketing, and *Bancassurance*. f

The present study, being of an exploratory and empirical nature, identifies a couple of opportunities for future research, which will be necessary to refine and further elaborate the findings of this study. First, although this study reports the significant efficiency difference between domestic and foreign life insurers in Korea, very little can be said of the key drivers for the difference as it is beyond the scope and motivation of this study. A study in search of key drivers to better understand the efficiency difference can be of interest to insurers who plan to expand their operations into the emerging markets such as the Korean market. Second, the study can be extended into other emerging markets to investigate any efficiency difference by ownership as shown in Korea.

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Appendix A.

List of Life Insurers in Korea and Summary Statistics of Technical Efficiency Estimates

Panel A: Foreign Life Insurers[a]							
		Constant Returns Scale			Variable Returns Scale		
Insurer	N[b]	TE	Min	Max	TE	Min	Max
AIA	12	0.931	0.853	1.000	0.944	0.853	1.000
ABL	12	0.923	0.832	1.000	0.928	0.832	1.000
BNP	12	0.994	0.925	1.000	1.000	1.000	1.000
Chubb	12	0.635	0.554	0.736	0.826	0.565	1.000
ING	12	0.775	0.702	0.861	0.790	0.703	0.897
Lina	12	1.000	1.000	1.000	1.000	1.000	1.000
MetLife	12	0.439	0.395	0.482	0.446	0.404	0.517
PCA	12	0.258	0.212	0.353	0.355	0.233	0.517
Prudential	12	0.879	0.808	1.000	0.900	0.808	1.000
Panel B: Korean Life Insurers							
		Constant Returns Scale			Variable Returns Scale		
Insurer	N	TE	Min	Max	TE	Min	Max
DongBu	12	0.873	0.771	1.000	0.885	0.771	1.000
DGB	12	0.943	0.776	1.000	0.996	0.971	1.000
DongYang	12	0.941	0.824	1.000	0.951	0.845	1.000
HanHwa	12	0.860	0.735	1.000	0.942	0.831	1.000
Hana	12	0.723	0.457	0.967	0.915	0.664	1.000
HeungKuk	12	0.939	0.825	1.000	0.955	0.841	1.000
Hyundai[c]	12	0.873	0.548	1.000	0.887	0.549	1.000
IBK	8	1.000	1.000	1.000	1.000	1.000	1.000
KB	12	0.993	0.913	1.000	1.000	0.995	1.000
KBLP	5	0.807	0.131	1.000	1.000	1.000	1.000
KDB	12	0.944	0.891	1.000	0.947	0.895	1.000
KyoBo	12	0.881	0.788	1.000	0.963	0.893	1.000
Mirae	12	0.668	0.577	0.791	0.680	0.580	0.803
NongHyup	7	1.000	1.000	1.000	1.000	1.000	1.000
SamSung	12	0.978	0.848	1.000	1.000	1.000	1.000
ShinHan	12	0.886	0.806	0.989	0.911	0.806	1.000

[a] Foreign-owned life insurers in Korea started as either Korean owned or joint venture and was later acquired by foreign capital.

[b] N represents the number of years in business, regardless of ownership change, during the sample period between 2006 and 2017.

[c] Taiwan's Fubon Life Insurance became the largest shareholder through a paid-in capital increase and changed its name to Fubon Hyundai Life Insurance in September 2018.