A Multi-Line Insurance Fraud Recognition System: A Government-Led Approach in Korea

Hunsoo Kim
W. Jean Kwon

Abstract

This article introduces a government-led insurance fraud detection program in Korea. The Insurance Fraud Recognition System (IFRS) uses policy and claims data from multi-lines of insurance (life, automobile, and fire), employs a three-stage statistical and link analysis to identify presumably fraudulent claims by claimant or by group, and generates system reports that the government regulator draws on to make decisions. The authors evaluate the system based on the fraud statistics and IFRS results for 2004, and offer recommendations for system improvement. This article examines existing studies about fraud, industry experiments using advanced technology, and government assistance to the insurance industry's fight against fraud in selected countries. It also provides a brief overview of the Korean insurance market, especially after the recent Asian economic crisis.

Introduction

Every valid insurance contract requires the presence of insurable interest. Without this requisite, unethical persons and entities would use the insurance mechanism to support their gambling activity rather than to protect their wealth against future losses, and insurers would face extreme difficulty in estimating their contractual liabilities to policyholders. Controlling problems of moral hazard with this requisite is a means of keeping the cost of insurance at a reasonable level. However, use of this passive approach alone does not guarantee operational and financial soundness of the insurance mechanism. Insurers need to employ active approaches to identify genuine claims and expedite services for those claims, while deterring people from filing false or inflated claims. Detecting such claims is equally important.

The term "fraud" in the insurance industry is broadly used to refer to false or inflated claims. To be precise, fraud refers to an act that a person or entity, individually or jointly, willfully commits to obtain a monetary gain from an insurer by knowingly presenting false evidence of economic loss.[1] The evidence can be false in its entirety, thus making the act an attempt of "hard fraud," or false in part (e.g., inflating the actual loss amount), thus making it an attempt of "soft fraud." These types of deliberate and intentional acts, when not prevented or captured, increase the cost of insurance.

Ex ante elimination of fraudulency in the insurance market is feasible only in theory, as it literally means a complete control of moral hazard in the market. Instead, we tend to employ *ex post* approaches that can effectively deter unethical persons' attempts to gain financially by ill-using the insurance mechanism, or penalize the deceit. These approaches often require coordination of efforts by three parties. First, the insurance industry must develop a market environment where genuine claims are honored. It can do so by furthering the clarity of the terms and conditions in insurance contracts and by maintaining effective claims management programs. The government can help the industry by reforming the legal environment so that insurance fraud is a crime without exception. The academician can offer the research support for the development and enhancement of fraud deterrence or detection programs. We discuss these tripartite efforts in the section below.

Academic Research

Numerous researchers, some in academia and others in the industry, have, since the early 1980s, examined and proposed solutions to problems of moral hazard (and fraud in particular) in the insurance market. Notable studies include, but are not limited to, examination of how the presence of insurance affects the possibilities of fraud (Dionne, 1984), perception of fraud by the insurer and by the insured in eight countries (Clark, 1990), behavioral factors and lottery conditions under the no-fault automobile insurance system (Derrig, Weisberg, and Chen, 1994), workers' compensation insurance fraud (Butler, Durbin, and Helvacian, 1996), the theoretically fraud-inducing economic environment (Boyer, 2000), claims auditing as a means to deter and detect fraud in automobile insurance (Tennyson and Salsas-Forn, 2002), use of general damage awards by insurers to reduce fraudulent claims (Loughran, 2005), and the relationship between coinsurance and fraud frequency in the healthcare industry (Sulzle and Wambach, 2005). Several studies also look into ethics in the insurance market (e.g., Tennyson, 1997, 2002; Dean, 2002).

These and many other studies provide the insurance industry with a better understanding of behavioral aspects of insureds and claimants, particularly their inclination to maximize monetary benefits from third-party financiers of insured losses. However, provision of theoretical foundations or empirical findings about this type of financial motive alone seems insufficient for insurers to contain the cost of fraud. A rise in the consumption of insurance as well as ever more complex economic and legal systems in modern society calls for effective and practical programs that insurers can use not only to weed out fraudulent claims but also to expedite services for *bona fide* claims.

---

[1] Derrig and Krauss (1994) and Derrig (2002) include "criminality" in the definition, However, not all governments treat insurance fraud as a criminal act.

The changing environment in the insurance market, along with the advance of information technology, has led to the development of database-, data mining-, and other artificial intelligence-based models. For example, a series of articles apply fuzzy set theory to insurance (e.g., Cummins and Derrig, 1993; Derrig and Ostaszewski, 1995) to tackle problems of territorial classification errors and fraud in automobile insurance.

Brockett and Xiao (1998) propose Kohonen Self-Organizing Feature Mapping as an approach to classify automobile injury claims by the degree of fraud suspicion, thus overcoming problems related to cluster analysis (i.e., being able to identify groups presenting strongly suspicious insurance claims). The authors find this neural network approach produces better results than claims adjusters' or investigators' assessments. Brockett et al. (2002) also suggest use of principal component analysis, particularly a nonparametric PRDIT, to simultaneously detect the statistical importance of the individual fraud indicator and the fraud suspicion level of the individual claim.

Artis, Ayuso, and Guillén (1999) use discrete choice models to estimate the presence of fraud in claims, subject to previous knowledge of insureds' behaviors in the Spanish insurance market. In a later study Artis, Ayuso, and Guillén (2002) find a significant portion of the claims that were previously classified as legitimate contain omission errors, and thus are likely to be fraudulent. These two studies are followed by Caudill, Ayuso, and Guillén (2005) who find that a multinomial logit model can be used to identify misclassified claims.

Industry Experiment

Insurers have also developed systematic approaches to detect fraud and thus to contain their loss experience. Such a development has become possible with the recent advancement in information technology (e.g., data storage and processing), applied statistics, and artificial intelligence.

Examples of firm-specific approaches include one by MetLife Auto & Home (USA). It provides field investigators with the information obtained from data mining of MetLife's own claims data for two years. The information helps the firm catch policyholders attempting to evade premiums by providing the insurer with false or not completely accurate information. The Electronic Fraud Detection (EFD) of the Travelers Insurance Companies (USA) for pre-investigative analysis of healthcare provider fraud is another example. This knowledge-based technique first integrates expert knowledge with statistical data assessment to identify cases of atypical behaviors of healthcare providers, followed by a second-stage process of frontier identification and synthesis for the development of new rules and improvement of the fraud identification process (see Major and Riedinger, 2002). In Europe, Halifax General Insurance (UK), Allianz (Germany), and Zurich Financial Services (Switzerland) use or are considering using voice stress analysis software to detect fraud. This Nemesysco software analyzes abnormalities in the sound frequency of the caller's voice; of course, some are concerned about the accuracy, thus the validity, of this software.

Some of the approaches may be used by an individual insurance company. Similar efforts are observed at the industry association level. For example, Coalition Against Insurance Fraud (CAIF) functions as an anti-fraud watchdog. National Insurance Crime Bureau (NICB) assists supporting insurers and law enforcement agencies in their fight against

insurance crimes. There exist professional associations (e.g., National Society for Professional Insurance Investigators, National Health Care Anti-Fraud Association, and National Coalition for the Prevention of Economic Crime) and information providers (e.g., Insurance Information Institute and Insurance Services Office) concerned with fraud. Also found are international societies such as International Association of Special Investigation Units, International Association of Insurance Fraud Agencies, and International Association of Auto Theft Investigators. The Venezuelan Insurance Association works with the Insurance Services Office (USA) for the operation of a localized ISO ClaimSearch system, success of which requires gathering 50 percent of the nation's claims data.

The Association of British Insurers (ABI) has, since early 2005, worked to interlink databases and data mining systems of participating U.K. insurance companies. It has also negotiated a national agreement for the prompt transfer of information between insurers and law enforcement agencies. The Insurance Council of Australia (ICA) is attempting to adopt a similar system in the country (Insurance Australia Group, 2004). Comparable activities in other European countries include *Bureau Répartiteur* (centralization of fraudulent claims files provided by participating life insurers) in Belgium, ALFA (a claims database management and inter-insurer message system) in France, and ZIS (central information system) in Switzerland and Finland.

Government Support

Support at the government and supranational levels exist. The International Association of Insurance Supervisors (2003) has adopted a core principle (ICP 27), which prescribes that, "The supervisory authority requires that insurers and intermediaries take the necessary measures to prevent, detect and remedy insurance fraud." The principle adds that, among others, committing fraud is a criminal offense. The insurance firm is required to allocate its resources to systematically fight fraud; and insurance regulators are to coordinate their efforts to counter fraud. Nevertheless, no regional or global level of *de facto* cooperation among insurance regulators in line with this principle is currently observed. This implies that insurance crime prevention programs remain at the local level, if not at the firm level, in most jurisdictions.[2] Indeed, the OECD (2004) points out that there is "very little comparative information at the international level," and encourages use of fraud prevention and detection programs at the firm and government levels. We summarize such programs found in selected countries, beginning with the United States.

U.S. insurance regulators coordinate their fight against insurance fraud by jointly introducing model laws at the NAIC level; by requiring insurers to submit an anti-fraud plan, to maintain a special investigation unit, or both; or by conducting fraud investigation at the government level. Housed commonly within the state's department for insurance regulation, insurance fraud bureaus, for example, investigate fraud cases based primarily on referrals from insurers, consumers, and other government and law enforcement agencies. These bureaus in aggregate presented 4,810 cases—about one out of four cases investigated—for prosecution. On average, two of three cases presented for prosecution

---

[2] The European Union established the European Anti-Fraud Office (OLAF) in 1999. However, the office focuses more on the detection and monitoring of fraud in the customs field, misappropriation of subsidies and tax evasion, and the protection of the financial interests in the broader European community than within the EU insurance market.

end up with convictions. Many of the insurance fraud bureaus seem to share a major concern—shortage of manpower, budget, and technology (Coalition Against Insurance Fraud, 2002). Lack of full-level coordination and management of insurance claims data between state governments and between the bureau and the local industry is probably another unvoiced concern.

Anti-fraud programs are found at the U.S. federal government level. For instance the Risk Management Agency of the U.S. Department of Agriculture launched in 2000, a predictive analytical program to fight fraud in crop insurance. This effort, made jointly with a local university, has resulted in finding evidence of fraudulent claims amounting to $250 million during the first three years. The U.S. Department of Justice, particularly the Federal Bureau of Investigation, operates the Criminal Investigation Division to detect and prosecute insurance-related economic criminal activities.

In Japan, nonlife insurers seem to be depending on a centralized registration system merely as a reference point for policy renewal or claim processing, an information exchange group known as the Nonlife Insurance Crime Prevention Council, and cooperation with the National Policy Agency to reduce fraud in the market. Other Asian governments, except that of Korea, seem relatively less active in implementing insurance fraud prevention or detection programs.

As summarized above, academics and researchers offer theoretical foundations and empirical support for the identification and detection of fraudulent claims. However, practicality and prediction accuracy of the models remain as key issues. Implementation of anti-fraud programs by several insurance firms, alone or in conjunction with an industry association, has often helped them prevent fraudulent activities and detect fraud by policyholders or other culprits. Nonetheless, this firm- or industry-specific approach may fail to capture fraud or fraud attempts across lines of insurance. Government support in selected countries furthers the firms' and the industry's fight against fraud. Nevertheless, no governments apparently attempt to play the role of leader in the war against fraud.

All parties are aware of the need for more collaboration in developing a systematic and universal approach to fully centralizing claims database management and fraud detection programs for the country. All being equal, we can reasonably assume that the fuller the database, the more reliable the statistical findings, and that the wider the scope of the database (e.g., covering multi-lines of insurance), the more effective would be the fraud detection system. Despite the potential merit of a more widely developed program, no industry associations or governments have adopted such a program. The reasons are multifold. It would require a centralized portal for data collection, management, and analysis; participation of all insurance services providers in both private and public sectors (as governments tend to be providers of select insurance programs); and complete coordination between the database administrator and the law enforcement agency. Concerns about data security and possible invasion of privacy rights under the centralized program are another issue in most countries.

One program close to this more developed approach is found in Korea. Known as the Insurance Fraud Recognition System (IFRS), it has several unique characteristics in administration and in its analytical approach. In the remainder of this article, the authors offer a synopsis of the Korean insurance market, describe the IFRS, and evaluate the system.

THE KOREAN INSURANCE MARKET

Korea, an OECD member state, maintains the world's eighth largest insurance market in terms of premium.[3] Specifically, the life insurance market generated premiums amounting to $48.7 billion (ranked seventh in the global market) in 2004. This translates into an insurance density of $1,007, or a penetration ratio of 6.75. The premiums written in the nonlife insurance market during the same year was $19.9 billion (ranked eleventh), which can be translated into an insurance density of $412, or a penetration ratio of 2.25.

Personal insurance dominates the life insurance market, leaving group insurance with only 11 percent of the market's share in terms of premiums. More specifically, policies offering protection against death generated 49 percent of the premiums in the life insurance market, endowment-type policies 16 percent, and savings-oriented policies 24 percent, all as of the year-end of 2004 (KIDI, 2006).

Automobile insurance (see Box 1) and long-term insurance dominate the nonlife insurance market.[4] They contributed to 36.7 percent and 41.4 percent, respectively, of the premiums written in the market in 2004 (KIDI, 2006). General liability insurance, which includes voluntary workplace injury coverage in excess of government-mandated workers' compensation insurance, shares 9.1 percent of the nonlife insurance market. In terms of premium volume, the public workers' compensation insurance program in which almost all employers must participate is about one-tenth the size of the nonlife insurance market.

In the past, the Korean government protected a small number of then incumbent insurers from entries of new players, whether domestic or foreign. The gradual removal of entry barriers beginning in 1986 has resulted in a rise in the number of insurance firms in the country. The number of life insurers jumped from six in 1986 to thirty-three in 1992. However, some went into run off, especially after the Asian economic crisis, and some foreign insurers left the country. Currently, there are twenty-three life insurers including nine foreign firms. The number of nonlife insurers rose from eleven in 1986 to twenty-one—including six non-domestic firms—in 2006.

Insurance Fraud in Korea

It is probably safe to state that neither the government nor the insurance industry paid close attention to the issue of insurance fraud until the Asian economic crisis. Until then, only a handful of large insurers ran in-house special investigation units; thus there was no active data exchange or integration of data among insurers or with government agencies. There were government policies and notices permitting information exchange among insurers, but none of these were known to be effective in fighting insurance fraud. Industry associations also had committees or crime prevention arms, which targeted a specific line of business (e.g., automobile insurance).

The Asian economic crisis caused a near-perpendicular depreciation of the currency (Korean Won), economic uncertainty (e.g., surging interest rates and unemployment),

---

[3] The insurance data in this section are based on Swiss Re (2005).

[4] Long-term insurance refers to savings-type nonlife insurance policies (e.g., fire, accident, and automobile insurance) covering bodily injury and property damage for at least three years. This type of insurance is also found in Japan.

Box 1
Automobile Insurance in Korea

Automobile insurance coverage in Korea is available in two layers. The lower layer is compulsory liability insurance that all motorists must maintain. As of May 2006, the limit of this third-party coverage is 20 million Korean Won (US$1 ≈ 1,000 Won) for bodily injury (100 million Won for death) and 10 million Won for property damage.

Motorists may opt to purchase voluntary insurance. This coverage offers an additional layer of liability coverage as well as first-party coverage. More specifically, the insured may opt to purchase an unlimited amount of coverage for third-party bodily injury, and an excess coverage up to 100 million Won for third-party property damage. He or she may also purchase uninsured/underinsured motorist insurance coverage.

This voluntary insurance also includes an optional coverage for first-party bodily injury and property damage. The bodily injury coverage indemnifies the insured for medical expenses in addition to providing a disability benefit and, if applicable, death benefit, when the insured suffers from an accident at his or her fault. The property damage coverage promises to repair the insured vehicle or indemnify the insured for up to the market value of the vehicle at the time of the accident.

In Korea, medical coverage under automobile insurance is primary to the national health insurance plan. Further, the coverage scope and limits under the typical automobile insurance policy are commonly broader and higher, respectively, than under the national health insurance plan. Not surprisingly, insureds and healthcare providers show preference of medical coverage under automobile insurance to one under the national healthcare plan. Insurers currently attempt to synchronize the scopes and limits between these two types of insurance programs.

---

and societal insecurity. During this period of crisis, some people under severe financial distress inflicted self-injury or caused damage to their property in an attempt to gain illegally from insurance. Widespread news about such mishaps not only indicated a societal issue but also alerted the insurance industry.

The then Insurance Supervisory Board, which merged with the banking and investment industry regulators into the Financial Supervisory Service (FSS), responded to this problem of moral hazard by creating the Insurance Fraud Investigation Division within the FSS in 1999. The Korean Nonlife Insurance Association began in 2000 to actively utilize its Insurance Fraud Crime Center. The association also began to offer its member insurers online information services, for example, provision of supplementary data for cases of insurance claims with a coverage amount exceeding an arbitrary threshold such as 100 million Won. The Korea Insurance Development Institute, an insurance rate advisory and think tank institution, created a large insurance accident database using its own infrastructure. Nonetheless, these initiatives were fragmented and incomplete.

Finally, the FSS decided to create a nationwide insurance fraud database and a fraud detection system, now known as the Insurance Fraud Recognition System. The prototype of the system was introduced in March 2003, and the final version was introduced in January 2004. The FSS is in charge of administering the system.

INSURANCE FRAUD RECOGNITION SYSTEM (IFRS)

All parties with interest in insurance were aware of the need for a nationwide anti-fraud database even before the introduction of the IFRS. However, insurance companies, especially large ones, and industry associations wanted to protect their proprietary data and turfs. Some of them indicated an intention to develop their own systems. Only the Korean Nonlife Insurance Association and the Korea Insurance Development Institute did so but these failed to capture the attention of all interested parties.

FIGURE 1
The Five Stage Approach of the Insurance Fraud Recognition System (IFRS)

Database Generation	Analysis 1 (Statistical)	Analysis 2 (Expansive)	Analysis 3 (Link Analysis)	Report Generation
Data Collection and database creation for statistical, expansive, and link analysis	Fraud Index (FI) calculation - Multi-claimant Analysis - Conventional Analysis - Target-specific Analysis	Expansive analysis for claim trait identification - Claimants - Agents - Healthcare providers - Auto repair shops	Generation of links based on suspects found in Analyses 1 & 2 - Individual approach - Group (ring) approach	Suspect determination Report generation Request for formal investigation by law enforcement

With the IFRS, the industry has a near-complete database, and the government is able to more effectively fight fraud. The IFRS uses claims data and attached policy information submitted by life and nonlife insurers. Using the data, the system generates fraud index scores, which are then used for expansive analysis and link analysis. At the final stage, the IFRS produces fraud reports. Based on these the insurance regulator may request a formal investigation of insurance fraud suspects by the law enforcement agency. Figure 1 depicts the IFRS approach, which we further describe below.

Database Generation

The FSS administers a multi-line based IFRS database. It contains: (1) policy and claims information of policies for protection-type products in life insurance and for accident and illness products in nonlife insurance; (2) claims filing, accident investigation, claims reimbursement (or payment request) data for bodily injury and vehicle repair, and related insurance policy information in automobile insurance; and (3) claims filing and investigation data in fire insurance. All life and nonlife insurers in Korea are required to submit their claims data for policies covering losses against property damage, bodily injury (caused by illness or accident), disability, or death.[5]
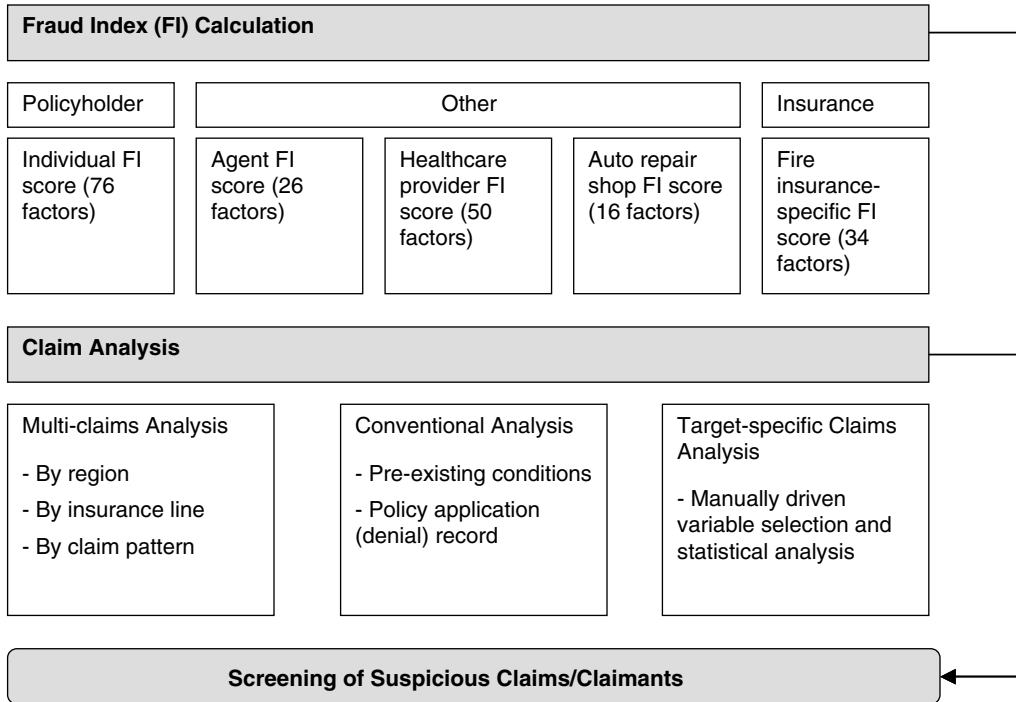
The IFRS database is thus multi-line, and covers all claims in the aforementioned lines filed on or after January 1, 1998. The FSS receives data via the Internet on a monthly basis. As of March 2006, the FSS gathered data for 100 million policies and 189 million claims.

---

[5] Nonparticipating insurers are quasi-private insurers (e.g., the National Post Office and agricultural cooperatives). Data from the providers of social insurance (national pension scheme, national health insurance, unemployment insurance, and industrial accident compensation insurance) are not collected. Neither quasi-private insurers nor social insurance providers are subject to FSS regulation or supervision.

FIGURE 2
Analysis I (Statistical)

Fraud Index (FI) Calculation

Policyholder	Other			Insurance
Individual FI score (76 factors)	Agent FI score (26 factors)	Healthcare provider FI score (50 factors)	Auto repair shop FI score (16 factors)	Fire insurance-specific FI score (34 factors)

Claim Analysis

Multi-claims Analysis	Conventional Analysis	Target-specific Claims Analysis
- By region - By insurance line - By claim pattern	- Pre-existing conditions - Policy application (denial) record	- Manually driven variable selection and statistical analysis

Screening of Suspicious Claims/Claimants

Analysis I (Statistical Analysis)

On receiving new claims-filing data, the IFRS conducts a series of analyses. The first is a statistical analysis designed to identify fraud suspects. The system uses two specific approaches for this analysis:

- **Fraud Index Analysis.** Based on the recommendations made by a working committee, the FSS has identified 202 Fraud Index (FI) factors that may affect the frequency or severity of fraudulent claims.[6] Each FI carries a weight.[7] As shown in Figure 2, the system calculates FI scores for five categories: policyholder/claimants, agents, healthcare providers, auto repair shops, and fire insurance. It uses seventy-six factors to measure an FI in the policyholder/claimant category. The seventy-six factors are divided further into ten factors related to insurance policies, fourty-one to the nature and cause of loss, eight to medical services, and seventeen to claims filing information.

  Additionally, the IFRS uses twenty-six factors to calculate the FI of the agent (e.g., agent-specific loss ratio), fifty factors for the healthcare provider, and sixteen for

---

[6] The working committee comprising industry experts concluded that healthcare providers, auto repair shops, or both, often played an essential role for organized ring-type fraud. The committee also found evidence that several insurance agents masterminded hard fraud.

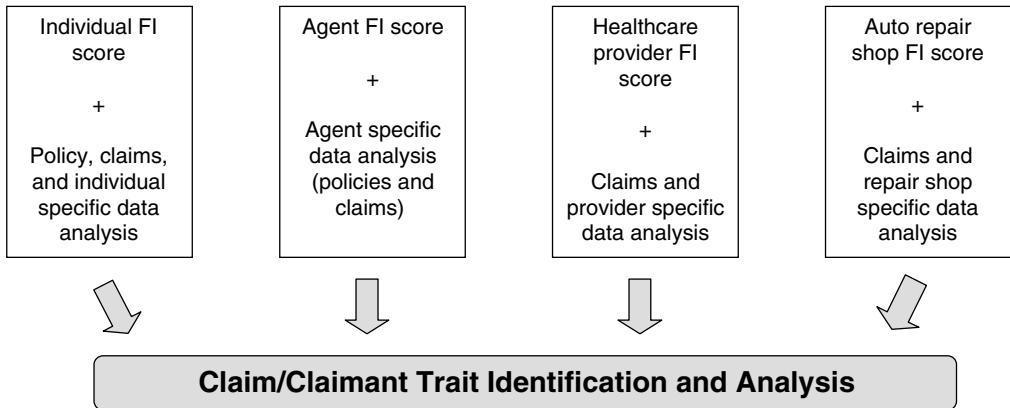[7] Details of FI factors and their weights are not made public.

TABLE 1
IFRS Fraud Index Categories and Examples (as of July 2005)

Category	FI Factors (Selected)	Maximum FI Score
Policyholder/ Claimant	Contract basis (10 factors) including: • Multiple insurance policies for a similar risk • Multiple policies issued around a specific date Accident basis (41 factors) including: • Accident occurred soon after policy inception • Accident late at night or without a witness Medical treatment basis (8 factors) including: • Minor injury with long hospitalization period • Disability diagnosis for nonserious injury Claim basis (17 factors) including: • Lawyer or claims adjuster involved • Insurance proceeds concentrated on a particular beneficiary or beneficiaries	450
Agent	26 factors including: • Solicitation of policy to applicants who were rejected by other insurers • High loss ratios	200
Healthcare Provider	50 factors including: • Long hospitalization period • High ratio of automobile accident patients	200
Auto Repair Shop	16 factors including: • Record of submission of repair costs far exceeding the usual range	200
Fire Insurance Only	34 factors including: • Building with employee dormitory but no one at the facilities at the time of accident	300

Source: FSS (2005).

the auto repair shop. When applicable, the IFRS uses thirty-four factors related to fire insurance claims. See Table 1.

The IFRS assigns up to 450 scores for the sum of the factors reflecting the suspiciousness of the individual, 200 scores each for the agent, the healthcare provider, and the auto repair shop, and 300 for fire insurance. The pattern of insurance fraud changes constantly, and fraud suspects may migrate from one area to another. As such, the FSS regularly reviews FI factors and updates them as and when necessary. The system adds all FI scores, and provisionally classifies all claimants with a score greater than the system's threshold as suspects.

Analysis II (Expansive)

Individual FI score	Agent FI score	Healthcare provider FI score	Auto repair shop FI score
+	+	+	+
Policy, claims, and individual specific data analysis	Agent specific data analysis (policies and claims)	Claims and provider specific data analysis	Claims and repair shop specific data analysis

⇩　　　⇩　　　⇩　　　⇩

Claim/Claimant Trait Identification and Analysis

- **Claims Analysis.** In this approach, the system uses the findings of the three following analyses to identify suspects: (1) multi-claim analysis by insurance line and territory, supported by historical data about automobile and other accidents; (2) conventional analysis including examination of policy application (denial) records for, say, cancer or critical illness coverage as well as diagnoses of pre-existing conditions; and (3) target-specific analysis, which permits the FSS staff to select certain fraud indices or enter customized commands. See Figure 2.

Analysis II (Expansive Analysis)

Members of the Insurance Fraud Investigation Division use the findings from Analysis I to widen the scope of investigation. The analysis begins with close examination of the individual suspect based on the person's FI, insurance policy information, and accident report. They further the examination process with a detailed analysis of FI scores and Claims Analysis findings about the agent, the healthcare provider, and the auto repair shop. The main objectives of Analysis II are to find and confirm traits of the suspects and unique characteristics of the claims, and to build the basis for link analysis. See Figure 3.
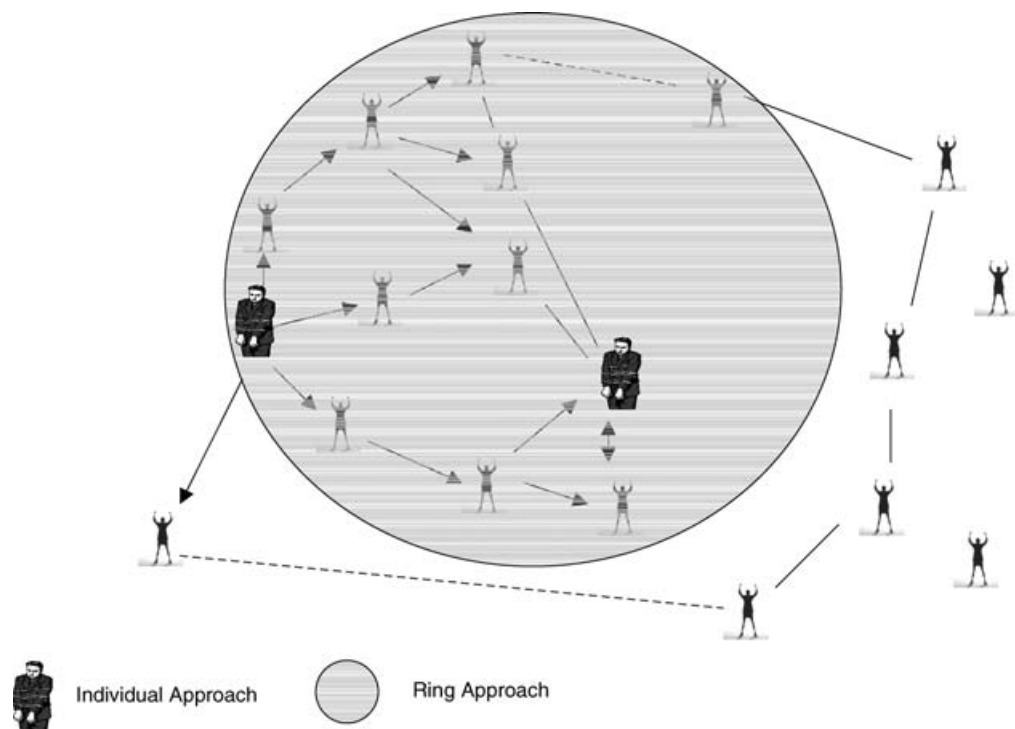
Analysis III (Link Analysis)

Organized crime rings often disguise their activities behind many seemingly innocent parties. Manually exposing these hidden relationships, thus revealing the nefarious activity, is not only difficult but also very time consuming. Link analysis can shorten investigation time. Link analysis here refers to a statistical, artificial intelligence technique that reveals and visually exposes complex patterns of association between entities in any number or type of data sources.[8] Results of the analysis are usually displayed as a picture of linked objects, with the links supporting various object manipulation and crime ring operations. The visual output of link analysis enables investigators to better understand the hidden structure of investigated data. Link analysis

---

[8] For more detailed discussion of link analysis, see American Association for Artificial Intelligence (1998), and Wasserman, et al. (1999).

FIGURE 4
Illustration of Link Analysis

has been extensively utilized by law enforcement agencies to track criminal activities (e.g., money laundering) and terrorism activities. Several insurance companies have also used, albeit limitedly in scope, their own link analysis programs to detect insurance fraud.

The IFRS version of link analysis is broad in scope, and creates links using findings from two detection approaches (see Figure 4). The first approach begins with one individual suspect, and it involves analyzing data about the suspect and other parties involved in insurance claims to check for the presence of one or more potential accomplices. The system then links the suspect with all accomplices and each accomplice with other suspects.

The other, closely related approach is based initially on the sum of FI scores of all suspected groups (e.g., groups of claimants with an FI score greater than 3,500), followed by the creation of links among all members of the group.

Decision Making and Report Generation

At this final stage, the IFRS produces reports for an individual suspect or for a group of suspects. The system also permits the FSS staff to produce target-specific reports manually. Then, the FSS makes a financial decision with the assistance of the special investigation units (SIUs) of insurance companies from whom bogus policies were issued

TABLE 2

Best Practices Compliance Survey in 2005 (Twelve Life Insurers and Sixteen Nonlife Insurers)

Check Points	Total	Life	Nonlife
Company's grand strategy to fight fraud	23	10	13
Integrated firm structure to monitor fraud control activities	12	2	10
Special investigation unit (SIU)	18	7	11
Fraud report hotline	23	10	13
Internal guideline (or policy) to deter fraud	17	4	13
Internal manual to deter fraud	19	6	13
Regular training for SIU staff	22	9	13
Fraud red flagging (or index) system	17	9	8
Automatic fraud recognition system	7	5	2
Anti-fraud best employee award	22	11	11
Fraud investigation expert committee	7	2	5
Anti-fraud promotion effort	18	6	12
Feedback system for fraud case	20	8	12

Source: KIDI (2005).

or to which fraudulent claims were filed. For instance, the SIU staff may provide the FSS with the credit history of the suspects or findings from their own internal examination. They may also assist the FSS in lodging requests for formal investigation by the law enforcement agency.

EVALUATION OF THE IFRS

The Insurance Fraud Recognition System (IFRS) of Korea is unique in several aspects. It is probably the first systematic approach to detect fraud using a multi-line insurance database. It is a government-led, industry participation-mandated approach. Use of link analysis on top of a series of statistical analyses also evidences the uniqueness of the system.

In addition to the management of the IFRS, the Korean regulator advises insurance companies to increase their efforts to fight fraud. Specifically in 2002, it introduced *Insurance Fraud Preparedness Best Practices*. This guideline consists of thirteen checkpoints that the regulator uses to survey insurers' preparedness. See Table 2 for a summary of the survey results for 2005.[9]

Table 3 shows yearly changes in the number and amount of insurance fraud detected between 1997 and 2005. Examination of the changes by market (life and nonlife) or by the entire industry shows a significant increase in the fraud cases detected since the

---

[9] The regulator also uses the results of this survey as part of the assessment basis for the broader *Overall Business Evaluation of Insurance Companies*.

TABLE 3

Insurance Fraud in Korea: 1997–2005

		1997	1998	1999	2000	2001	2002	2003	2004	2005
Life	Number	15	72	193	104	148	84	638	869	1,630
	Amount*	4,819	5,603	9,529	6,165	4,817	5,728	7,619	26,492	34,751
	Average/Case*	321.3	77.8	49.4	59.3	32.5	68.2	11.9	30.5	21.3
Nonlife	Number	1,936	2,612	3,683	4,622	5,601	5,673	8,677	15,644	21,977
	Amount*	20,516	23,983	34,744	25,256	35,623	35,404	52,986	102,547	145,447
	Average/Case*	10.60	9.18	9.4	5.5	6.4	6.2	6.1	6.6	6.6
Total	Number	1,951	2,684	3,876	4,726	5,749	5,757	9,315	16,513	23,607
	Amount*	25,335	29,587	4,4273	31,421	40,440	41,132	60,605	129,039	180,198
	Average/Case*	12.99	11.02	11.4	6.6	7.0	7.1	6.5	7.8	7.6

*In Korean million Won (= US$1,000)

Source: FSS.

TABLE 4

Distribution of Insurance Fraud Investigation Results

	Pre-IFRS Period				Post-IFRS Period		
Year	1999	2000	2001	2002	2003	2004	2005
Indictment	59.4	69.5	63.9	65.6	70.7	67.8	78.0
Tracing suspects	12.5	11.3	8.3	9.9	9.9	8.4	5.2
Under investigation	7.3	4.0	2.7	8.2	0.8	1.9	7.7
Charge dropped	19.8	14.6	16.9	15.5	17.9	20.1	7.1
Other	0.0	1.0	8.1	0.8	0.7	1.8	3.0
Total	100%	100%	100%	100%	100%	100%	100%

Source: FSS.

testing and introduction of the IFRS. For instance, the total number of insurance crimes detected rose from 5,757 in 2002 (before the implementation of the IFRS) to 9,315 in 2003 (the IFRS testing year) to 16,513 in 2004 (the first year with the IFRS) and to 23,607 in 2005 (the second year). The changes in amount also show a similar pattern between 2002 (41 billion Won) and 2005 (180 billion Won). Although not proven empirically, these changes indicate the effectiveness of the anti-fraud efforts made by all parties of interest in the soundness of insurance operation—particularly the FSS—and of the IFRS.

Table 4 provides a comparison of criminal investigation results during 1999–2005. It shows that those charged with insurance fraud were increasingly indicted in court after the testing and introduction of the IFRS. We can find some improvement in the ratio of

cases where suspects were being traced as well as in the ratio where the charges were dropped (particularly in 2005).

The most significant contribution of the IFRS thus far is an improvement in claims screening speed. For example, the system requires two hours to complete a link analysis—a task that would require one to three months of investigation under the traditional approach.

CONCLUDING REMARKS

As in many other countries, committing fraud is a criminal offense in Korea. The Penal Code of the country prescribes that persons committing fraud—not specifically insurance fraud—will be sentenced to a term not greater than ten years of imprisonment, a fine of not greater than 20 million Won, or both. However, judges tend to render very light sentences (e.g., probation and fine) in most insurance fraud cases. Again, this court environment, combined with the depressing economic environment after the recent Asian economic crisis, seems to have caused problems of moral hazard in insurance to deepen in Korea.

As an attempt to deter criminals and ill-minded policyholders from committing fraud, the FSS introduced the Insurance Fraud Recognition System. The system is found to be effective in link generation speed. At this early stage of the system use, however, the FSS has not yet generated enough data that the authors could use to examine statistically the efficiency of the system. Certainly, improvement in system efficiency is what the FSS and the industry ought to target; otherwise, benign claims could be classified as suspicious and innocent victims would suffer financially and emotionally.

There are several related issues to which the government and the industry need to pay attention. Like most other fraud detection systems, the IFRS is designed mainly to detect hard fraud. Some policyholders commit soft fraud, and some survey respondents admitted that they might, without feeling guilty, build up their claims or lower their share—deductible or coinsurance—of losses (Tennyson, 1997, 2002; Dean, 2002). When no statistical approach is found effective to detect soft fraud, the FSS may consider escalating its public awareness programs jointly with the industry to fight soft fraud.

The FSS may need to strengthen its power to investigate insurance crimes and take timely legal action. The Insurance Business Law of Korea merely prescribes that the regulator may investigate insurance fraud by entities. It does not allow the FSS to issue a subpoena or obtain a sworn statement from the suspect. Neither is the FSS empowered to obtain documents related to fraud investigation from the suspect entity.[10]

Two of the lines of insurance that are vulnerable to fraud are workers' compensation and health insurance. In Korea, they are public insurance: Korea Labor Welfare Corporation administers workers' compensation insurance (other than voluntary excess coverage available in the private sector), and the National Health Insurance Corporation manages national healthcare insurance programs. These (quasi-) government institutions are not subject to FSS regulation or supervision. This structure in the Korean insurance market has made it difficult for private insurers and the FSS to obtain data from the public insurers. With the recent creation of the Insurance Fraud Investigation Council, of which the

---

[10] The FSS and the insurance industry have jointly submitted a bill to amend the relevant section of the Insurance Business Law. The bill is still pending.

public insurers are members, the FSS—also representing private insurance companies—expects less burdensome access to the databases that the suppliers of social insurance manage.[11] In doing so, all the parties must act prudently and should not invade the right of privacy of ordinary citizens. For this reason, the FSS does not share the database openly with private insurance companies.[12]

Finally, the FSS needs to conduct an empirical study about the efficiency of the IFRS. Effectiveness of the system in detecting fraudulent cases, cost effectiveness, improvement in the ratio of the number of cases indicted to all cases investigated by the police, and most importantly, reduction in erroneous classification of genuine claims as bogus are some of the elements for study the authors suggest.

References

American Association for Artificial Intelligence, 1998, *Symposium on Artificial Intelligence and Link Analysis*, October 23–25, Orlando, USA.

Artis, M., M. Ayuso, and M. Guillén, 1999, Modeling Different Types of Automobile Insurance Fraud Behavior in the Spanish Market, *Insurance: Mathematics and Economics*, 24: 67-81.

Artis, M., M. Ayuso, and M. Guillén, 2002, Detection of Automobile Insurance Fraud with Discrete Choice Models and Misclassified Claims, *Journal of Risk and Insurance*, 69: 325-340.

Boyer, M., 2000, Centralizing Insurance Fraud Investigation, *Geneva Papers on Risk and Insurance—Theory*, 25: 159-178.

Brockett, P., and O. Xiao, 1998, Using Kohonen's Self-Organizing Feature Map to Uncover Automobile Bodily Injury Claims Fraud, *Journal of Risk and Insurance*, 65: 245-274.

Brockett, P., R. Derrig, L. Golden, A. Levine, and M. Alpert, 2002, Fraud Classification Using Principal Component Analysis of REDITs, *Journal of Risk and Insurance*, 69: 341-371.

Butler, R., D. Durbin, and N. Helvacian, 1996, Increasing Claims for Soft Tissue Injuries in Workers' Compensation: Cost Shifting and Moral Hazard, *Journal of Risk and Uncertainty*, 13: 73-87.

Caudill, S., M. Ayuso, and M. Guillén, 2005, Fraud Detection Using a Multinomial Logit Model with Missing Information, *Journal of Risk and Insurance*, 72: 539-550.

Cho, H. Kyun, and W. Seung Yang, 2001, A Study of National Strategy to Control Insurance Fraud, *Insurance Development Studies*, 33: 167-192.

Clark, M., 1990, The Control of Insurance Fraud: A Comparative View, *British Journal of Criminology*, 30: 1-23.

Coalition Against Insurance Fraud, 2002, *A Statistical Study of State Insurance Fraud Bureaus* (Washington, D.C.: Coalition against Insurance fraud).

---

[11] The FSS, the Financial Supervisory Commission, the Korea Insurance Development Institute, the Korea Life Association, the Korea Nonlife Insurance Association, and the National Pension Service are also members of the Council.

[12] In fact, the Medical Law of Korea bars institutions other than the National Health Insurance Corporation from accessing the medical information of private citizens (Cho and Yang, 2001).

Cummins, D., and R. Derrig, 1993, Fuzzy Trends in Property–Liability Insurance Claim Costs, *Journal of Risk and Insurance*, 60: 429-465.

Dean, D., 2002, Perceptions of the Ethicality of Consumer Insurance Claim Fraud, *Journal of Business Ethics*, 54: 67-79.

Derrig, R., 2002, Insurance Fraud, *Journal of Risk and Insurance*, 69: 271-287.

Derrig, R., and K. Ostaszewski, 1995, Fuzzy Techniques of Pattern Recognition in Risk and Claim Classification, *Journal of Risk and Insurance*, 62: 447-482.

Derrig, R., and L. Krauss, 1994, First Steps to Fight Workers' Compensation Fraud, *Journal of Insurance Regulation*, 12: 390-415.

Derrig, R., H. Weisberg, and X. Chen, 1994, Behavioral Factors and Lotteries Under No-fault with a Monetary Threshold: A Study of Massachusetts Automobile Claims, *Journal of Risk and Insurance*, 61: 245-275.

Dionne, G., 1984, The Effect of Insurance on the Possibilities of Fraud, *Geneva Papers on Risk and Insurance—Issues and Practice*, 9: 304-321.

Financial Supervisory Service (FSS), 2005, *Introduction to Insurance Fraud Recognition System* (Seoul, Korea) Insurance Fraud Division, Financial Supervisory Service.

Insurance Australia Group, 2004, *Hidden Costs: Insurance Fraud in Australia*.

International Association of Insurance Supervisors, 2003, *Insurance Core Principles and Methodology*.

Korea Insurance Development Institute (KIDI), 2005, *Estimation of Insurance Fraud Scale and Analysis of Insurance Fraud Deterrence in Korea* (Seoul: KIDI).

Korea Insurance Development Institute (KIDI), 2006, *2004 Annual Insurance Statistic* (Seoul: KIDI).

Loughran, D., 2005, Deterring Fraud: The Role of General Damage Awards in Automobile Insurance Settlements, *Journal of Risk and Insurance*, 72: 551-575.

Major, J., and D. Riedinger, 2002, EFD: A Hybrid Knowledge/Statistical-based System for the Detection of Fraud, *Journal of Risk and Insurance*, 69: 309-324.

Organization for Economic Cooperation and Development, 2004, *OECD Guidelines for Good Practice for Insurance Claim Management*.

Sulzle, K., and A. Wambach, 2005, Insurance in a Market for Credence Goods, *Journal of Risk and Insurance*, 72: 159-176.

Swiss Re, 2005, *World Insurance in 2004* (Sigma 2).

Tennyson, S., 1997, Economic Institutions and Individual Ethics: A Study of Consumer Attitudes Toward Insurance Fraud, *Journal of Economic Behavior & Organization*, 32: 247-255.

Tennyson, S., 2002, Insurance Experience and Consumers' Attitudes Toward Insurance Fraud, *Journal of Insurance Regulation*, 21: 35-55.

Tennyson, S., and P. Salsas-Forn, 2002, Claims Auditing in Automobile Insurance: Fraud Detection and Deterrence Objectives, *Journal of Risk and Insurance*, 69: 289-308.

Wasserman, S., K. Faust, D. Iacobucci, and M. Granovetter, 1999, *Social Network Analysis: Methods and Applications* (Cambridge: Cambridge University Press).