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# **What Happened to the Selected? Performance Measurement of the Korea Customs Service Selectivity System**

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## **Abstract**

Customs uses risk management as the core philosophy to balance regulatory control and trade facilitation. To deal with emerging and evolving risks, Customs should regularly adjust their risk management techniques and develop new approaches when necessary. Improving such efforts can benefit by applying rigorous risk management practices from other disciplines and measuring the results empirically. This paper examines the performance of the Korea Customs Service (KCS) selectivity system, drawing on practices used in the fields of taxation and insurance that deal with similar kinds of risk or fraud. This paper focuses on the relationship between selection and detection rather than scrutinizing selection and detection rates independently in order to alleviate concerns about smugglers possibly exploiting revealed selectivity performance data. The KCS currently uses three selection methods: manual selection, rule-based selection, and random selection. During the study, manual selection surprisingly showed the highest detection rate and the best efficiency. The rule-based selection appears to play an important role in deterring fraud techniques and opens the way for Customs officers to use their experience, knowledge and skills to adopt manual selection to keep up with smugglers' evolving approaches. Random selection also appears to have a deterrent effect because its unpredictability overcomes smugglers' evolving predictions on selection patterns. The paper analyzes these results and concludes that the three selection methods are complementary for the detection and deterrence of emerging and evolving risks.

## **Key words**

Risk Management, Rule-based Selection, Manual Selection, Random Selection, and Korea Customs Service (KCS)

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## 1. Introduction

During the past 60 years, the volume of international trade has increased exponentially. Resources that Customs can mobilize to handle the increasing trade have been, however, limited and their reinforcement have not caught up with the pace of international trade growth (Keen, 2003). The expansion of international trade and pressure from the international trading community to minimize government intervention increased Customs' interest in trade facilitation. To harmonize regulatory control and trade facilitation<sup>1</sup>, many Customs have adopted risk management as their dominant philosophy and this was embedded in the WCO's Revised Kyoto Convention (Harrison and Holloway, 2007). The extensive use of risk management in Customs administration was reflected in a risk management survey conducted by the WCO in 2010 where 84 percent of respondents answered they have adopted risk management in their administration (WCO, 2010).

For Customs, the most prominent risks are non-compliant or illegitimate trade transactions undermining government revenue and dangerous goods threatening society, although risks that Customs should address are all events and activities that hinder Customs from achieving their objectives (WCO, 2011; Widdowson, 2005). Risk management to Customs is a process to mitigate and avoid risks<sup>2</sup> hampering achievement of Customs objectives. The introduction of risk management in Customs administrations has brought a change in Customs' approach to risk. While putting risk management in place, many Customs have kept away from their traditional stringent gatekeeper role at borders. They have lessened their regulatory control-oriented administration and minimized unnecessary disruption and cost to legitimate trade and passengers (Widdowson, 2007). Customs have re-engineered their strategies and tactics against risk so to concentrate their resources on the high-risk end of the risk continuum (WCO, 2011) and have launched various forms of risk management programs fitting their environments, such as cargo selectivity systems, post-clearance audit programs, and Authorized Economic Operator programs (Closs and McGarrell, 2004). Yet, whereas there have been many upper-level discourses advocating the adoption of risk management in Customs administration, there have been few studies to present substantial methodologies necessary to operate the introduced risk management programs (Hinsta *et al*, 2011). The lack of research to examine the feasibility, effectiveness, and efficiency of risk management programs (Laporte, 2011) has hampered improving the existing programs and devising new ones. The problem may be influenced by many factors, such as political and administrative culture, fiscal situation, and information and telecommunication infrastructure where Customs undertake their daily tasks.

From a research perspective, however, two reasons seem to be prominent. First, few theories have been formulated so as to assist the embedding of risk management in Customs administrations. Theoretical frameworks are important in operating risk management programs because theories play a role in seeking and providing logically

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<sup>1</sup> The harmonization of the two distinct objectives does not just take into account trade facilitation more and regulatory control less than before and achieve an appropriate balance between them but also prevent the influx of high risk cargo without interfering with trade facilitation.

<sup>2</sup> According to Deloach (2000), there are four ways in dealing with risk: avoid, reduce, transfer, and retain or accept.

plausible explanations necessary for the operation of risk management programs and helping to predict their outcomes based on the formulated mechanisms (Babbie, 2007). Second, limited data is available for research on Customs risk management. Customs are reluctant to share their data with researchers because they fear traders are likely to exploit such statistics to avoid examination and inspection<sup>3</sup>. Thus, risk management techniques have not been much vetted theoretically and empirically, despite their importance to all Customs administrations.

This paper focuses on Customs selectivity systems, which is generally regarded as a type of Customs risk management technique. In particular, this study analyzes the effectiveness and efficiency of selection methods that the selectivity systems employ and derives important factors in operating the selectivity systems, with data supplied by the KCS and drawing on theories developed in other domains.

## 2. Theory

Several international organizations have produced Customs risk management guides. The WCO has developed practical guides including on Customs risk indicators (WCO, 2011). The Organization for Economic Cooperation and Development (OECD) and the World Bank, have released publications advocating Customs' adoption of risk management to facilitate trade (De Wolf and Sokol, 2004; McLinden *et al*, 2010; OECD, 2003). There is a gap, however, between the strategic justification and operational guides for risk management. To embed risk management in Customs administration, intermediates filling the chasm are necessary. The role is fulfilled by theories for risk management in the sense that theories sort out plausible factors influencing risk management programs and provide logical explanations to improve the programs. Yet, few theories that play such an expected role have been known in the field of Customs administration.

Unlike Customs administration, the fields of taxation and insurance, which have similar mechanisms to that of Customs administrations in terms of fraud control, have analyzed how to detect and deter tax and insurance fraud (Derrig, 2002; Viaene and Dedene, 2004; Andreoni *et al*, 1998). Tax and insurance fraud control theories have focused on three categories: (1) why fraud is committed; (2) why selection is needed; and (3) how selection should be made.

First, analysis of the causes of tax and insurance fraud occurrence has focused on fraud opportunities rather than fraudsters' individual characteristics. Viaene and his colleagues (2004) contend that, like other kinds of crimes, fraud is also committed by a combination of motivated offenders and criminogenic opportunities, drawing on Felson's routine activity theory<sup>4</sup>. They suggest that it is important to remove fraud-ridden

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<sup>3</sup> In this paper, whereas the term examination refers to probing the veracity of information on documents, such as manifests, declarations, invoice, bill of lading, and packing lists, the term inspection refers to investigation of the physical status of cargo. Most cases concerning valuation issues need examination of documents without physical inspection of cargo. Cases concerning classification of products, however, require not only examination of documents but also physical inspection of products.

<sup>4</sup> According to Felson (2009), crime occurs when a motivated officer meets a suitable target that is not protected by a guardian. His routine activity theory emphasizes the convergence of a motivated officer, a suitable target, and absence of guidance.

opportunities to prevent occurrence of fraud. Game theorists analyze fraud with the principal-agent model, focusing on how prospective offenders have motives for fraud and exploit fraud-ridden opportunities. According to the principal-agent model, whereas tax payers and insurance claimants (agent) have full information about their status of income, health, and accidents, tax agencies and insurance companies (principal) do not know about the agent as much as the agent. The information asymmetry leaves the principal with no option but to trust the agent; which provides the agent with an incentive to defraud tax agencies and insurance companies. Thus, tax agencies and insurance companies have devised various methods to narrow the information gap between the principal and the agent (Tennyson and Salsas-Forn, 2002; Viaene and Dedene, 2004). Some scholars focusing on tax compliance have tried to explain tax non-compliance with variables regarding tax policies and administration, such as, tax rates, tax payer perception of fairness in taxation, tax audit methods, and non-compliance penalties (Alm, 1999; Andreoni *et al*, 1998; Kirchler *et al*, 2007).

Second, tax and insurance fraud control theorists are interested in case selection mechanisms in the sense that selection is a prerequisite for detection. It is important to establish a system that a crime committed is known to the authorities for crime prevention and control. The detection process of tax and insurance fraud is somewhat different from that of ordinary commercial frauds. Whereas detection of ordinary commercial frauds is usually triggered by victim reports to the authorities, detection of tax and insurance fraud is barely gleaned by individual clients' reports. In other words, whereas the victims of ordinary commercial frauds take their cases to the authorities, such as criminal justice systems and civil courts, to try to reconstitute their loss, tax authorities and insurance companies play a role in enforcing laws and contracts for their clients, such as tax payers and insured person, rather than being entities protected by laws and contracts. However, the fraud victims are tax agencies and insurance companies themselves. They usually do not recognize their own victimization until they proactively investigate fraud to discover it (Piquet *et al*, 2007). Thus, tax and insurance fraud control theories focus on the selection of incoming tax returns and insurance claims as a process of detecting their victimization (Graetz *et al*, 1986). Even though tax agencies and insurance companies undertake a screening process of incoming tax returns and insurance claims to identify frauds, they cannot do an in-depth examination of all incoming tax returns and insurance claims. Tax payers and insurance claimants, meanwhile, want their reports to be processed and confirmed quickly. Fraud control entails costs not only to taxpayers and claimants but also to tax agencies and insurance companies. Thus, tax agencies and insurance companies should concentrate their limited resources on a small number of high risk targets. This situation leads tax agencies and insurance companies to select a small number of tax returns and claims to verify whether their reports are accurate. For this, tax agencies have formulated tax audit programs, which select the most suspicious tax turns as subjects of tax audit (Alm, 1999; Andreoni *et al*, 1998). Insurance companies have established automated fraud detection systems, which sort out incoming claims into two bins where (1) a group of non-suspicious routine claims is put through a simplified process and claims are paid quickly and (2) the group of suspicious claims is processed through intensive verification, such as special identification units' investigation and external audit (Derrig, 2002; Graetz *et al*, 1986; Viaene *et al*, 2007). Recent automated detection systems evaluate the gravity of incoming claims with lists of fraud indicators or flags representing fraud detection expertise.

Third, tax and insurance fraud control theories have examined selection methodologies in light of effectiveness and efficiency. Some assert that selection should focus on minimizing total costs, including fraud control cost and losses incurred by fraud. Fraud control is conducted to prevent financial and reputational damage from fraudulent claims. Fraud control *per se*, however, incurs costs to tax agencies and insurance companies as well. Thus, they contend that fraud control should be done to the extent that the expected marginal costs of fraud control are equal to its marginal savings from the control (Tennyson and Salsas-Forn, 2002).

Other theorists assert that suspicious tax returns and insurance claims should be addressed from the perspective of deterrence. In fraud control, it is important to detect fraudulent tax returns and insurance claims, but the ultimate goal of fraud control is to prevent recidivism and deter new fraudsters. According to deterrence theory, the deterrent effect<sup>5</sup> increases in three situations: the severity of the punishment increases, the probability of being punished increases, or the temporal gap between crime commitment and punishment decreases<sup>6</sup> (Becker, 1968; Nagin, 1998). In this connection, in the field of insurance, scholars recommend that insurance companies carry out intensive audits frequently to raise the rate of fraudulent claims detection (Picard, 1996). Fraud control theorists contend that fraudsters adjust techniques so as to exploit the inertia of complex systems and evade fraud control. Because fraudsters adapt their tactics, fraud control should be unpredictable. Thus, these scholars support the use of random selection for intensive audits (Tennyson and Salsas-Forn, 2002).

Customs also have concerns about fraud control similar to tax agencies and insurance companies. Like tax agencies and insurance companies, Customs (the principal) are disadvantaged to traders (the agent) in terms of quantity and quality of information about cargo, traders, and consignment payment terms. This is because Customs are not involved in the trade transactions and are unaware of the specific agreements between the exporter and the importer. Customs usually simply accept the information that traders submit as it is for speedy clearance, so long as information on declarations matches that of trade documents and is not explicitly suspected of document manipulation.

Even though Customs can close in on the substance of a trade transaction by examining invoices produced by the exporter and the importer, if the invoices are manipulated, either individually or by collusion between the exporter and the importer, then Customs get deceived. Customs can uncover the veracity of a trade transaction by in-depth investigation of trade documents (e.g., invoice, packing list, and Bill of Lading) and historic databases of traders, gathering intelligence from informants, and physical cargo inspection. Traders are aware, however, that Customs cannot examine all declarations and cargo because the cost not only impacts traders (e.g., inspection fee, container devanning/revanning cost, and delaying cost) but also Customs (e.g.,

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<sup>5</sup> Many empirical studies suggest double-barreled findings on deterrence theory; whereas macro-level deterrence studies show that programs based on deterrence perspective have a weak influence on crime rates, the perceptual deterrence literature shows that deterrence measures working on perceptions of deterrence are likely to have some effects on crime (Nagin, 2011; Pratt *et al* 2008).

<sup>6</sup> This proposition suggests that the shorter the interval between crime commitment and punishment, the greater the deterrent effect of the punishment. For instance, immediate punishment is likely to be more deterrent than delayed punishment.

inspection facility operating costs and inspection officers' travel expenses). The information asymmetry between Customs and traders provides a motive for traders to engage in illegal trade, including Customs fraud.

In this connection, Customs have endeavored to gather more comprehensive data about traders and their trade transactions as early as possible in the supply chain in order to reduce the information gap between traders and themselves. To have the obtained information used immediately for examination of trade transactions and inspection of cargo, many Customs have established automated selectivity systems, which screen incoming reports (e.g., manifests and declarations) by freight forwarders and traders and decide which reports are sufficiently low-risk to be cleared without any intervention and which ones are suspicious and merit intensive examination. However, some Customs administrations have not clarified what purposes their selectivity systems are designed to achieve, which method is most efficient, and which is best fit for their trade environment and administrative culture. This study, drawing on studies from taxation and insurance, describes why and how Customs can strengthen the establishment and operation of their selectivity systems.

### **3. Data**

It is essential to establish a theoretical foundation to run a Customs selectivity system effectively and efficiently. It is difficult, however, for external researchers to acquire data concerning the performance of selectivity systems for theory formation and testing. Many Customs have low examination and inspection rates, taking into account trade facilitation objectives and limited resources for regulatory control (Closs and McGarrell, 2004; Geourjon *et al*, 2012; Harrison and Holloway, 2007). Some Customs fear that if their risk management performance data and methodologies are open to outside stakeholders, then prospective non-compliant traders can exploit the information.

The concern is based on the assumption that traders are unaware of the selection and detection rates of Customs selectivity systems. Traders are aware, however, of the limitations of Customs controls. Some traders know how many of their declarations and cargo are examined and inspected. What traders do not know is the overall selection and detection rates. Hence, what Customs should be concerned about is not the likelihood that criminal traders evade the selectivity systems or exploit publicized data but whether they can improve selectivity systems through constant evaluation. Nonetheless, there is a need to accept that selection and detection rates can be generally understood by experience. Furthermore, given the likelihood that once risk management performance statistics are made public, even reliable traders are attracted to circumvent Customs selectivity systems, it is necessary to reach a compromise between Customs' concern about the publicity of the statistics and the necessity of research on Customs selectivity systems. The resolution can begin with the questions of what information Customs are reluctant to divulge and what information is truly needed to study selectivity systems. The information that Customs does not want to share are the selection and detection rates of their selectivity systems. Studies should, however, focus on the relationship between selection rates and detection rates. Hence, the authors of this study asked the KCS to provide its selectivity system performance statistics and obtained permission to use its statistics under the condition that selection and detection rates are not specified in the final research product. To have heightened understanding on the KCS's selectivity systems and their performance

data, the authors interviewed three key officers are in charge of operating the selectivity systems.

### *Selection*

All declarations and reports to the KCS are submitted electronically and go through a process of decision-making of whether they are legitimate enough to be accepted. The decisions are made by Customs officers who screen incoming declarations and reports that are assigned to them. Customs officers proactively accept non-suspicious declarations and reports. However, if Customs officers do not make any decision on the assigned declarations and reports within a certain period of time, the KCS's automated clearance system<sup>7</sup> accepts declarations and reports as they are in order to prevent the non-decision making from hampering trade facilitation. Selection is a kind of decision-making to withhold acceptance of declarations and reports. The KCS conducts regular selections<sup>8</sup> in seven channels for examination and inspection: manifest reports<sup>9</sup>, import declarations, export declarations, import express parcels, incoming passengers' luggage, cleared declarations (for post-clearance audits) and drawback claims. All selection processes and results reporting are managed by the selectivity systems of each channel. In each selectivity system, sample selections are categorized into two methods: (1) computerized selection and (2) Customs officers' manual selection.

The computerized selection comprises two types: rule-based and randomness. The rules, or selection criteria, of the rule-based selection draw from several sources. The dominant criterion is based on successful detections made by manual selection. Data-mining on the accumulated declarations extracts patterns (Geourjon *et al*, 2012; Laporte, 2011) of legitimate trade transactions and builds the computer selection criteria that sort out irregular declarations that do not meet the patterns. Some criteria incarnate trade regulations of the government and automatically screen out declarations that do not meet the regulations. The rule-based selection criteria that do not detect anything during a certain period of time (e.g., six months) after being mounted on a selectivity system are destined to be automatically dismantled from the selection system. The random selection is to select declarations whereby all declarations have an equal chance of being selected, not just unplanned or unconscious selection. Manual selection is conducted by Customs officers based on their own experience and knowledge, not with the use of computerization or by pre-programmed criteria. The process for the manual selection is, however, supported by the selectivity systems that record which officer selected which declaration and what offense was charged for the selected declaration.

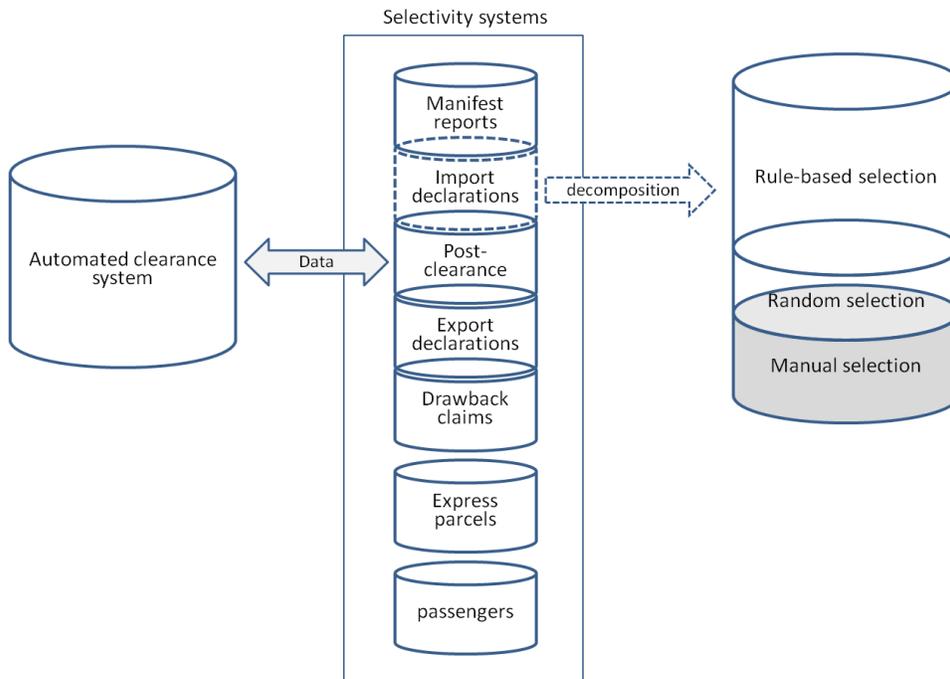
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<sup>7</sup> The KCS has an automated clearance system named Uni-Pass; which processes a variety of data from freight forwarders, carriers, shippers, bonded warehouses, traders, Customs brokers, and trade-related governmental agencies. The processed data are shared with its selectivity system which has been developed along with each part of the automated clearance system and whose origin dates back to the early 1990s.

<sup>8</sup> The KCS does not necessarily rely on regular selections for inspection on cargo and audit on traders. When the KCS has solid intelligence about certain cargo and transactions, it undertakes inspections and audits without the assistance of the selectivity systems.

<sup>9</sup> The KCS selects manifests to inspect containers in which high risk cargoes are likely to be included in order to detect smuggling committed without import declarations.

Figure 1: Composition of selectivity systems of the KCS



Source: the authors

KCS management monitors and manages the overall selection rate based on its strategic risk assessment. For instance, when the Korean government began to prioritize trade facilitation, the KCS lowered the selection rate. The KCS has also adjusted the selection rate as a result of health risks of some imported goods. Its working-level officers allot the overall selection rate to each selectivity systems as their target selection rates, taking into account their selection speeds, detection rates, and responses from traders, and fine tune the ratios among the selection rates.

Table 1: Composition ratios (%) of the selection methods in the import selectivity system

Year	2009	2010	2011	2012 (Q1 to Q3)
Rule-based selection	80	84	79	79
Random selection	7	4	6	7
Manual selection	13	12	15	13
Total	100	100	100	100

In the import selectivity system that plays the most import role in the KCS's selectivity systems, the rule-based selection accounts for about 80 percent of KCS's overall selection rate. Originally the rule-based selection was made by risk indicators, which suspicious declarations and cargoes have in common. For example, if a certain kind of products manufactured by company A in country B had been detected as infringing on intellectual property rights, the same kind of products of company A are registered to the import selectivity system for inspection<sup>10</sup>. The rule-based selection,

<sup>10</sup> If the trader who imports a kind of products manufactured by company A is charged with an IPR infringement, the importer usually replaces company A with another supplier to avoid his or her cargo being selected again. If the infringement on IPRs was a mistake and unusual, the

together with an increase in the collected data quantity and advancement of database technology, has evolved to the current advanced form in which Customs officers establish not only verification criteria (If-Then Select) but also falsification ones (Unless-Then Select). For example, when a certain kind of goods are produced only in Country B that has concluded a Free Trade Agreement with Korea, if declarations to import the same kind of goods from countries other than Country B are submitted to Customs, then the declarations are suspected to evade Customs duty and should be selected.

The manual selection accounts for about 10 percent of the overall selection rate. According to the interviewed officers, even though KCS management has wanted to have a little higher rate in the manual selection, the number has not increased. The officers attribute its low selection rate to its labor intensive methodology that the manual selection is not simply based on their instant intuition but made through risk analysis on declarations with their own expertise and knowledge, which takes 3 to 4 hours per declaration. They cannot conduct many analyses because of clearance time requirements<sup>11</sup>. In addition, cargo inspection entails costs not only to traders but also to Customs. Customs officers tend to be circumspect in manual selection and concentrate on a small number of apparently problematic declarations in order to avoid blame for "selection-but-no-detection". Customs officers' manual intervention is not confined to selection. Even if the programmed selections winnow out some declarations or cargo for examination and inspection, Customs officers can override the selections when they are confident the selected declarations or cargo are not suspicious.

Among the seven KCS selectivity systems, this study examines the import selectivity system. The seven selectivity systems are respectively operated in the three divisions of the KCS. The two divisions that maintain selection data regarding manifest reports, passengers, and express parcels declined to participate in this research project. This study is provided with the 15 quarterly selection data from 2009 to the third quarter of 2012 concerning import declarations, export declarations, post-clearance audits, and drawback claims, but decided to focus on the import selectivity system. This decision was based on the higher volume generated by the import selectivity system.

### *Detection*

Selection is intended to detect offenses. There are many types of Customs offenses and they vary country to country. Customs duty and tax evasion is the primary offense that Customs targets. Other offenses relate to illegal drugs, counterfeit goods, and endangered fauna and flora. Customs is also concerned with manipulation of origin of goods and defects in import/export requirements. The KCS pays special attention to these problems as core targets that need criminal penalties or administrative sanctions. Errors in the quantity and quality of goods that are not related to Customs duty and taxes, however, are regarded as minor problems for which the KCS gives traders demerits of

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importer needs to endure inspections on subsequent consignments until the KCS gets sure that Company A's export cargo is no longer problematic and dismount the selection criterion from its selectivity system.

<sup>11</sup> The KCS's automated clearance system measures the elapsed time of each declaration and evaluates clearance performance of each Customs house with its averaged elapsed time monthly, quarterly, and annually.

being selected for comprehensive compliance audits<sup>12</sup>. Even though the errors harm the accuracy of trade statistics, the KCS refrains from sanctions on traders and goods because enforcement against minor violations would hamper trade facilitation. In this respect, in this study, such minor problems that do not need criminal penalties or administrative sanctions are excluded<sup>13</sup>.

#### **4. Analysis**

##### *Hypotheses*

The study has two key objectives. First, it examines which selection method among the three selection methods is the most efficient. There are two lines of thoughts on selection methods. Many field officers, who are inclined to give more credit to their intuition and accumulated experience, claim that manual selection is more effective and efficient than rule-based selection<sup>14</sup>. Some management-level officers who seek predictable and reliable Customs practices prefer the rule base selection method, believing it is more objective approach because it is mainly based on historical data. Moreover, there is the view that it prevents officer from being involved in corruption. As shown in the table 1 presenting the lowest portion of the random selection in the overall selection rate, field officers and management-level officers regard the random selection as a supplement instrument for the other selection methods rather than an independent detection tool. To test the hypotheses, this study seeks a way of comparing detection rates of each selection method employed in the import selectivity system.

Second, this study addresses the question of how a change in selection rates affects detection rates. Customs is destined to detect harmful foreign products and illegitimate trade transactions. On the other hand, Customs is regularly pressured to facilitate trade. Customs that emphasizes regulatory control more than trade facilitation may increase selection rates. However, traders may be dubious of whether an increase in selection rates leads to an increase in detection rates. This study examines the relationship between selection rates and detection rates with simple bivariate correlation analysis.

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<sup>12</sup> The KCS has a comprehensive compliance audit program as a regular check-up of traders. For comprehensive compliance audits, officers visit traders' main offices and examine their businesses related to Customs administration all together, such as import declarations, export declarations, drawback claims, management of origins, and foreign exchange transactions. To select subjects for the comprehensive compliance audit program, the KCS maintains a trader profile database combining all examinations, inspections, and investigation results and minor errors.

<sup>13</sup> In the KCS, the detection rates influence field officers' bonus, transfer to better positions, and promotion. The officers had paid excessive attention to minor errors to get higher detection rates until the KCS established a policy of zeroing in on core targets in evaluation of performance of Customs houses and officers. This practice had brought about unnecessary tension with traders and had been thought of as a factor against trade facilitation. The KCS decided to consider detection rates concerning core targets in performance evaluation, even though it maintains records of minor violations.

<sup>14</sup> According to the officers interviewed with the author, even though Customs field officers believe that manual selection is the most effective and efficient method, they do not think that most selections should be made by the manual selection.

### Effectiveness of selection

Selection does not guarantee detection. Customs endeavors to improve selectivity to raise detection rates. This study employs a *relative risk* formulation to examine how more strongly a selection method is associated with detection than another selection method and determine which selection method is most effective. The relative risk<sup>15</sup> refers to the ratio of probabilities in which an event occurs in two different groups (Agresti and Finlay, 1999; Miller, 2005). For instance, the relative risk of the manual selection to the random selection is calculated by dividing the detection rate of the manual selection by the detection rate of the random selection. The relative risks do not show how well each selection method targets but can indicate which selection method is more accurate.

Table 2 shows that the detection probability by the manual selection (MN) is about six to eight times higher than that of the random selection (RD) (MN > RD). The rule-based selection (RB)'s detection probability is about two times higher than that of the random selection (RB > RD). The manual selection is about three times better than the rule-based selection in detection probability (MN > RB). According to the relative risks the manual selection is more effective than the other methods (MN > RB > RD). The random selection has the worst detection performance<sup>16</sup>.

Table 2: Relative risks for the selection methods of the import selectivity system

	2009	2010	2011	2012 (Q1 to Q3)
Rule-based selection to Random selection	1.7	2.1	2.1	2.4
Manual selection to Random selection	5.8	8.0	7.4	9.5
Manual selection to Rule-based selection	3.3	3.8	3.5	3.9

The difference in detection performance between the manual selection and the rule-based selection is intriguing because it would imply that officers' discretion shows better performance than risk-based selection drawing from historical data. In particular, some scholars criticize that manual selection, which is dependent upon human judgment, is static and rigid and is vulnerable to fraudsters' ever-changing techniques, compared to statistical scoring techniques (Geourjon *et al*, 2012; Laporte, 2011). However, there are a number of reasons for why this may be the case. First, the rule-based selection may not be as swift as the manual selection in keeping up with evolving fraud techniques. As criminologists have said about crime displacement<sup>17</sup> (Welsh and Farrington, 1999), criminals change their techniques when they think the government is successfully

<sup>15</sup> The term risk in the relative risk, which is usually used in epidemiology, would be better to be interpreted as a probability of the occurrence of an event (selection) in this study.

<sup>16</sup> Some Customs officers present an opinion that the primary objective of the random selection is not to detect illegitimate transactions but to capture the prevalence of illegitimate cargoes or transactions. Whereas the detection rates from the rule-based selection and the manual selection cannot be used to infer the prevalence of illegitimate cargoes and transaction in all declarations, the detection rate by the random selection shows how many illegitimate cargoes and transactions are likely to be in all declarations.

<sup>17</sup> There are five different types of crime displacement: temporal (change in time), tactical (change in method), target (change in victim), territorial (change in place) and functional (change in type of crime). They have concerned that crime prevention and control measures can be compromised by these displacements and have sought to solutions to secure intended outcomes (Welsh and Farrington, 1999).

targeting those techniques. However, for Customs officers, it takes time to capture criminal traders' adjustments. Moreover, it even takes more time to implement responses to the changed techniques because they are made through a process of extracting effective manual selections. Hence, when new selection criteria of the rule-based selection are applied to declarations, criminal traders may have already changed methods again. Second, the selection criteria of the rule-based selection include not only the extractum of the effective manual selections but also trade regulations<sup>18</sup>, which broadly indicate kinds of goods requiring special handlings rather than pinpoint suspects. Such requirements cannot be adjusted quickly to chase ever-changing fraud techniques. Thus, if low effective criteria based on government's trade regulations were dismantled from the selectivity system, the rule-based selection would have better detection rate. The selection criteria embodying trade regulations cannot be removed from a pool of selection criteria (the reason is presented later). The factors seem to have influenced that the criteria tend to become deadwood to skillful fraudsters in detection.

### *Efficiency of selection*

Detection rates are a good indicator to evaluate the performance of the selectivity systems. However, detection rates *per se* do not provide a clue regarding costs incurred by selections. The costs involved in selection are an important concern to both Customs and traders. When there are selection methods with the same level of detection rates, if a selection method entails a lower level of costs than the others, it is natural that the selection is preferred by Customs and traders. In other words, detection rates or relative risks may not be a sufficient indicator to evaluate selection methods. Hence, this study introduces selection efficiency, which takes into account the effectiveness of detection and the costs derived by selection simultaneously. This can be expressed in a ratio of the detection rate to the selection rate. This is intended to encompass both detection and selection rates in examining the performance of selection methods on the assumption that an increase in the number of selections leads to a proportional increase in clearance costs to traders and Customs, provided the cost per selection is the same across the selection methods.

A hypothetical example shown in Table 3 illustrates how different Method A and Method B that have the same detection rate are in their selection efficiency. Suppose that Method A and Method B have the same detection rate of 5 percent; yet, their selection rates differ. Method A selected fewer declarations than Method B and obtained the same level of detection rate. This means that Method A is more efficient than Method B.

Table 3: Selection efficiency of two different methods with the same detection rate

	Population	Selection		Detection		Selection efficiency
		case	rate (%)	case	rate (%)	
Method A	4,000	100	2.5	5	5	2
Method B	4,000	200	5	10	5	1

<sup>18</sup> The KCS also makes selection criteria, consulting trade regulations regarding food, sanitation, and health and receiving other ministries and agencies' requests.

When comparison between the three selection methods is made, Table 4<sup>19</sup> shows that the manual selection is the most efficient, and is followed by the random selection and the rule-based selection. This finding sounds somewhat counterintuitive. It is predicted that the manual selection based on Customs officers' own experience, intelligence and intuition produces greater detection with a small number of selection. The finding that the random selection is more efficient than the rule-based selection, however, is surprising.

There are a number of possible reasons for the finding. First, as Table 1 shows, the KCS emphasizes the rule-based selection in operating the selectivity system, even though the rule-based selection's effectiveness is inferior to the manual selection. The KCS's course of having the rule-based selection method the highest selection rate, regardless of its low detection, has contributed to the low efficiency of the rule-based selection. Second, the random selection's selection rate (denominator) is the lowest but its detection rate (numerator) is not much lower than that of the rule-based selection. In other words, the random selection is structured to select less and get a detection rate corresponding to the population parameter (i.e., illegitimate trade rate). In particular, the KCS uses random selection for inferring the prevalence of illegitimate cargo in declarations from the detected samples and capturing illegitimate cargo that the manual selection and the rule-based selection fail to detect. Unlike the other two selection methods, random selection does not have predictable selection patterns. The unpredictability of the random selection may counteract criminal traders' adjustment of their fraud techniques to predictable selections and to contribute to better efficiency of the random selection.

A caveat in interpreting the finding is that the rule-based selection is not as efficient as the other two methods do not necessarily mean that rule-based selection is not useful. The value of the rule-based selection should be sought from the perspectives of not only detection but also deterrence<sup>20</sup>. The essence of deterrence theory is to sanction rule-breakers and prevent them and even others from engaging in crime and deviance again (Nagin, 2011).

Table 4: Selection efficiency of the selection methods of the import selectivity system

	2009	2010	2011	2012 (Q1 to Q3)
Rule-base selection	3.1	3.6	5.3	5.0
Random selection	20.9	33.9	32.1	22.6
Manual selection	62.1	96.5	100.3	118.4

In this respect, the rule-based selection may play a role in deterrence in two ways. First, important trade-related regulations are factored into the selectivity system in

<sup>19</sup> The selection efficiency (= a detection rate / a selection rate) does not say a probability, or percentage. This measure can provide information of which method is superior compared to the others. This does not say how more efficient method A is than method B. For instance, in interpreting Table 4, it should not be said that the manual selection was three times as efficient as the manual selection in 2009.

<sup>20</sup> The three selection methods all may have deterrent effect. The manual selection's deterrent effect is quite collateral. In other words, whereas the manual selection is more punishment-oriented deterrence than the others, the rule-based selection is more prevention-oriented than the manual selection.

the form of the selection criteria of the rule-based selection. If a trader violates a regulation that is enrolled in as a selection criterion in the selectivity system, their declaration or cargo is selected for examination or inspection and they are less likely to engage in such an offense again. Second, the rule-based selection may reduce criminogenic opportunities by enrolling the verified selection criteria in their detection effectiveness. Even though the rule-based selection's primary objective is to tackle illegitimate trade, it is also meaningful to prevent criminal traders from employing the same techniques and narrow down the number of techniques that criminal traders can rely on.

### *Correlation between selection and detection*

When the general public has a heightened concern about illegitimate trade, especially with respect to health and security issues, Customs are pressed to conduct more selections to detect more. Given that not every selection leads to detection, however, an increase in selection does not guarantee an increase in detection. This study examines the correlation between selection and detection to probe what changes in detection are induced by changes in selection.

In Table 5, the correlation coefficient<sup>21</sup> for the overall selection rate shows that there is nearly no relationship between selection and detection ( $r_o = -0.001$ ); which means that a change in the overall selection rate is not likely to lead to a change in its detection rate.

The correlation analysis on each selection method, however, shows somewhat different pictures. The manual selection has a stronger relationship between the selection and detection rates ( $r_m = -0.41$ ) than the other selection methods ( $r_{ru} = 0.11$  and  $r_{ra} = 0.32$ ). The low coefficient for the rule-based selection ( $r_{ru} = 0.11$ ) implies that its selection and detection rates are barely related. When it comes to the directions of the coefficients for each selection method, the coefficient of the random selection are positive. In other words, an increase in the selection rate of the random selection tends to lead to an increase in its detection, whereas for the manual selection, the more selected, the less detected. This finding suggests that a simple increase in selection rate is likely to end up imposing costs to Customs and traders without an increase in detection rate. In particular, when the KCS is asked to raise its selection rate, it would be better to raise the random selection rate rather the manual selection rate.

Table 5: Correlation coefficients to show the association between selection and detection rates of selection methods

Overall	Rule-based selection	Random selection	Manual selection
-0.001	0.11	0.32	-0.41

## **5. Conclusion**

This study shows that the three selection methods have different outcomes. However, they do not work independently but are intertwined and complement one another. Without the manual selection, the rule-based selection cannot stand. As

<sup>21</sup> The subject of this study is the population of import declarations submitted to the KCS from 2009 to 2011. Significance tests are not necessary to infer population parameters from sample statistics.

advocates for statistical scoring techniques admit, the results from manual selections are a crucial ingredient of rule-based selections. The results from random selections show clues of which areas Customs officers pay attention to when they manually select suspicious declarations or cargoes. The performance of rule-based selections plays a role in presenting guides to develop powerful manual selections applicable to region-wide or nationwide.

There is no doubt, therefore, that good manual selections benefit rule-based selections. Even though the manual selection shows a good outcome, if the rule-based selection produces poor performance, it should be suspected that there is something wrong with the process of transforming refined manual selections to the selection criteria of the rule-based selection. Three kinds of problems may occur in the migration process. First, some skillful selectors do not have motivation to share their expertise with their colleagues because their own expertise is the result of their investment for better information and knowledge. Their selection expertise is tightly associated with promotion and merit bonus. Second, it takes time to make powerful selection criteria applicable to nationwide or region-wide with individual manual selection results. Hence, a division may need to be in full charge of creating and managing selection criteria.

It is necessary to share responsibilities between the three selection methods in order to make the import selectivity system work well as a whole. The manual selection needs to concentrate on complicated fraud techniques and cunning traders and make better achievement, when the rule-based selection treats relatively simple frauds and casual fraudulent traders. If Customs rely on only the manual selection to obtain a current level of deterrence without employing the rule-based selection, Customs need to recruit more Customs officers for selection work or cannot help taking sloppy selections. The random selection also complements the other two selection methods through its unpredictable selection pattern. The manual selection and the rule-based selection are based on the analysis of criminal traders' fraud technique patterns and in turn the selections are carried out with certain patterns. Hence, the manual selection and the rule-based selection have difficulties in tackling unknown and irregular techniques. Such obscure techniques can come to light by the random selection. Therefore, a selectivity system can operate by an exquisite combination among the three selection methods.

This study does not take into account various factors in its analyses on the performance of the import selectivity system, such as the attention or will of the commissioner or directors on selection work, the proficiency of selectors and inspectors, and changes in incentive for higher detection rate. This study's subject is the import selectivity system of the KCS and does not contend that the results are generalizable to other Customs' selectivity systems. That is because each Customs may have different contexts and mechanisms in operating its selectivity system. Nonetheless, this study is expected to function as a stepping stone for subsequent empirical research on risk management techniques.

## References

- Agresti, A. and Finlay, B. (1999) *Statistical Methods for the Social Sciences*. Upper Saddle River: Prentice Hall.
- Alm, J. (1999) Tax Compliance and Administration. In: W. Hildreth and J. Richardson (eds.) *Handbook on Taxation*. Boca Raton: CRC Press.
- Andreoni, J., Erard, B., and Feinstein, J. (1998) Tax Compliance. *Journal of Economic Literature*, 16: 818-860.
- Babbie, E. (2007) *The Practice of Social Research*. Belmont: Thomson-Wadsworth.
- Becker, G. (1968) Crime and Punishment: An Economic Approach. *Journal of Political Economy*: 169-217.
- Closs, D. and McGarrell, E. (2004) *Enhancing Security throughout the Supply Chain*. Washington D.C.: the IBM Center for the Business of Government.
- De Wolf, L. and Sokol, J. (eds.) (2004) *Customs Modernization Handbook*. Washington, D.C.: The World Bank.
- Deloach, J. (2000) *Enterprise-Wide Risk Management: Strategies for Linking Risk and Opportunity*. London: Financial Times/Prentice Hall.
- Derrig, R. (2002) Insurance Fraud. *The Journal of Risk and Insurance*, 69(3): 271-287.
- Felson, M. (2009) *Crime and Everyday Life*. Thousand Oaks: Sage Publication.
- Geourjon, A., Laporte, B., Coundoul, O., and Gadiaga, M. (2012) Inspecting Less to Inspect Better. In: T. Cantens, R. Ireland, and G. Raballand (eds.) *Reform by Numbers: Measurement Applied to Customs and Tax Administrations in Developing Countries*. Washington D.C.: The World Bank.
- Graetz, M., Reinganum, J. and Wilde, L. (1986) The Tax Compliance Game: Toward an Interactive Theory of Law enforcement. *Journal of Law, Economics, and Organization*, 2(1): 1-32.
- Graetz, M., and Wilde, L. (1985) The Economics of Tax Compliance: Fact and Fantasy. *National Tax Journal*, 38: 355-363.
- Harrison, M and Holloway, S. (2007) Customs and Supply Chain Security – “The Demise of Risk Management?” Paper presented at Annual Conference of APEC Centres: 18 April, Melbourne, Australia.
- Hints, J., Hameri, A., Thibedeau, C., Sahlstedt, J., Tsikolenko, V., Finger, M., and Granqvist, M. (2011) *Customs Risk Management (CRiM): A Survey of 24 WCO Member Administrations*. Lausanne: Cross-Border Research Association.

- Keen, M. (2003). The Future of Fiscal Frontiers and the Modernization of Customs Administration. In: M. Keen (eds.) *Changing Customs: Challenges and Strategies for the Reform of Customs Administration*. Washington D.C.: The World Bank.
- Kirchler, E., Muehlbacher, S., Kastlunger, B., and Wahl, I. (2007) *Why Pay Taxes? A Review of Tax Compliance Decisions*. International Studies Program Working Paper 07-30. Atlanta: Georgia State University.
- Knowles, J., Persico, N., and Todd, P. (2001) Racial Bias in Motor Vehicle Searches: Theory and Evidence. *Journal of Political Economy*, 109(1): 203-229.
- Laporte, B. (2011) Risk Management Systems: Using Data Mining in Developing Countries' Customs Administrations. *World Customs Journal*, 5(1): 17-27.
- McLinden, G., Fanta, E., Widdowson, D., and Doyle, T. (eds.) (2010) *Border Management Modernization*. Washington D.C: The World Bank.
- Miller, J. (2005) *The Chicago Guide to Writing about Multivariate Analysis*. Chicago: The University of Chicago Press.
- Nagin, D. (2011) Deterrence – Scaring Offenders Straight. In: F. Cullen and C. Jonson (eds.) *Correctional theory: Context and Consequences*. Thousand Oaks: Sage Publication.
- Nagin, D. (1998) Criminal Deterrence Research at the Outset of the Twenty-First Century. *Crime and Justice*, 23: 1-42.
- Organization for Economic Cooperation and Development (OECD). (2003) *Policy Brief - Trade Facilitation: The Benefits of Simpler, more Transparent Border Procedure*. Paris: The OECD.
- Picard, P. (1996) Auditing claims in the insurance market with fraud: the creditability issues. *Journal of Public Economics*, 63:27-56.
- Pinquet, J., Ayuso, M. and Guillen, M. (2007) Selection Bias and Auditing Policies for Insurance Claims. *Journal of Risk and Insurance*, 74(2): 425-440.
- Pratt, T., Cullen, F., Blevins, K., Dagie, L., and Madensen, T. (2008). The Empirical Status of Deterrence Theory: A Meta-Analysis. In: F. Cullen, J. Wright, and K. Blevins (eds.) *Taking Stock: The Status of Criminological Theory*. New Brunswick: Transaction Publishers.
- Tennyson, S. and Salsas-Forn, P. (2002) Claims Auditing in Automobile Insurance: Fraud Detection and Deterrence Objectives. *Journal of Risk and Insurance*, 69(3): 289-308.
- Viaene, S., Ayuso, M., Guillen, M., Van Gheel, D., and Dedene, G.. (2007) Strategies for detecting fraudulent claims in the automobile insurance industry. *European Journal of Operational Research*, 176: 565-583.

- Viaene, S. and Dedene, G. (2004) Insurance Fraud: Issues and Challenges. *The Geneva Papers on Risk and Insurance*, 29(2): 313-333.
- Welsh, B. C. and Farrington, D. P. (1999) Value for money? A review of the costs and benefit of situational crime prevention. *The British Journal of Criminology*, 39(3): 345-368.
- Widdowson, D. (2007) The Changing Role of Customs: Evolution or Revolution? *World Customs Journal* 1(1): 31-37.
- Widdowson, D. (2005) Managing Risk in the Customs Context. In: L. de Wulf and J. Sokol (eds.) *Customs Modernization Handbook*. Washington D.C.: World Bank.
- World Customs Organization (WCO). (2011) *WCO Customs Risk Management Compendium*. Brussels: The WCO.
- World Customs Organization (WCO). (2010) *Security and Facilitation of Trade: Consolidated Results of Safe Framework Implementation Survey*. Brussels: The WCO.