

Are There Examples of the “Galapagos Effect” in Korea? An Analysis Using Payment Card Validation Systems

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Abstract—This study considers the Japanese “Galapagos Effect” and investigates if a possible example of this phenomenon can be identified in South Korea. A sample of Payment Card transaction experiments is gathered to determine what authentication systems are widely used in the country. Then, the results are compared to what systems are used internationally to see if evidence of the evolution of an isolated service environment is emerging. The results suggest that this business area is evolving on a path towards isolation and amendments to the legal framework used to manage this business area are recommended. These should be put in place as soon as possible before the divergence becomes too significant.

Index Terms—Innovation, South Korea, Japan, transactions, security.

I. INTRODUCTION

South Korea has reached an important stage in its development as a nation. The country succeeded in moving through the stages of economic development at a fast pace beginning in the 1960s, and despite suffering some setbacks, continued to develop throughout the next five decades. One of the cornerstones of this development was the ability to manufacture and export relatively high-quality products at lower costs than other competing countries. However, Korea has now moved up the manufacturing Value Chain and can no longer be considered as a low cost country. This means Korea now has to use innovative approaches to create new markets, and then products must be developed for those markets. This requires the ability to develop both international service models along with manufactured products. One country that already reached the stage Korea is currently at in the past is Japan. Therefore, it is valuable to study some of the problems Japan tried to solve while navigating its way through this stage to see if there are any successes or failures that could provide valuable lessons for Korea.

One theory that is worthy of study at this stage for Korea is known as the “Galapagos Effect” phenomenon in Japan. Research by Kushida [1], [2] put forward the theory that even though Japan achieved global leadership in certain industries including automobiles, precision equipment and high-technology components, the Galapagos Effect became a barrier to exporting services and products in other areas. The examples used in this study from Japan mostly came from the ICT area. The term, Galapagos Effect, was

originally popularized by Natsuno [3] to describe Japan’s progress in the mobile phone area in the early 2000s. It was inspired by Charles Darwin’s research on evolution undertaken on Ecuador’s Galapagos Islands. He proposed that isolated biological species evolved to develop unique characteristics allowing them to adapt to the local environment.

Natsuno used the term to explain why Japanese companies developed a range of relatively advanced mobile phones in the 1990s and 2000s but they were unable to successfully export them as international business trends were evolving on a different trajectory to Japan’s [4].

This effect has also been listed by Iwatani *et al* [5] and Fukao [6] as a reason for why Japan’s share of world export value declined from 30% in the 1990s to less than 15% in 2015. Dujarric and Hagui [7] also used the Galapagos Effect to analyze why Japanese Anime content has not been more successful globally despite its strong position domestically in Japan. This effect has also been used to look at Scientific Research activities in Japan by Shirakawa *et al* [8].

In business research, International collaboration has been identified as one of the key ways in which lead times for innovation can be reduced. Vogel [9], Teece [10], Chesbrough [11], and Iansiti and Levien [12] outlined the importance of business networking, cross-border open innovation collaboration and international business ecosystems when it comes to innovation and the development of new markets and products. Language and Cultural barriers can thus be considered to have a negative effect on innovation [13], [14].

The aim of this study was to check how rigorous the Payment Card verification processes are at retail POS terminals in South Korea. To test this, unsigned cards were presented at various POS retail locations in South Korea in order to check if a signature verification process is being implemented. This will in turn assess the efficacy of basic security setup changes to POS terminal transactions in South Korea when it comes to preventing Payment Card fraud.

Then, the Payment Card Verification Systems in Korea will be studied to see if the evidence suggests that it could be evolving into an example of the Galapagos Effect. This research studies the available literature on the topic and also includes an experiment carried out over two years using payment cards in Korea in order to check the various authentication systems that are used. This study will also try to determine what changes could be made to avoid the payment system evolving into an isolated ecosystem in Korea.

Manuscript received August 12, 2017; revised October 20, 2017.

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II. BACKGROUND INFORMATION

The use of Payment Cards has become one of the primary transaction methods at Point Of Sale (POS) retail locations in South Korea. Virtually all businesses offer the option of accepting either Cash or Cards for payments. When a consumer chooses Payment Cards as the preferred transaction option, there are a number of configuration options available for merchants when it comes to verification. Older POS configurations may require customers to provide a physical signature with a pen on a printed receipt to process the transaction. Newer systems involve prompting a customer to provide a digital signature on a Payment Terminal Signature Capture Screen [15]. Then, in order to ensure the customer presenting the card is the actual Cardholder, the Retail Assistant should check the provided signature against the signature on the Payment Card to ensure the owner of the card is the customer making the transaction.

An alternative to signature verification is the Europay, MasterCard and Visa (EMV) Chip and Pin system where consumers enter digits that are uniquely associated with their Payment Card as verification. This system is also available in South Korea at certain retail locations and it may become more widespread as time goes by. Some countries have even changed liability laws on the use of fraudulent and stolen Payment Cards in order to encourage the transition from signature-based verification methods to the EMV Chip & Pin approach [16].

III. LITERATURE REVIEW

In recent years, South Korean consumers have exhibited some of the highest credit card ownership and usage rates in the world. According to a report by the Credit Finance Association of Korea [17], the number of Credit Cards owned per economically active person in the country hit a peak of 4.9 in 2011 but has declined gradually to 3.9 in 2014. The report partially attributed this decline to changes implemented by the Korean Financial Supervisory Service Organization. This Governmental body changed the minimum legal age from which Credit Cards can be issued from 18 to 20. They also set a minimum income level at KRW500,000 for Credit Card Applicants. However, the volume of transactions made by Credit Cards has continued to increase steadily in recent years. In 2014, this hit a new high of KRW522.77 trillion. Furthermore, in a study carried out by the Committee on Payment and Settlement Systems in 2011, Korea had the highest number of annual Credit Card Transactions per capita, based on a comparative study of a large group of advanced economies [18]. For example, Korea had a figure of 129.7, significantly ahead of Canada in second place (89.6), the U.S (77.9) and Hong Kong (55.1) in the study. Competing payment options are now also on the horizon due to the increased use of Mobile Devices for Micropayments. However, as of 2014, 76% of POS retail payments were made by payment cards in South Korea [19]. Cash Payments currently account for around 20% of the total suggesting a strong shift to digital payment systems at POS terminals.

The Major Global Credit Card Payment Networks provide guidelines on what Merchants should do if they are

presented with an unsigned Payment Card. For example, according to Global MasterCard Requirements [20], when a Merchant sees an unsigned Payment Card, the Merchant should ask the customer to provide photo identification, and then tell the Cardholder they need to sign the card before completing the transaction. Other major Payment Networks have similar guidelines.

The dependence on signature verification for Payment Card transaction security was flagged as a weak link in a study by the U.S Congressional Research Service [21]. The study determined that the majority of Payment Card fraud in the U.S takes place at POS terminals using stolen or counterfeit cards, and that EMV Chip & Pin Cards provide a much better solution than signature verification when it comes to crime prevention. To encourage the transition to the use of EMV Chip & Pin Systems, many countries are implementing liability shifts for fraudulent transactions [22]. In the past, the card issuer was liable for fraudulent transactions in most countries. After a liability shift takes place, if the Merchants POS does not support EMV, then the merchant is liable for a fraudulent transaction. For example, the USA followed the UK and most of Western Europe by implementing a liability shift in October 2015 [23].

In March 2015, The South Korean Financial Supervisory Service implemented a new rule mandating the exclusive use of EMV Chip and Pin Cards for Automatic Telling Machine (ATM) Cash withdrawals [24]. In South Korea liability for domestic fraudulent Credit Card POS Usage is covered by Article 16 of the Specialized Credit Finance Business Act [25]. This law explains that liability for fraudulent Credit Card use is dependent on the contract that has been signed between the Credit Card Company and the Credit Card Holder [26]. However, the Korean Fair Trade Association determined that if a contract transfers liability solely to the Cardholder, it is unfair unless they can prove that a cardholder acted negligently [27].

Korea has suffered from a number of major Credit Card data thefts in recent years. For example in December 2014, the South Korean police arrested a group of hackers who stole information from 3.2 million credit-card transactions made on POS terminals. The personal information of 205,000 cardholders was sold and 268 of the Cardholders incurred a cumulative total of KRW120 million won in financial damages [28]. The compromised information included names, telephone numbers, credit card numbers, card expiration dates and passwords.

IV. EXPERIMENT METHODOLOGY

In order to check what validation procedure for signatures is followed when electronic capture pads are used, a set of Payment Cards from large domestic Korean banks was gathered. This involved cards from eleven distinct issuers which covers almost the entire range of issuers that provide cards currently to South Korean consumers.

These Payment Cards all featured International Payment Network logos but their systems are only used when the Credit Cards are used internationally outside of South Korea so it was outside of the scope of this study. The Payment

Cards used for this experiment had both Credit Card and ATM Cash withdrawal technology embedded, so they were enabled for either signature-based or EMV Chip & Pin usage. The Payment Cards used were never signed after being issued.

In order to test acceptance of the Card without a Signature, a sample of POS terminals representing a variety of retail locations was chosen. The sampling approach used a combination of convenience and diversity sampling. At the beginning of the study, a maximum sample size was not set, but the aim was to try and test as wide a range of retail POS services as possible. However, testing a wide range of POS services means purchasing a lot of things, so some convenience-based sampling selection decisions, based on availability and pricing were necessary. Communication when carrying out the transactions took place using the Korean language to ensure there would be no misunderstandings about which form of POS Payment verification would be used. The Cardholders making the transactions included a mixture of Korean and non-Korean individuals to minimize the possibility of bias through profiling.

721 transactions were made in total. The transactions were made in 6 major South Korean Cities; Seoul, Busan, Daejeon, Daejeon, Jeju and Ulsan and also in rural locations. The transactions involved a number of different retail outlets including coffee shops, movie theatres, train stations, hair salons, small corner stores, Taxi rides, large supermarkets, bus stations, hotels, clothing stores and restaurants. The transactions also spanned a range of values. The minimum purchase was a single soft drink and the maximum purchase was Electronic Goods valuing in excess of KRW2,100,000.

In order to codify the results and ensure that each recorded transaction was in a distinct location, a naming and numbering convention was used to track each instance of the experiment. This system also identifies each transaction but circumvents the possibility of any legal repercussions that could arise from giving the full name of a business in South Korea. The transactions took place over a two year- long period beginning on January 1st 2015 until January 1st 2017.

V. RESULTS

The results show that the majority of retail outlets in South Korea use digital signature capture pads as their primary validation system. A small proportion of the retail outlets direct consumers to use EMV Chip & Pin number entry interfaces where a 4-digit pin is typed in order to validate the transaction. A summary of the results can be seen in Fig. 1 below.

Transaction Type	Number of Recorded Instances
Transactions where the Cashier directed the customer to use the EMV Chip & Pin System.	146
Transactions where the Cashier processed the transaction without asking for ID or requesting that the card should be signed.	575
Transactions where the Cashier asked for cash payments instead of accepting the Payment Card.	0

Fig. 1. Summary of results.

In the sample used, the customer was never once asked to provide photo ID or to sign the card. In the majority of transactions, the cashier retained the card for a few moments while the payment was being verified, but it was not examined to check if there was a signature present.

VI. IMPLICATIONS AND RECOMMENDATIONS

South Korea has made large steps towards lessening the usage of cash in POS retail transactions. Almost every retail location accepts Payment Cards even for very small micropayments or relatively large transactions. A migration toward the use of EMV Chip & Pin validation is taking place, but the change has not been forced through using a liability shift as it has been in other regions. This means that the migration is likely to take much longer to implement, as there is less motivation for Merchants to direct customers towards the use of Pin Numbers for validation. This may be because they do not have liability for any fraudulent transactions.

In many countries, the liability shift was driven by the influence of the large Payment Network Companies. In Korea, these Payment Network Companies logos do appear on most Cards, but their networks and systems are only used when the Cards are used for transactions outside of Korea. Therefore, they lack the lobbying power that they would have in countries where all transactions are processed using their Payment Networks.

In South Korea, there is a large risk of Payment Cards being stolen and misused in retail outlets. In order to protect against this, banks uses certain measures in Korea. For example, customers can request that payments can trigger a message notification to their phones. This can be activated for all transactions for just those beyond a certain threshold amount. Therefore, if a card is stolen / copied and used for an expensive purchase, the Cardholder can act quickly to cancel the payment before settlement. Another measure that is being used by some banks now in Korea is to have an activation / deactivation system connected to a Smartphone app that allows a Cardholder to effectively turn on and turn off their card.

To find out more about the risk at the POS itself, studies should be conducted on why Merchants and their staff do not check the signatures on the cards. A survey on a sample of Merchants would provide this insight. It may be because they do not want the Cardholder to lose face by being asked to sign the card, or possibly because they are focused on completing the transaction as quickly and efficiently as possible and are willing to bypass some of the procedural steps to accommodate this.

Therefore, information campaigns should target consumers making them aware of the need to immediately reporting their card as being stolen or lost to avoid liability for any transactions that may take place by criminals. In addition, Cashiers at retail outlets should be trained in order to establish basic signature checks in order to deter potential criminals from making fraudulent transactions. The Card Issuers should also implement a procedure to ensure that customers sign Payment Cards before receipt of purchased items.

VII. CONCLUSION

The aim of this research was to determine if evidence exists to suggest that the Payment Card authentication systems in Korea may be evolving in a way that could be described as being similar to the Galapagos Effect exhibited by certain Japanese business areas. This study studied the literature available in the area and also conducted an experiment using payment cards in Korea in a wide range of retail outlets and locations. The results suggest that the security systems that are prevalent internationally are not widely used in Korea and that the business area itself appears to be showing characteristics that are distinct from other countries. Therefore, it is highly possible that this business area is already or will become another example of the Galapagos Effect.

This could become a situation with implications for Korea. As this area evolves further in Korea, the security and authentication systems used within the country could become increasingly isolated. From an innovation perspective, there is then a significant risk that innovation will take place at a lower pace due to the closed nature of the business to emerging international trends. This could also leave the system exposed to exploits if the security system is not rigorous enough to protect against emerging forms of attacks. Moreover it means that any technology or services associated with the isolated business area will not be able to be exported or used outside the country. This could be a huge barrier to exports as banking and transaction handling are fundamental to commerce. In addition, it could result in a situation where the payment processing systems in Korea fall behind other countries. This in turn means that Korea would have to restrict or protect the marketplace against open competition from outside services, as they will then be likely to be more advanced than those available inside Korea and any competition could destroy the domestic businesses.

It can also affect consumers. When consumers get used to doing things in a certain way they might find it difficult to go overseas and use systems outside of their own country. In the e-Commerce area trust is a key factor when it comes to making a purchase and consumers are less likely to trust unfamiliar systems. This means that Korean consumers travelling abroad may find the transaction systems a barrier to shopping and tourists may not spend much in Korea for the same reason. These kinds of problems can have a major affect on tourism.

There are many other business areas in Korea that should also be investigated to see if more possible examples of the Galapagos Effect could be identified. When they are identified, then steps should be taken and recommendations should be made to ensure that they do not evolve in an entirely different direction before they diverge too far from International norms. As Korea is a country that has traditionally been dependent on exports it is a key study area for the country's future.

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